June 5, 2008

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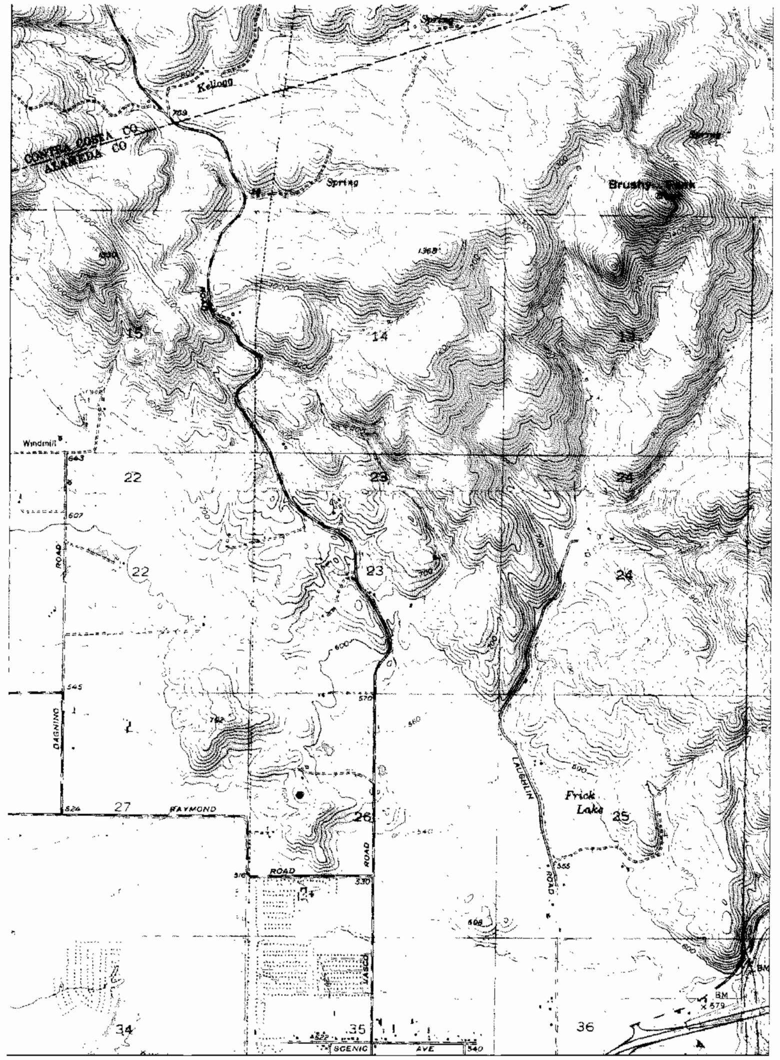
GEOTECHNICAL DESIGN AND MATERIALS REPORT
Vasco Road Safety Improvements in Alameda County From MP 3.4 to MP 4.3



Prepared for:
County of Alameda
Public Works Agency
399 Elmhurst Street
Hayward, California 94544

Prepared by:
Cal Engineering & Geology
1870 Olympic Boulevard
Suite 100
Walnut Creek, California 94596

October 2002

TO: Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 18 January 2002

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 1
Embankment Slope Alternatives
Lt Sta 0+600 to Lt Sta 0+960
Rt Sta 1+060 to Rt Sta 1+220

This design memorandum addresses geotechnical issues related to the configuration of two of the roadway embankments along the proposed realignment of Vasco Road MP 3.4 - MP 4.3. Specifically, we have reviewed possible alternative configurations for the left side slope of the embankment from station 0+600 to station 0+960 and for the right side slope from station 1+060 to station 1+220. The primary design objective of the alternative side slope configurations is to minimize encroachment on potentially environmentally sensitive areas compared to the encroachment anticipated from embankments constructed with conventional 1V:2H side slopes.

We have developed two viable design alternatives which would reduce the embankment encroachment on adjacent property. One alternative is to construct steeper embankment side slopes (1V:1.5H) by incorporating geogrid reinforcement into the embankments. The second alternative is to construct retaining walls at the toes of the embankments. A segmental retaining wall (SRW) with geogrid reinforcement is an appropriate retaining wall system for this application. Typical sections and design considerations for the two embankment slope alternatives are shown on the attached Figure 1. Figure 2 shows the two alternative configurations, as well as a conventional 1V:2H slope, overlaid on a number of embankment sections along the proposed alignment.

Both of the design alternatives presented are feasible with regard to geotechnical considerations. Alternative 2 (1V:2H slope with an SRW at the toe) appears to have a number of advantages over Alternative 1 (1V:1.5H reinforced slope) with regard to construction productivity. Construction of the geogrid reinforced zones and, in the case of Alternative 2, installation of the precast SRW facing units will require special construction methods and inspections. For Alternative 2, the geogrid reinforced SRW is a relatively small portion of the work and could be completed in advance of the conventional embankment construction. However, Alternative 1 requires the placement of geogrid reinforcement in the slope face for the entire height of the embankment, lowering overall productivity. Another advantage of Alternative 2 is that the 1V:2H embankment slopes above the retaining walls would have less potential for erosion than the 1V:1.5H slopes of the geogrid reinforced embankments. If the steeper embankment slopes are constructed, features should be included in the design to account for the increased erosion potential.

If Alternative 2 is chosen, we recommend that the retaining walls be situated at locations along the embankment toe which will not lead to excessive wall heights. As with most retaining wall types, construction complexities and costs increase dramatically as SRW heights increase. Based on our review of the embankment section for the proposed Vasco Road realignment, it appears that the desired benefit of reduced embankment encroachment can be realized while maintaining moderate wall heights of about 5 m on the left embankment slope from station 0+600 to station 0+960 and about 7 m on the right embankment slope from station 1+060 to station 1+220.

Once the preferred embankment slope alternative is selected and embankment sections are developed by the County, we will prepare design details and complete stability analysis of critical configurations. Preliminary values for design parameters provided in the project geotechnical design and materials report[1] will be used for design. It is not anticipated that additional subsurface investigation will be needed for the design of either of the embankment slope alternatives presented in this memorandum. Prior to completion of the final design, the planned embankment configuration and wall heights (if applicable), foundation conditions, and anticipated embankment fill materials will be reviewed for consistency with the preliminary design assumptions.

Please contact us if you have any questions regarding issues presented in this memorandum.

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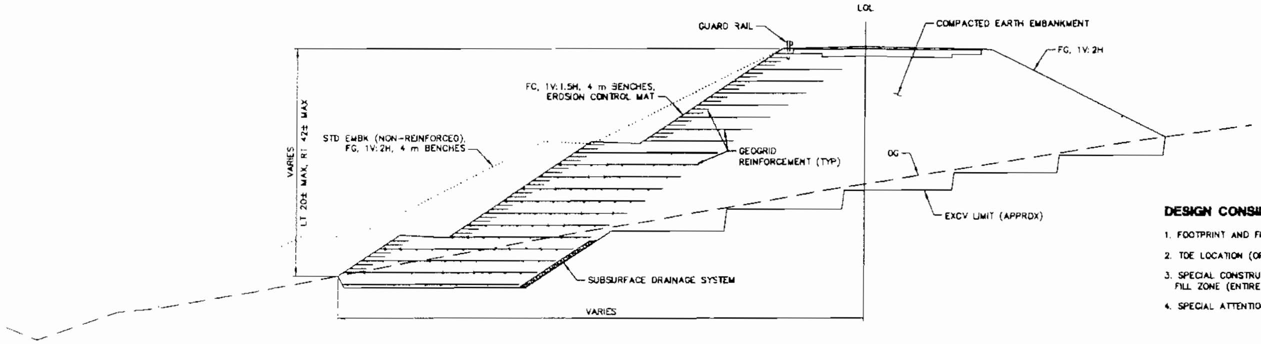
[1] Table 8-3: Earth Retaining Structure Design Parameters, "Geotechnical Design and Materials Report, Vasco Road Safety Improvements in Alameda County from MP 3.4 to MP 4.3," prepared by Cal Engineering & Geology, draft dated 8 August 2001.

NOTES

1. SUBSURFACE SOIL, ROCK, AND GROUNDWATER CONDITIONS VARY ACROSS THE SITE AND WITH DEPTH. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS SEE "GEOTECHNICAL DESIGN AND MATERIALS REPORT, VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3" PREPARED BY CAL ENGINEERING & GEOLOGY.

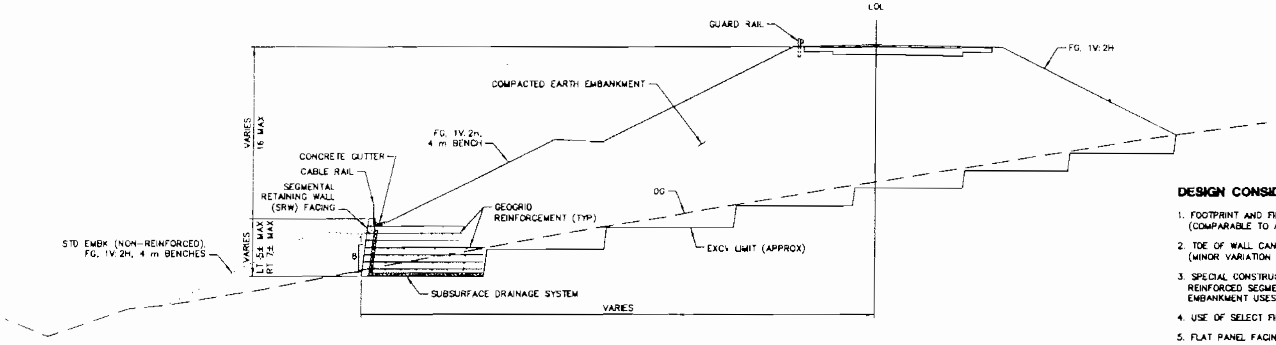


DESIGN CONSIDERATIONS

1. FOOTPRINT AND FILL VOLUMES LESS THAN EMBANKMENT WITH 1V:2H SLOPE
2. TOE LOCATION (OFFSET FROM LOL) VARIES CONTINUOUSLY ALONG ALIGNMENT
3. SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOGRID REINFORCED FILL ZONE (ENTIRE HEIGHT OF EMBANKMENT)
4. SPECIAL ATTENTION NEEDED TO AVOID EROSION PROBLEMS ON 1V:1.5H SLOPE

ALTERNATIVE 1: 1V:1.5H SLOPE WITH GEOGRID REINFORCEMENT

LT STA 0+600 – LT STA 0+960
RT STA 1+060 – RT STA 1+220 (SIMILAR)



DESIGN CONSIDERATIONS

1. FOOTPRINT AND FILL VOLUMES LESS THAN EMBANKMENT WITH 1V:2H SLOPE (COMPARABLE TO ALTERNATIVE 1)
2. TOE OF WALL CAN BE LAID OUT AT UNIFORM OFFSET DISTANCES (MINOR VARIATION IN TOE OFFSET DUE TO 8V:1H WALL BATTER)
3. SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOGRID REINFORCED SEGMENTAL RETAINING WALL (RELATIVELY SMALL ZONE) – REMAINDER OF EMBANKMENT USES CONVENTIONAL CONSTRUCTION METHODS
4. USE OF SELECT FILL IN REINFORCED ZONE IS RECOMMENDED
5. FLAT PANEL FACING ELEMENTS AND STEEL REINFORCEMENT ARE NOT RECOMMENDED

ALTERNATIVE 2: 1V:2H SLOPE WITH REINFORCED SEGMENTAL RETAINING WALL AT TOE

LT STA 0+600 – LT STA 0+960
RT STA 1+060 – RT STA 1+220 (SIMILAR)

0 10 20
SCALE METERS

ALAMEDA COUNTY Metric
UNITS ARE IN METERS UNLESS OTHERWISE NOTED

CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
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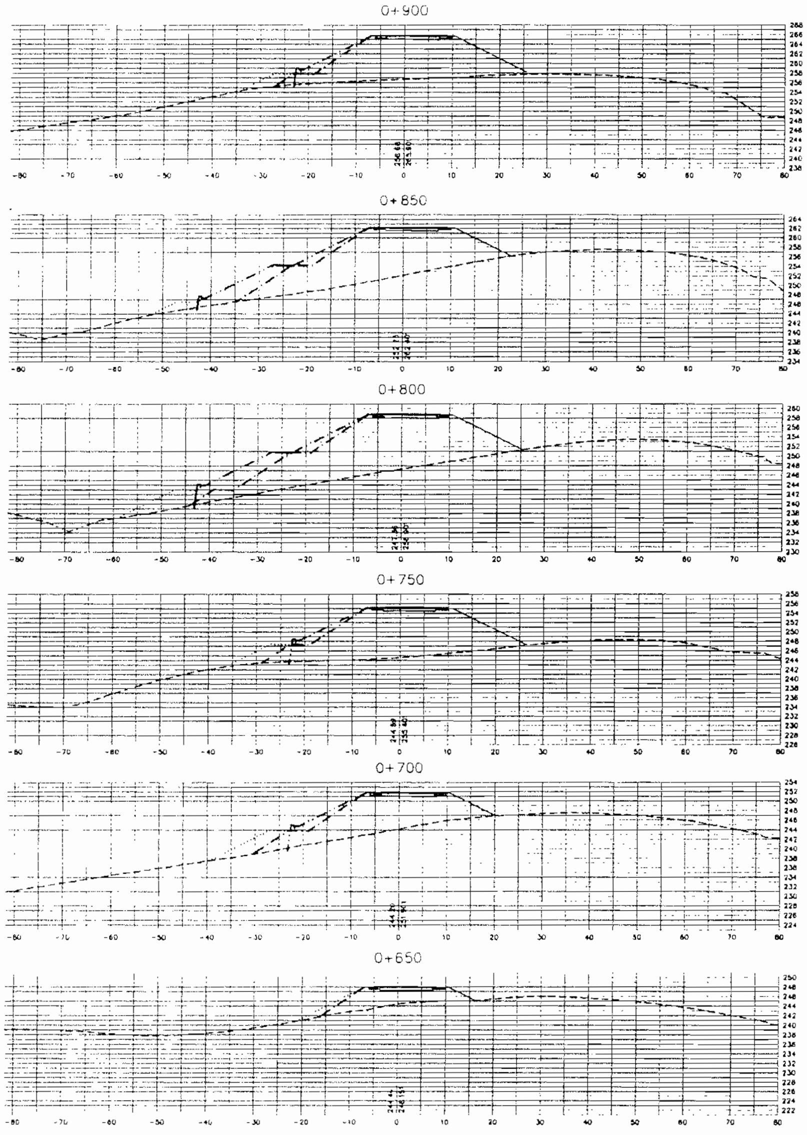
DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EMBANKMENT SLOPE ALTERNATIVES
LT STA 0+600 - 0+960 AND RT STA 1+060 - 1+220

CEG REF NO. 001660	JANUARY 2002	DM-1 FIGURE 1

...\CEG\001660\VascoDM1.dwg Figure 1

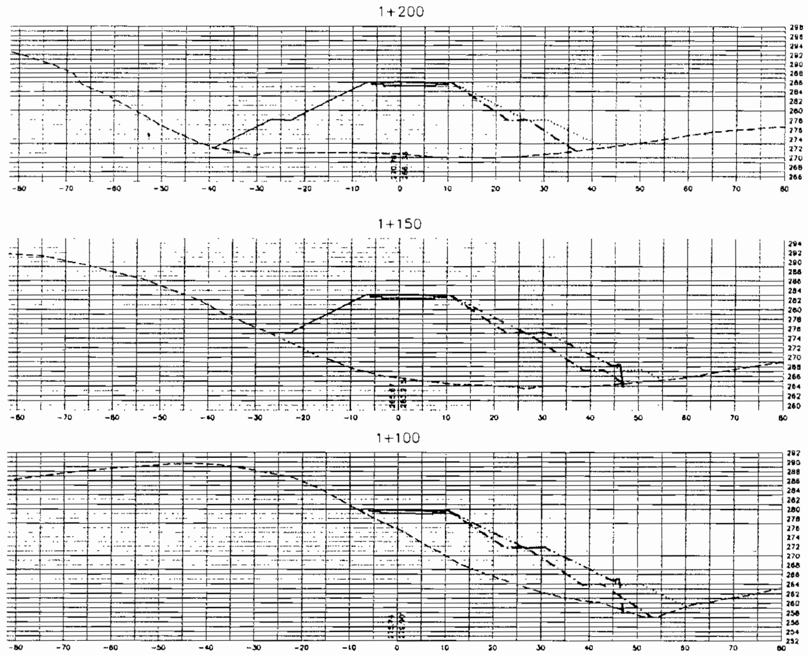


REPRESENTATIVE SECTIONS

LT STA 0+600 - LT STA 0+960

NOTES

1. REPRESENTATIVE EMBANKMENT CROSS SECTIONS ARE SHOWN WITH A STANDARD 1V:2H SLOPE, A 1V:1.5H SLOPE (ALT 1), AND A 1V:2H SLOPE WITH A RETAINING WALL AT THE TOE (ALT 2). THIS SHEET IS A WORKING DRAWING – THE RETAINING WALL LOCATIONS SHOWN (ALT 2) ARE CONCEPTUAL ONLY AND HAVE NOT BEEN OPTIMIZED. RETAINING WALL MAY NOT BE NEEDED ALONG ENTIRE EMBANKMENT TOE.



REPRESENTATIVE SECTIONS

RT STA 1+060 - RT STA 1+220

LEGEND

- - - - - - ORIGINAL GRADE

STANDARD 1V:2H SLOPE

— · — ALT 1 (1V:1.5H SLOPE WITH GEOGRID REINF)

— · · — ALT 2 (1V:2H SLOPE WITH SRW AT TOE)

0 10 20 30 40 50
SCALE METERS

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DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EMBANKMENT SLOPE ALTERNATIVES
LT STA 0+600 - 0+960 AND RT STA 1+060 - 1+220

CEG REF NO. 001860	JANUARY 2002	DM-1 FIGURE 2

TO: Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 18 January 2002

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 2
Embankment Edge Reconstruction
Rt Sta 0+120 to Rt Sta 0+230

This design memorandum addresses geotechnical issues related to the proposed edge reconstruction of the roadway embankment at the south conform area (approximately from station 0+120 to station 0+230) of the proposed realignment of Vasco Road MP 3.4 - MP 4.3. In this location the edge of the embankment adjacent to the northbound shoulder will require only minor widening and reconstruction. However, if a conventional 1V:2H side slope is used the new embankment will encroach into an existing drainage swale which runs approximately parallel to the existing roadway embankment. We have reviewed the geotechnical issues related to this proposed embankment edge reconstruction and have prepared the following summary and design recommendations.

With a conventional 1V:2H side slope the embankment toe would encroach into the invert or bank of the swale from about station 0+120 to station 0+190. From about station 1+190 to station 1+230 it appears that the roadway embankment could be reconstructed with a conventional 1V:2H side slope without any encroachment into the swale.

We have identified several viable design alternatives which would reduce the impact of the embankment edge reconstruction on the existing swale. Two alternatives involve constructing a steeper embankment side slope by incorporating either geogrid reinforcement (1V:1.5H) or stacked geocell units (1V:0.5H) into the embankment face. Two alternatives involve installing retaining walls to support the roadway shoulder and thus minimize the extent of the embankment reconstruction required. Typical sections and design considerations are shown on the attached figure.

All of the design alternatives presented are feasible with regard to geotechnical considerations. The choice of the most desirable system should take into account other factors such as cost, construction access, maintenance requirements, environmental impacts, and aesthetics. Considering all these factors the sheet pile wall alternative appears to have some advantages over the other systems. In particular, since traffic is to be maintained during construction and clearance is limited, the expedience of sheet pile installation and minimal required excavation of the shoulder area are significant advantages associated with this alternative. In addition, the sheet pile wall system appears to have the least environmental impact.

Once the preferred embankment edge system is selected by the County, we will develop design details and complete stability analysis. Preliminary values for design parameters provided in the project geotechnical design and materials report[1] will be used initially. However, prior to completion of the final design, subsurface conditions along the embankment edge should be more fully investigated. The nature of the system selected will influence the scope of this subsurface investigation.

Please contact us if you have any questions regarding issues presented in this memorandum.

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[1] Table 8-3: Earth Retaining Structure Design Parameters, "Geotechnical Design and Materials Report, Vasco Road Safety Improvements in Alameda County from MP 3.4 to MP 4.3," prepared by Cal Engineering & Geology, draft dated 8 August 2001.

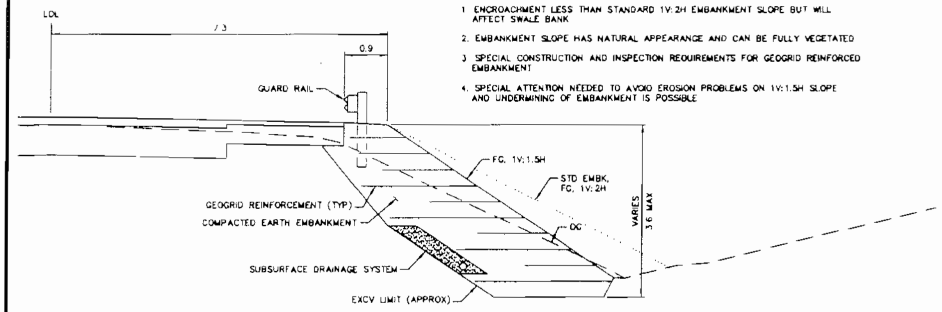
DESIGN CONSIDERATIONS

1 ENCROACHMENT LESS THAN STANDARD 1V:2H EMBANKMENT SLOPE BUT WILL AFFECT SWALE BANK

2. EMBANKMENT SLOPE HAS NATURAL APPEARANCE AND CAN BE FULLY VEGETATED

3 SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOGRID REINFORCED EMBANKMENT

4. SPECIAL ATTENTION NEEDED TO AVOID EROSION PROBLEMS ON 1V:1.5H SLOPE AND UNDERMINING OF EMBANKMENT IS POSSIBLE



ALTERNATIVE 1: GEOGRID REINFORCED EMBANKMENT (1V:1.5H)

RT STA 0+120 - RT STA 0+190
(SEE NOTE 2 ON THIS SHEET)

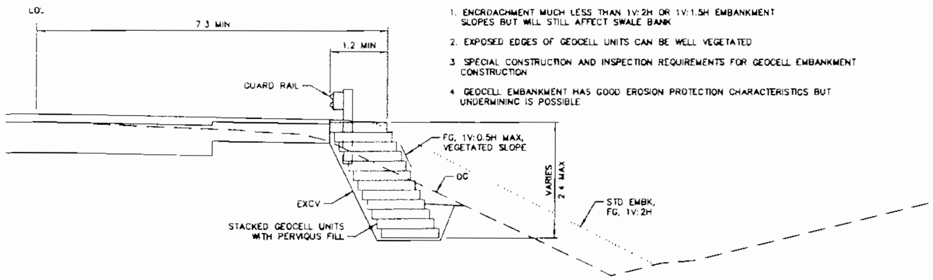
DESIGN CONSIDERATIONS

1. ENCROACHMENT MUCH LESS THAN 1V:2H OR 1V:1.5H EMBANKMENT SLOPES BUT WILL STILL AFFECT SWALE BANK

2. EXPOSED EDGES OF GEOCELL UNITS CAN BE WELL VEGETATED

3 SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOCELL EMBANKMENT CONSTRUCTION

4 GEOCELL EMBANKMENT HAS GOOD EROSION PROTECTION CHARACTERISTICS BUT UNDERMINING IS POSSIBLE



ALTERNATIVE 2: STACKED GEOCELL EMBANKMENT (1V:0.5H)

RT STA 0+120 - RT STA 0+190
(SEE NOTE 2 ON THIS SHEET)

NOTES

1. SUBSURFACE SOIL ROCK, AND GROUNDWATER CONDITIONS VARY ACROSS THE SITE AND WITH DEPTH. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS SEE "GEOTECHNICAL DESIGN AND MATERIALS REPORT, VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3" PREPARED BY CAL ENGINEERING & GEOLOGY.

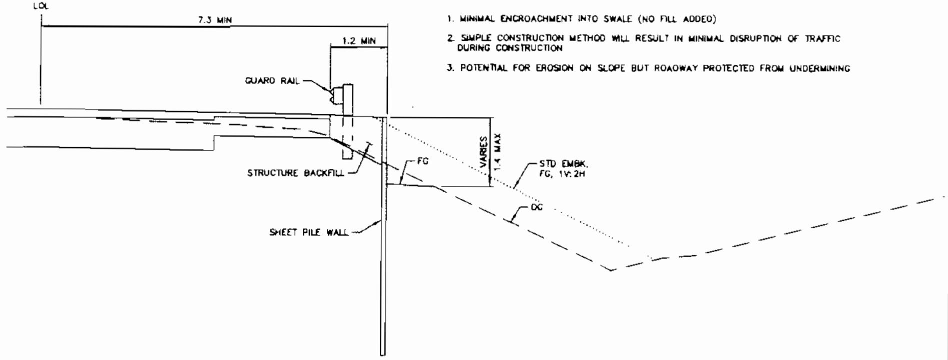
2. EMBANKMENT EDGE RECONSTRUCTION ALTERNATIVES SHOWN ON THIS SHEET APPLY TO STATIONS 0+120 THROUGH 0+190. FROM STATIONS 0+190 TO 0+230 IT APPEARS THAT THE ROADWAY EMBANKMENT CAN BE RECONSTRUCTED USING A CONVENTIONAL FILL SLOPE OF 1V:2H WITHOUT ENCROACHMENT INTO THE SWALE

DESIGN CONSIDERATIONS

1. MINIMAL ENCROACHMENT INTO SWALE (NO FILL ADDED)

2. SIMPLE CONSTRUCTION METHOD WILL RESULT IN MINIMAL DISRUPTION OF TRAFFIC DURING CONSTRUCTION

3. POTENTIAL FOR EROSION ON SLOPE BUT ROADWAY PROTECTED FROM UNDERMINING



ALTERNATIVE 3: SHEET PILE WALL

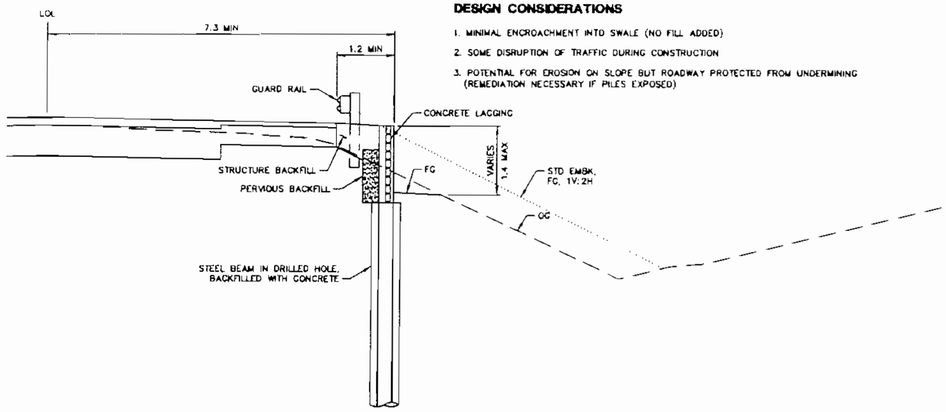
RT STA 0+120 - RT STA 0+190
(SEE NOTE 2 ON THIS SHEET)

DESIGN CONSIDERATIONS

1. MINIMAL ENCROACHMENT INTO SWALE (NO FILL ADDED)

2. SOME DISRUPTION OF TRAFFIC DURING CONSTRUCTION

3. POTENTIAL FOR EROSION ON SLOPE BUT ROADWAY PROTECTED FROM UNDERMINING (REMEDIATION NECESSARY IF PILES EXPOSED)



ALTERNATIVE 4: PILE AND LAGGING WALL

RT STA 0+120 - RT STA 0+190
(SEE NOTE 2 ON THIS SHEET)

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DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EMBANKMENT EDGE RECONSTRUCTION ALTERNATIVES
RT STA 0+120 - 0+230

CEG REF NO. 001860	JANUARY 2002	DM-2 FIGURE 1

TO: Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 18 January 2002

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 3
Lowering of Grade
Lt Sta 1+690 to Lt Sta 1+910

This design memorandum addresses geotechnical issues related to a proposed lowering of the existing roadway grade at the north conform area (approximately from station 1+690 to station 1+910) of the proposed realignment of Vasco Road MP 3.4 - MP 4.3. The new roadway profile is up to 1 m lower than the existing grade. If conventional 1V:2H slopes are used, the cuts may encroach on a PG&E gas valve facility located within 14 m of the southbound shoulder in the vicinity of stations 1+690 to 1+740. In addition, in the vicinity of stations 1+740 to 1+910, the cuts would encroach into the reinforced backfill zone of an existing MSE wall which is part of an earth berm located adjacent to the southbound shoulder. Typical sections are shown in the attached figure. We have reviewed the geotechnical issues related to this proposed grade lowering and have prepared the following summary and design recommendations.

Portions of the existing cut adjacent to the southbound shoulder from stations 1+690 to 1+740 are in rock and are near vertical. However, the quality of material varies and in one area the cut apparently failed and has been stabilized with sacked concrete. We recommend that an earth-retaining structure be constructed from about stations 1+690 to 1+740 in order to lower the roadway grade without requiring additional significant encroachment into the PG&E facility area. A conventional cast-in-place concrete retaining wall would be an appropriate type of structure for this location.

The proposed lowering of the roadway grade from stations 1+740 to 1+910 will affect an existing earth berm located adjacent to the southbound shoulder of the roadway. The earth berm, which begins at about station 1+740 and extends to the north well beyond the project limits, is apparently intended to help protect the Los Vaqueros Reservoir watershed. The earth berm was constructed with a mechanically stabilized embankment (MSE) wall which faces away from Vasco Road. The precast concrete MSE wall facing has a height (including the embedded portion) of up to 6.5 m and is located approximately 8 m or more from the edge of the existing pavement. On the Vasco Road side, the berm has a short concrete retaining wall (traffic barrier) with a sloping backfill. As shown in the original construction plans, the MSE wall has a reinforced (mechanically stabilized) backfill zone that extends up to 5.5 m behind the wall facing. Based on our review of the cross sections for the proposed roadway cuts and the as-built plans of the MSE retaining wall, we conclude that excavation into the reinforced backfill zone of the existing MSE wall will adversely affect the performance of the wall by exposing the soil reinforcement thereby reducing its effective embedment length.

We recommend that a retaining wall be constructed adjacent to the lowered roadway from about stations 1+740 to 1+910 to achieve the required grade lowering without affecting the reinforced backfill zone of the MSE wall. From the cross sections reviewed, it appears that the height of the wall would not exceed 2.0 m. A variety of wall types could be used, however we feel that a conventional cast-in-place concrete retaining wall would be the most appropriate alternative.

Based on the anticipated wall heights and the backfill and toe configurations, it appears that a standard Caltrans Type 1A retaining wall design could be utilized for both of the applications described above (stations 1+690 to 1+740 and stations 1+740 to 1+910). For wall heights over 3.6 m or backfill steeper than 1V:2H, a Type 1 retaining wall (battered backface) could be used. Additional design considerations are noted on the attached figure.

Preliminary values for retaining wall design parameters are provided in the project geotechnical design and materials report[1]. Prior to completion of the retaining wall final design, subsurface conditions along the wall alignment should be investigated to verify and document the properties of the foundation and retained soils. All soil properties as well as the final retaining wall and backfill geometry should be reviewed for consistency with those assumed in the standard Caltrans wall design. If actual site conditions vary significantly from those assumed, the standard wall design should be modified as required.

Please contact us if you have any questions regarding issues presented in this memorandum.

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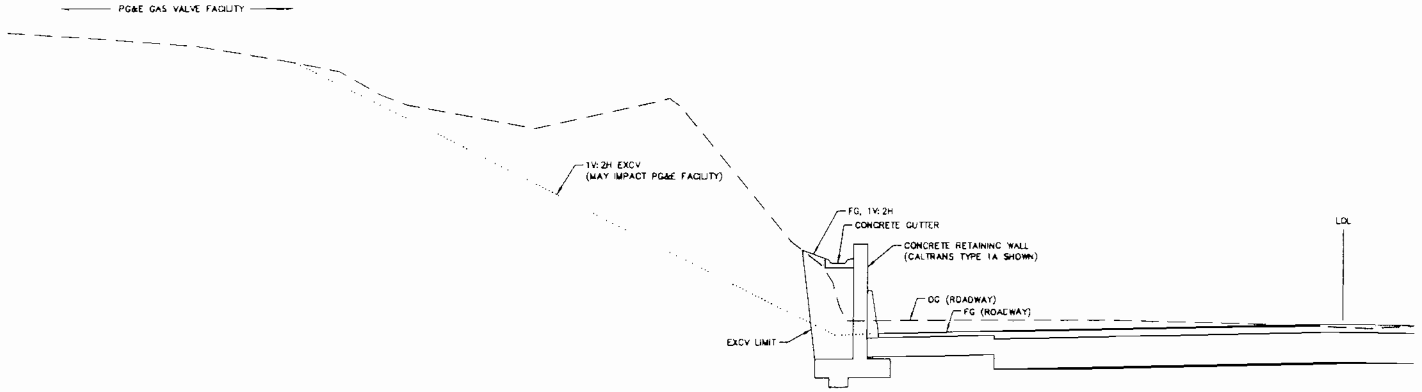
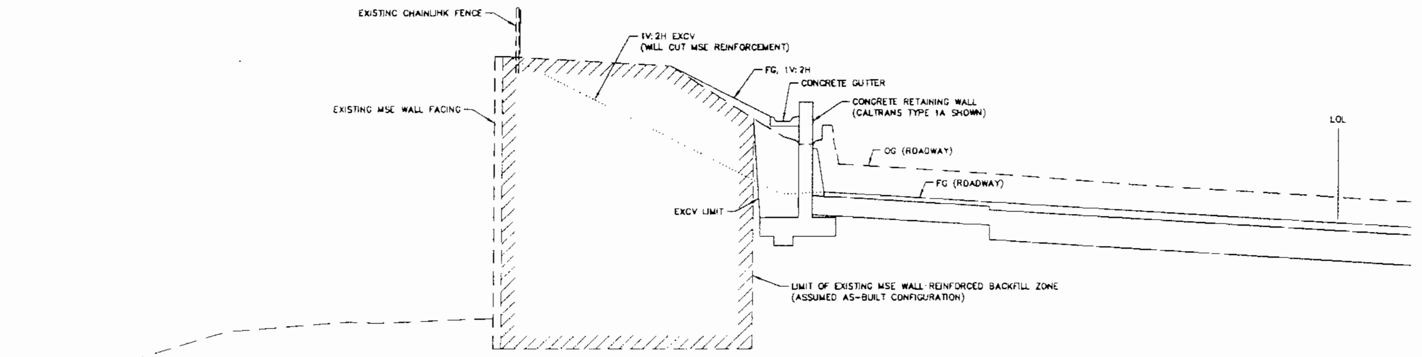
[1] Table 8-3: Earth Retaining Structure Design Parameters, "Geotechnical Design and Materials Report, Vasco Road Safety Improvements in Alameda County from MP 3.4 to MP 4.3," prepared by Cal Engineering & Geology, draft dated 8 August 2001.



LOWERING OF GRADE AT PG&E FACILITY

LT STA 1+690 – LT STA 1+740



LOWERING OF GRADE AT EXISTING MSE WALL

LT STA 1+740 – LT STA 1+910

NOTES

1. SUBSURFACE SOIL, ROCK, AND GROUNDWATER CONDITIONS VARY ACROSS THE SITE AND WITH DEPTH. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS SEE "GEOTECHNICAL DESIGN AND MATERIALS REPORT, VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3" PREPARED BY CAL ENGINEERING & GEOLOGY.

DESIGN CONSIDERATIONS

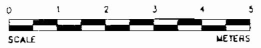
1. RETAINING WALL SHOWN REDUCES CUT AND POSSIBLE IMPACT ON PG&E FACILITY (APPROXIMATE STATIONS 1+690 TO 1+740) AND WILL REQUIRE LITTLE OR NO INTERFERENCE WITH REINFORCED ZONE OF EXISTING MSE WALL (APPROXIMATE STATIONS 1+740 TO 1+910).

2. CONVENTIONAL CALTRANS CAST-IN-PLACE CONCRETE RETAINING WALL IS RECOMMENDED DESIGN ALTERNATIVE. FOR WALL HEIGHTS UP TO 3.6 m, CALTRANS RETAINING WALL TYPE 1A (BACKFACE NOT BATTERED) COULD BE USED. FOR GREATER HEIGHTS OR MORE DEMANDING LOAD CASES, RETAINING WALL TYPE 1 (BATTERED BACKFACE) COULD BE USED.

3. RETAINING WALL LOADING ASSUMES 1V:2H OR FLATTER RETAINING WALL BACKFILL WITHOUT SURCHARGE (CALTRANS DESIGN LOADING CASE II). UNIT WEIGHTS AND STRENGTHS OF RETAINED SOILS SHOULD BE REVIEWED FOR CONSISTENCY WITH CALTRANS RETAINING WALL DESIGN VALUES (19 kN/m3, 33°42'). REDUCED LOADING CAN BE ASSUMED FROM RETAINED SOIL WITHIN THE REINFORCED ZONE OF THE EXISTING MSE WALL.

4. SPECIAL FOOTING DESIGN AND/OR PILE SUPPORT WILL BE NEEDED IF DESIGN TOE PRESSURE EXCEEDS BEARING CAPACITY (NOT ANTICIPATED FOR DESIGN HEIGHTS OF 3 m OR LESS).

5. SAFETY-SHAPE TRAFFIC BARRIER CAN BE INCORPORATED INTO FACE OF WALL AS REQUIRED.



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DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

LOWERING OF GRADE LT STA 1+690 - 1+910

CEG REF NO. 001860	JANUARY 2002	DM-3 FIGURE 1

TO: Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 5 March 2003

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 4
Embankment / Retaining Wall Alternatives
Sta 0+760 - Sta 0+830 (Pond Location)

This design memorandum is a follow up to our previous Design Memorandum No. 1, dated 18 January 2002, which presented general alternatives for minimizing encroachment on adjacent property of the roadway embankments for the proposed Vasco Road realignment. At your request, we have prepared this design memorandum which further develops variations on one of these alternatives for the specific purpose of reducing the encroachment of the embankment on an existing pond area located approximately 65 m to the left of the proposed road layout line in the vicinity of station 0+770.

One of the design alternatives (Alternative 2) presented in Design Memorandum No. 1 involves constructing a moderate height retaining wall at the toe of the embankment and a conventional 1V:2H side slope above. We suggested that a segmental retaining wall (SRW) with geogrid reinforcement would be an appropriate retaining wall system for this application. A variation on this alternative is to configure the embankment such that the retaining wall is situated at or near the top of the embankment adjacent to the roadway with the lower portion of the embankment constructed with a conventional 1V:2H side slope. A typical section with design considerations for this variation is shown as Alternative 2B on the attached Figure 1 along with Alternative 2 from Design Memorandum No. 1 (now labeled Alternative 2A). Figure 2 shows Alternative 2A and 2B embankment/wall configurations overlaid on affected cross sections along the proposed alignment.

Both Design Alternatives 2A and 2B are feasible with regard to geotechnical considerations. As with our previous recommendations involving SRW construction, we recommend that the embankment slope and retaining wall be configured such that wall height is not excessive. For both alternatives a maximum wall height of 5 m is recommended. With either design alternative, the inclusion of a wall of this height will allow the embankment or wall toe to be in approximately the same location as the 1V:1.5H embankment toe location presented in the County's 70% design submittal.

Incorporating a retaining wall in the embankment configuration will affect the stability of the overall embankment. Preliminary slope stability analyses for representative critical cross sections of the roadway embankment (without retaining walls) were completed as part of the project geotechnical design and materials report[1]. The static safety factor determined for a 20 m high 1V:2H embankment at station 0+800 was determined to be 1.57. Using the same assumed embankment material parameters and assumed parameters for select fill behind the wall, the stability of the two alternative embankment/wall configurations were analyzed. Our analysis indicates that, in both cases, the recommended minimum static safety factor of 1.5 could be achieved if select fill is used in the SRW reinforced zone and, in the case of Alternative 2B, additional geogrid is incorporated in the embankment to compensate for the adverse geometry of locating the wall on the top of the slope.

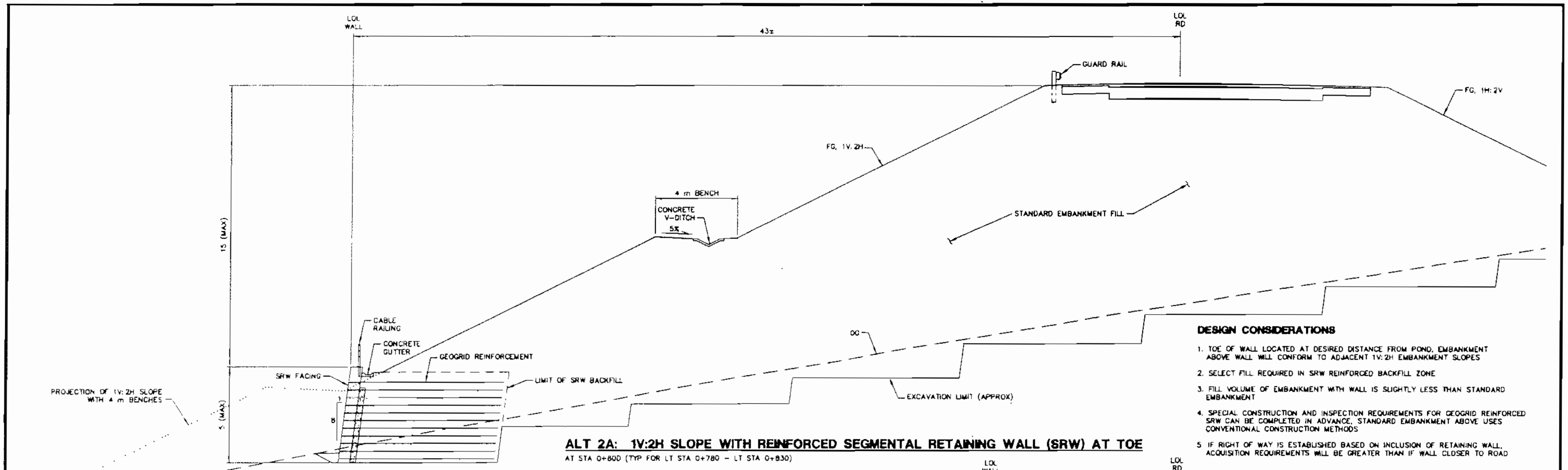
If the retaining wall is constructed at the toe of the embankment (Alternative 2A), and an embankment bench is not situated immediately upslope, a concrete gutter located behind the wall may be desirable to prevent flow over the wall face. If the retaining wall is constructed near the top of the slope (Alternative 2B) no special surface drainage features would be required at the wall unless runoff from the road is concentrated. Alternative 2B requires special features for dealing with surface drainage on the embankment below the wall. Since the embankment surface will not conform to the adjacent embankment slopes and benches, the runoff collected on the isolated bench below the wall will need to be conveyed to the embankment toe with a special drainage system such as a drainage inlet and corrugated steel pipe downdrain as shown on Figure 1.

Key considerations concerning special construction sequencing, finish embankment grades, and right of way acquisition for the two design alternatives are summarized on Figure 1. Once the preferred embankment/wall configuration is selected by the County, we will prepare design details for the retaining wall and embankment and complete the stability analysis of critical configurations.

Please contact us if you have any questions regarding issues presented in this memorandum.

---

[1] Section 8.3.1 and Table 8-2: Summary of Embankment Stability Analysis Results, "Geotechnical Design and Materials Report, Vasco Road Safety Improvements in Alameda County from MP 3.4 to MP 4.3," prepared by Cal Engineering & Geology, draft dated 8 August 2001.

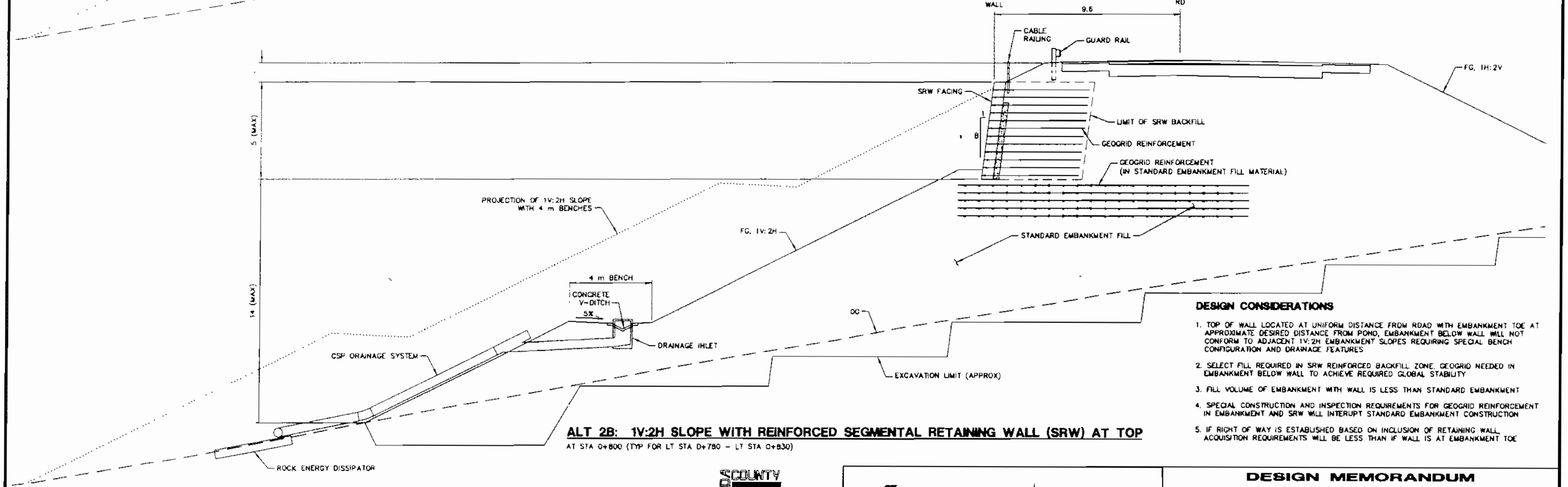


ALT 2A: 1V:2H SLOPE WITH REINFORCED SEGMENTAL RETAINING WALL (SRW) AT TOE

AT STA 0+800 (TYP FOR LT STA 0+780 – LT STA 0+830)

DESIGN CONSIDERATIONS

1. TOE OF WALL LOCATED AT DESIRED DISTANCE FROM POND, EMBANKMENT ABOVE WALL WILL CONFORM TO ADJACENT 1V:2H EMBANKMENT SLOPES
2. SELECT FILL REQUIRED IN SRW REINFORCED BACKFILL ZONE
3. FILL VOLUME OF EMBANKMENT WITH WALL IS SLIGHTLY LESS THAN STANDARD EMBANKMENT
4. SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOGRID REINFORCED SRW CAN BE COMPLETED IN ADVANCE, STANDARD EMBANKMENT ABOVE USES CONVENTIONAL CONSTRUCTION METHODS
5. IF RIGHT OF WAY IS ESTABLISHED BASED ON INCLUSION OF RETAINING WALL, ACQUISITION REQUIREMENTS WILL BE GREATER THAN IF WALL CLOSER TO ROAD



ALT 2B: 1V:2H SLOPE WITH REINFORCED SEGMENTAL RETAINING WALL (SRW) AT TOP

AT STA 0+800 (TYP FOR LT STA 0+780 – LT STA 0+830)

DESIGN CONSIDERATIONS

1. TOP OF WALL LOCATED AT UNIFORM DISTANCE FROM ROAD WITH EMBANKMENT TOE AT APPROXIMATE DESIRED DISTANCE FROM POND, EMBANKMENT BELOW WALL WILL NOT CONFORM TO ADJACENT 1V:2H EMBANKMENT SLOPES REQUIRING SPECIAL BENCH CONFIGURATION AND DRAINAGE FEATURES
2. SELECT FILL REQUIRED IN SRW REINFORCED BACKFILL ZONE, GEOGRID NEEDED IN EMBANKMENT BELOW WALL TO ACHIEVE REQUIRED GLOBAL STABILITY
3. FILL VOLUME OF EMBANKMENT WITH WALL IS LESS THAN STANDARD EMBANKMENT
4. SPECIAL CONSTRUCTION AND INSPECTION REQUIREMENTS FOR GEOGRID REINFORCEMENT IN EMBANKMENT AND SRW WILL INTERUPT STANDARD EMBANKMENT CONSTRUCTION
5. IF RIGHT OF WAY IS ESTABLISHED BASED ON INCLUSION OF RETAINING WALL, ACQUISITION REQUIREMENTS WILL BE LESS THAN IF WALL IS AT EMBANKMENT TOE

0 2 4 6 8 10

NOTES

1. SUBSURFACE SOIL, ROCK, AND GROUNDWATER CONDITIONS VARY ACROSS THE SITE AND WITH DEPTH FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS SEE "GEOTECHNICAL DESIGN AND MATERIALS REPORT, VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3" PREPARED BY CAL ENGINEERING & GEOLOGY.

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CE&G
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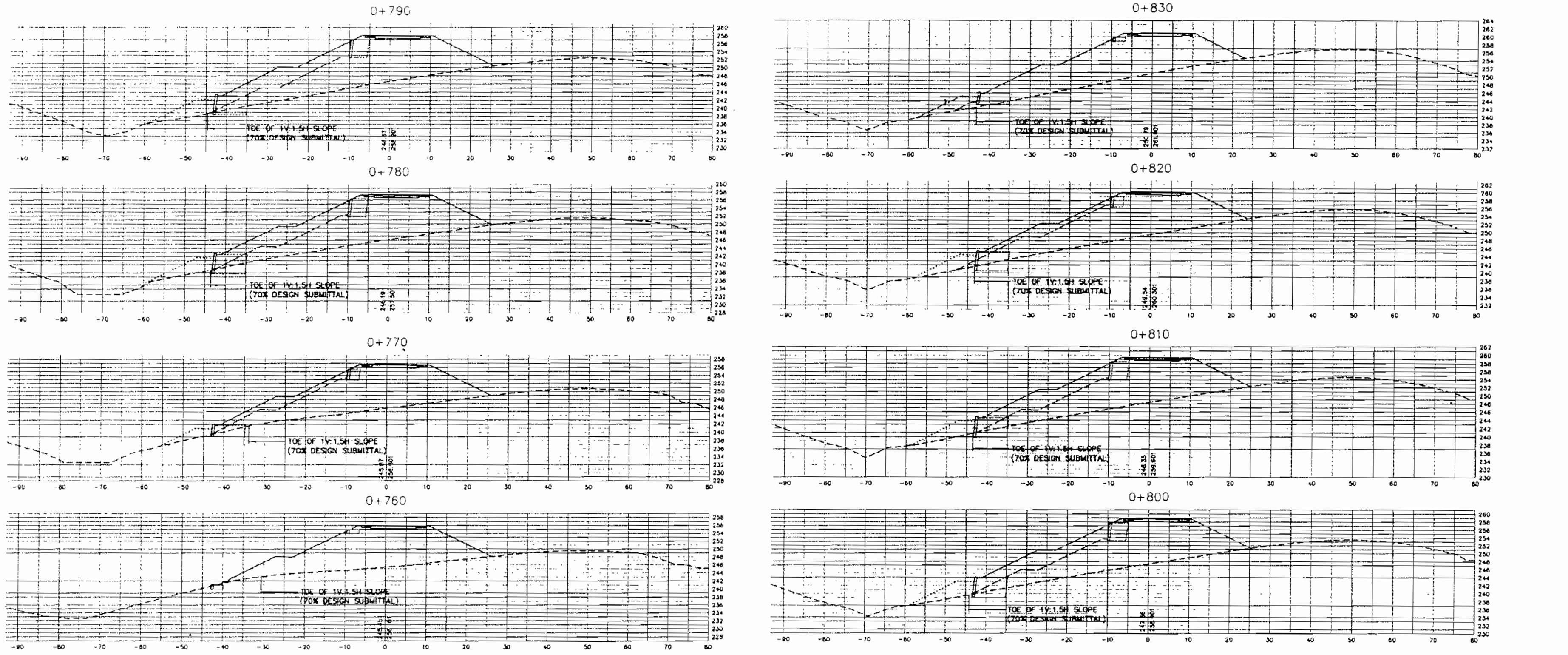
DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EMBANKMENT SLOPE ALTERNATIVES
STA 0+760 - STA 0+830

CEG REF NO. 001860	FEBRUARY 2003	DM-4 FIGURE 1

...\CEG\001860\VascoDM4.dwg Figure 1

NOTES

1. THIS IS A WORKING DRAWING - THE EMBANKMENT CONFIGURATIONS SHOWN ARE CONCEPTUAL ONLY. BENCH LOCATIONS HAVE NOT BEEN ADJUSTED.



LEGEND

- - - - - ORIGINAL GRADE

——— FINISH GRADE - 1V:2H SLOPE WITH SRW AT TOE

— — — FINISH GRADE - 1V:2H SLOPE WITH SRW AT TOP

· · · · PROJECTED 1V:2H SLOPE (FOR REFERENCE ONLY)

0 10 20 30 40 50
SCALE METERS

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DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EMBANKMENT SLOPE ALTERNATIVES
STA 0+760 - STA 0+830

CEG REF NO. 001860	FEBRUARY 2003	DM-4 FIGURE 2

\CEG\001860\VascoDM4.dwg Figure 2

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TO: Mr. James Chu
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 27 June 2007

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

PHILLIP O. GREGORY
No. Geo GE 2193
No Civil C 40728
Exp. 3/31/09

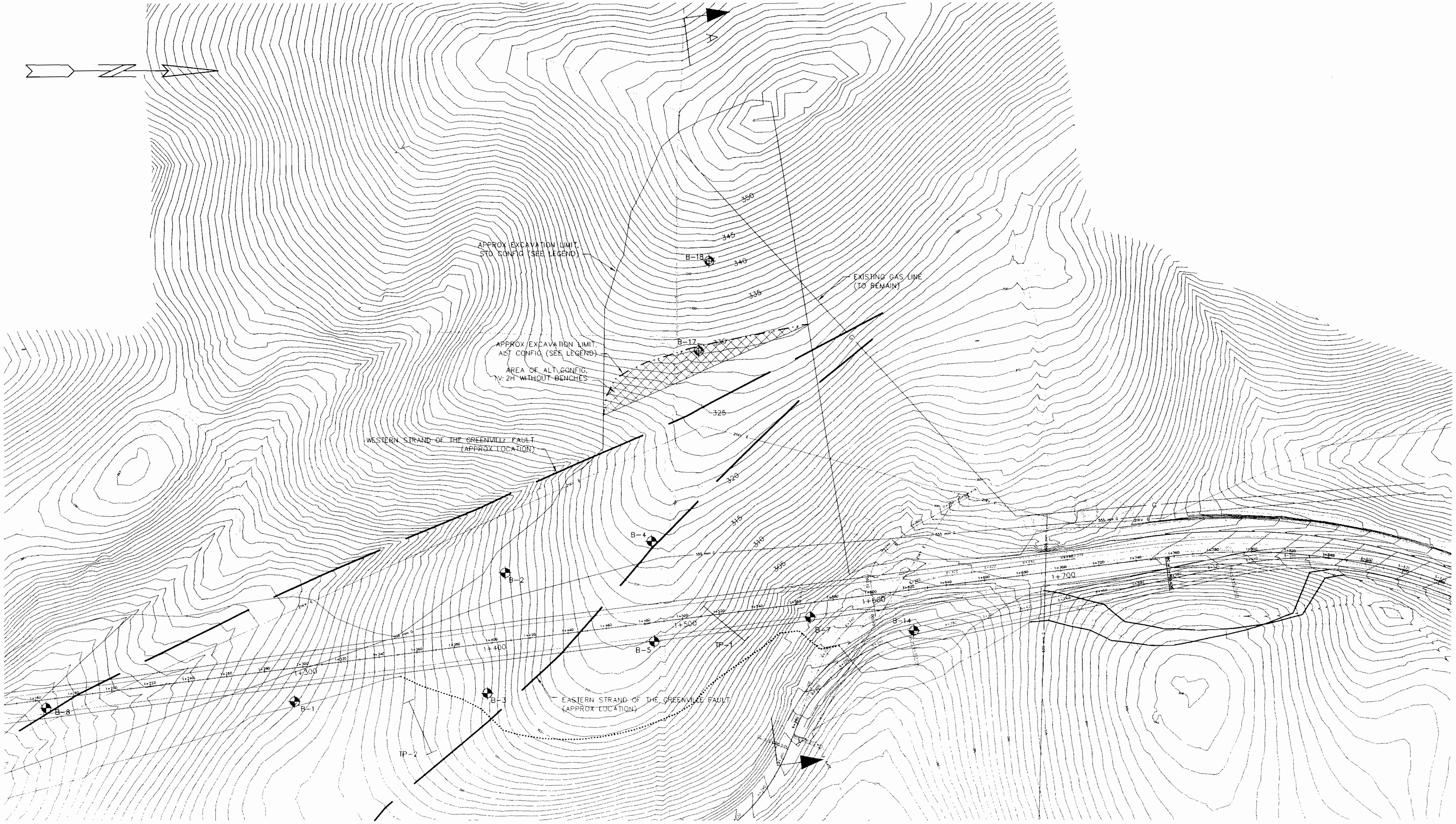
SUBJECT: Design Memorandum No. 5
Revised Excavation Recommendations
Sta 1+350 - Sta 1+590

This design memorandum is a follow up to our Geotechnical Report, dated October 2002, which presented excavation recommendations for cut slope configurations in Panoche Formation material in section 12.1.2.1. It was recommended that excavations made through this material should be designed at a relatively gentle inclination of 1V:3.5H. This recommendation resulted in a very large excavation between stations 1+350 and 1+590. Cal Engineering & Geology was retained to conduct a further study to determine if better materials exist on the west side of the Greenville fault, allowing for a steeper inclination of the cut slope and a corresponding reduction in excavation quantities.

A subsurface investigation was conducted to characterize the soils on the west side of the Greenville fault in January 2003. Two exploratory borings were excavated on the slope to depths of 20.0 and 25.0 meters. The locations of the borings are shown in Figure 1. The material obtained from the borings generally consisted of grey and orange, moderately hard, sandstone and claystone. The boring logs are attached as Sheet C11 of C11. The material encountered in the borings are in contrast to the materials found on the east side of the Greenville fault in which moderatly soft claystone was encountered in the borings to the depths explored as presented in our Geotechnical Report.

Steepening of the cut slope on the west side of the Greenville fault to 1V:2H is feasible with regard to geotechnical considerations. The steepened slope is shown in Figure 2. As with our previous recommendations involving cut slopes, the slope should be constructed from the top downslope to reduce the potential for slope instability and to facilitate geologic mapping of the excavation as it is made.

Please contact us if you have any questions regarding issues presented in this memorandum.



LEGEND

STD CONFIG – 1V: 3.5H SLOPE WITH 5 m BENCHES (GEOTECH DESIGN AND MATL REPORT RECOMMENDATION)

ALT CONFIG – STD CONFIG WITH 1V: 2H SLOPE BEYOND LT 140 m

B-14 TEST BORING (CE&G, 2000–2001)

B-18 TEST BORING (CE&G, 2000–2003)

TEST PIT (CE&G, 2000–2001)

0 50 100
SCALE METERS

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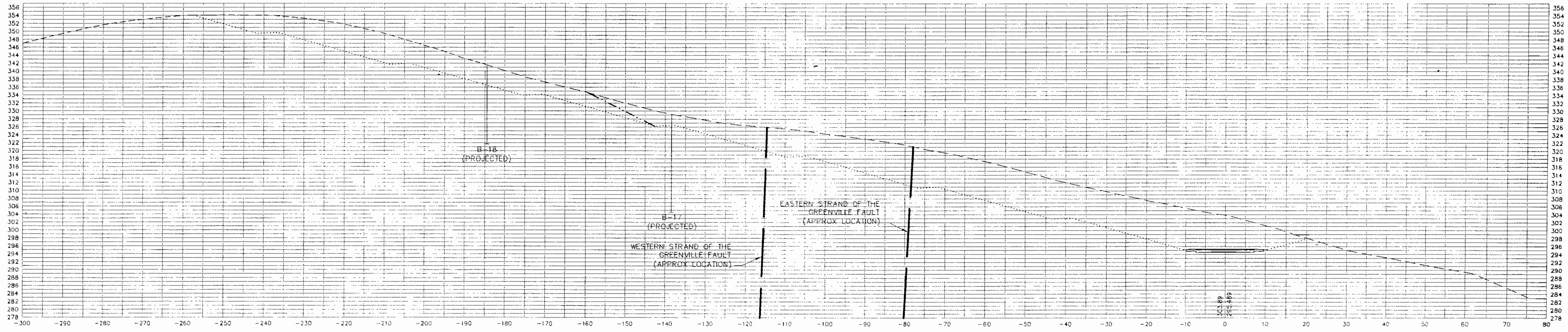
DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EXCAVATION SLOPE ALTERNATIVES LT STA 1+350 – 1+590

CEG REF NO. 001860 | JUNE 2007 | DM-5 FIGURE 1

..\CEG\001860\VascoDM5-Fig1.dwg



SECTION A-A

AT STA 1+540
(REPRESENTATIVE FOR STA 1+350 – STA 1+590)

LEGEND

— — — ORIGINAL GRADE

.... STD CONFIG - 1V 3.5H SLOPE WITH 5 m BENCHES
(GEOTECH DESIGN AND MAT'L REPORT RECOMMENDATION)

—·—— ALT CONFIG – STD CONFIG WITH 1V 2H SLOPE BEYOND LT 140 m.

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DESIGN MEMORANDUM
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
EXCAVATION SLOPE ALTERNATIVES
LT STA 1+350 - 1+590

CEG REF NO. 001860	JUNE 2007	DM-5 FIGURE 2

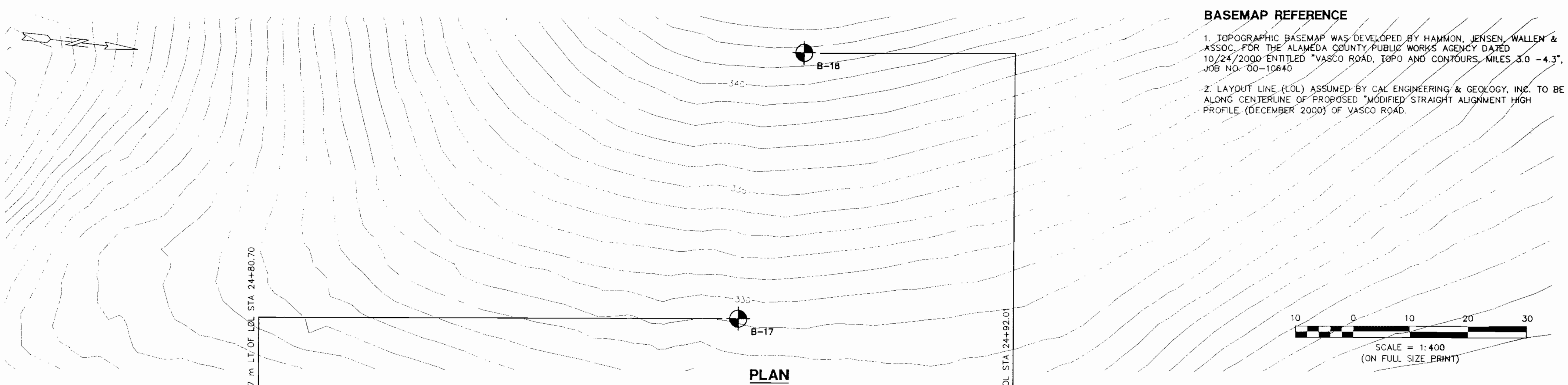
...\CEG\001860\VascoDM5-Fig2.dwg

\\Granite\CEG master files\2000\001860 ACPWA Vasco Road\Phase I\Design Memos\Design Memo 5\001860-DM5BoringLogs.dwg   VIEWPOINT ROTATION: 0'
PLOT SCALE: 1000 = 1   TEXT ROTATION: 0'
LOG OF TEST BORINGS: K-999-X   --

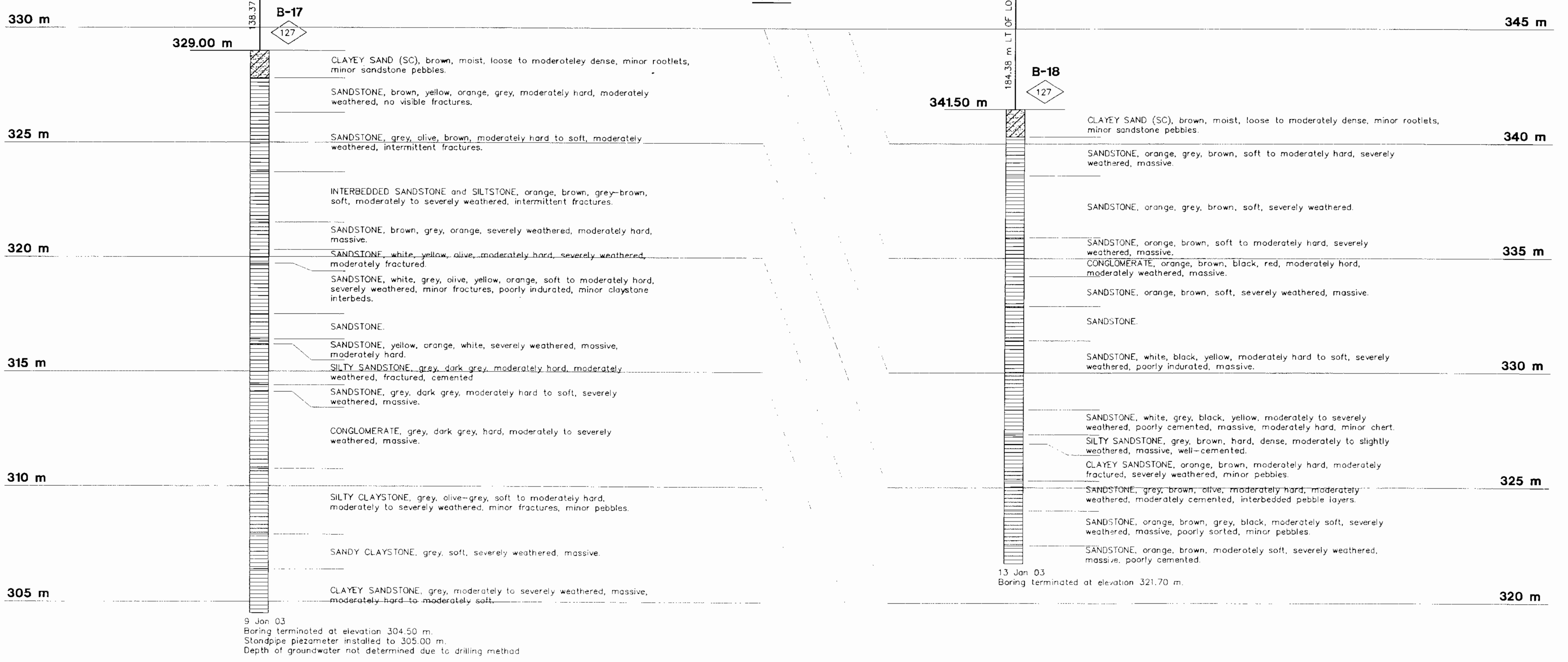
BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



PLAN



B-17

CLAYEY SAND (SC), brown, moist, loose to moderoteley dense, minor rootlets, minor sandstone pebbles.

SANDSTONE, brown, yellow, orange, grey, moderately hard, moderately weathered, no visible fractures.

SANDSTONE, grey, olive, brown, moderately hard to soft, moderately weathered, intermittent fractures.

INTERBEDDED SANDSTONE and SILTSTONE, orange, brown, grey-brown, soft, moderately to severely weathered, intermittent fractures.

SANDSTONE, brown, grey, orange, severely weathered, moderately hard, massive.

SANDSTONE, white, yellow, olive, moderately hard, severely weathered, moderately fractured.

SANDSTONE, white, grey, olive, yellow, orange, soft to moderately hard, severely weathered, minor fractures, poorly indurated, minor claystone interbeds.

SANDSTONE.

SANDSTONE, yellow, orange, white, severely weathered, massive, moderately hard.

SILTY SANDSTONE, grey, dark grey, moderately hard, moderately weathered, fractured, cemented

SANDSTONE, grey, dark grey, moderately hard to soft, severely weathered, massive.

CONGLOMERATE, grey, dark grey, hard, moderately to severely weathered, massive.

SILTY CLAYSTONE, grey, olive-grey, soft to moderately hard, moderately to severely weathered. minor fractures, minor pebbles.

SANDY CLAYSTONE. grey, soft, severely weathered, massive.

CLAYEY SANDSTONE, grey, moderately to severely weathered, massive, moderately hard to moderately soft.

9 Jan 03
Boring terminated at elevation 304.50 m.
Standpipe piezometer installed to 305.00 m.
Depth of groundwater not determined due to drilling method

B-18

CLAYEY SAND (SC), brown, moist, loose to moderately dense, minor rootlets, minor sandstone pebbles.

SANDSTONE, orange, grey, brown, soft to moderately hard, severely weathered, massive.

SANDSTONE, orange, grey, brown, soft, severely weathered.

SANDSTONE, orange, brown, soft to moderately hard, severely weathered, massive.

CONGLOMERATE, orange, brown, black, red, moderately hard, moderately weathered, massive.

SANDSTONE, orange, brown, soft, severely weathered, massive.

SANDSTONE.

SANDSTONE, white, black, yellow, moderately hard to soft, severely weathered, poorly indurated, massive.

SANDSTONE, white, grey, black, yellow, moderately to severely weathered, poorly cemented, massive, moderately hard, minor chert.

SILTY SANDSTONE, grey, brown, hard, dense, moderately to slightly weathered, massive, well-cemented.

CLAYEY SANDSTONE, orange, brown, moderately hard, moderately fractured, severely weathered, minor pebbles.

SANDSTONE, grey, brown, olive, moderately hard, moderately weathered, moderately cemented, interbedded pebble layers.

SANDSTONE, orange, brown, grey, black, moderately soft, severely weathered, massive, poorly sorted, minor pebbles.

SANDSTONE, orange, brown, moderately soft, severely weathered, massive, poorly cemented.

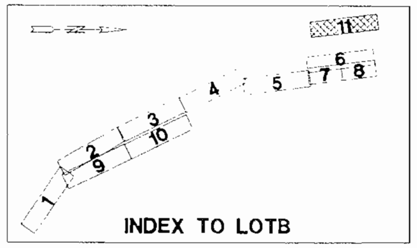
13 Jan 03
Boring terminated at elevation 321.70 m.

2.5 0 2.5 5 7.5
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

PROFILE

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
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CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

LEGEND OF EARTH MATERIALS

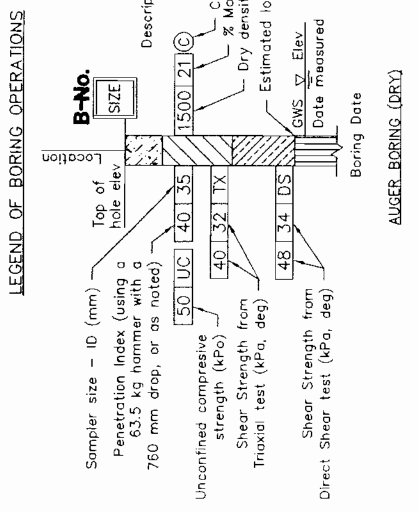
▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▨	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▨	METAMORPHIC ROCK
▨	CLAYEY SILT		

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

●	57 mm CONE PENETROMETER
SIZE	SAMPLE BORING (DRY)
SIZE	ROTARY SAMPLE BORING (WET)
SIZE	AUGER BORING (DRY)
⊢⊣	TEST TRENCH
◇ SIZE	DIAMOND CORE BORING
SIZE	JET BORING
▲	ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF BORING OPERATIONS



AUGER BORING (DRY)

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W.O. NO.: R23265   SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

LOG OF TEST BORINGS

CEG REF NO	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO	SHEET NO.	OF
001860	RS/SW	CAH	P.GREGORY	JUNE 2007	AS SHOWN	K-999-X	C11	C11

TO: Mr. Phillip Fung
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544
fax (510) 782-1939

FROM: Phillip Gregory, P.E., G.E.

DATE: 5 May 2003

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 6
Alternative Alignment of PG&E Re-routing

This design memorandum addresses geotechnical issues related to the County's proposed alternative alignment of the re-routing of PG&E's gas line. The approximate location of the proposed alternative re-route is shown on the attached annotated copy of Figure 4-3 of the project geotechnical report.

As indicated on the annotated figure, the proposed alternative re-routing results in the following geotechnical and/or geologic constraints:

1) The northern portion of the re-routed line would cross identified landslide LS-1.

2) The north-south segment of the re-routed line would cross two identified strands of the Greenville Fault (as does the existing line).

3) The central part of the north-south segment of the re-routed line would cross the upper portions of the identified landslide LS-3.

From a geotechnical point of view, these constraints are not insurmountable and can be mitigated as follows:

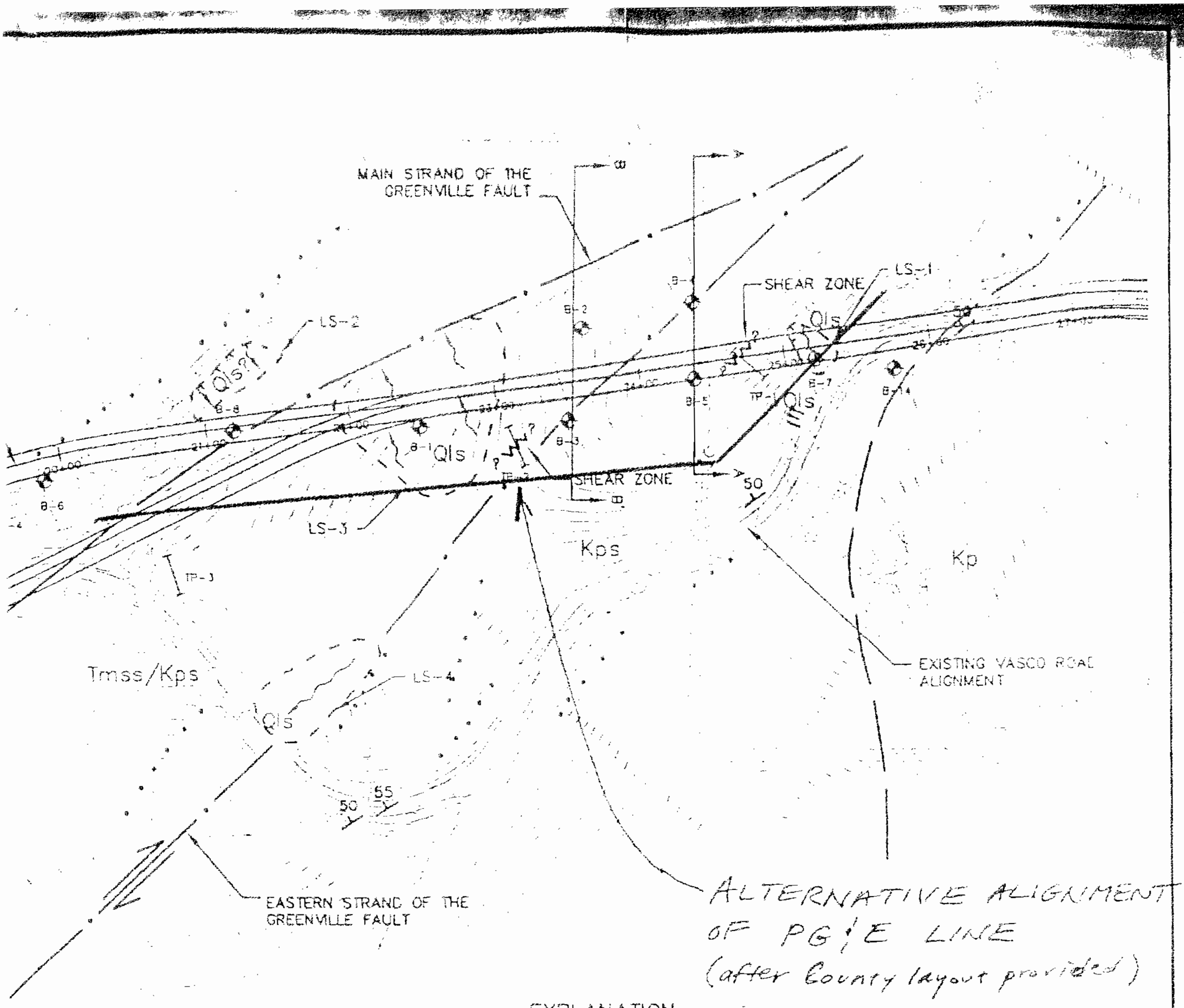
1) The majority of landslide LS-1 will be removed by design cut for the road. This excavation work can be completed prior to the road work in order to accommodate installation of the re-routed PG&E line.

2) The re-routing of the PG&E line will necessarily cross two strands of the fault, as the current line does. This hazard can be mitigated by designing the pipeline to address the anticipated displacement along the fault.

3) Landslide LS-3 can be avoided by locating the re-routed line approximately 25 - 30 meters south of the location shown on the attached figure. It should be noted that this will also allow for the possibility of adjusting (flattening) the design east cut slope between Sta 1+360 and Sta 1+560, if it is necessary to balance the project grading.

We conclude that the County's proposed alternative alignment for the re-routing of the PG&E line is feasible from a geotechnical standpoint if the above described mitigation measures are implemented. It is also our opinion that from a geotechnical perspective the constraints and associated risks for the proposed alternative are not significantly different from and are comparable to those of the currently proposed alignment. It should be noted that the final design of the proposed alternative alignment is subject to additional studies similar to any which have been or will be completed by PG&E for the currently planned alignment.

Please contact us if you have any questions regarding issues presented in this memorandum.



ALTERNATIVE ALIGNMENT OF PG&E LINE (after County layout provided)

EXPLANATION

B-16	TEST BORING (CEG, JAN 00)
TP-6	TEST PITS (CEG, JAN 00)
A A'	LOCATION OF GEOLOGIC SECTION
Qal	QUATERNARY ALLUVIAL AND COLLUVIAL DEPOSITS
Qls	LANDSLIDE Qls ① AND Qls ② VERY INDISTINCT AND UNCERTAIN IDENTIFIED BASED ON GEOMORPHIC EVIDENCE OBSERVED IN AERIAL PHOTOGRAPHS
Tmss	TERTIARY, UPPER MIOCENE CIERBO FORMATION. CONSISTS PRINCIPALLY OF TAN, PEBBLY ARKOSIC SANDSTONE WITH LOCAL COBBLE ZONES. INCLUDES BRIONES FORMATION OF CRANE (1995) AND MAJMUNDAR (1991)
Kp Kps	CRETACEOUS PANOCHE FORMATION Kp – ARKOSIC SANDSTONE, TYPICALLY MASSIVE WITH VARYING HARDNESS FROM FRIABLE TO VERY HARD. OCCASIONAL LARGE HARD CONCRETIONS WITH THIN INTERBEDDED SHALE Kps – MICACEOUS CLAYEY SHALE AND SILTSTONE, WITH LOCAL THIN INTERBEDDED SANDSTONE AND CONGLOMERATE
• • • •	PEBBLY CONGLOMERATE AND RESISTANT SANDSTONE OUTCROPS
50	STRIKE AND DIP
	GEOLOGIC CONTACT – DASHED WHERE APPROXIMATELY LOCATED
	FAULT – DASHED WHERE APPROXIMATELY LOCATED AND DOTTED WHERE CONCEALED. ARROWS SHOW INFERRED DIRECTION OF MOVEMENT
	SHEAR OBSERVED IN TEST PIT

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GEOTECHNICAL DESIGN REPORT

VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

MAP OF GEOLOGIC FEATURES

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 4-3

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TO: Mr. Phillip Fung
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fax (510) 782-1939

FROM: Phillip Gregory, P.E., G.E.

DATE: 9 June 2004
revised 16 June 2004

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 7
PG&E Gas Line Relocation
Cut/Fill Recommendations

This design memorandum presents recommendations for temporary and permanent cut and fill slopes for the proposed PG&E gas line relocation associated with Vasco Road Safety Improvements MP 3.4 - MP 4.3. We reviewed material that you provided including the proposed pipeline alignment plan and cross sections as well as PG&E construction access requirements. We understand that cuts and fills will be required to construct a temporary work strip for pipeline installation and that a permanent narrower access road will remain along the alignment.

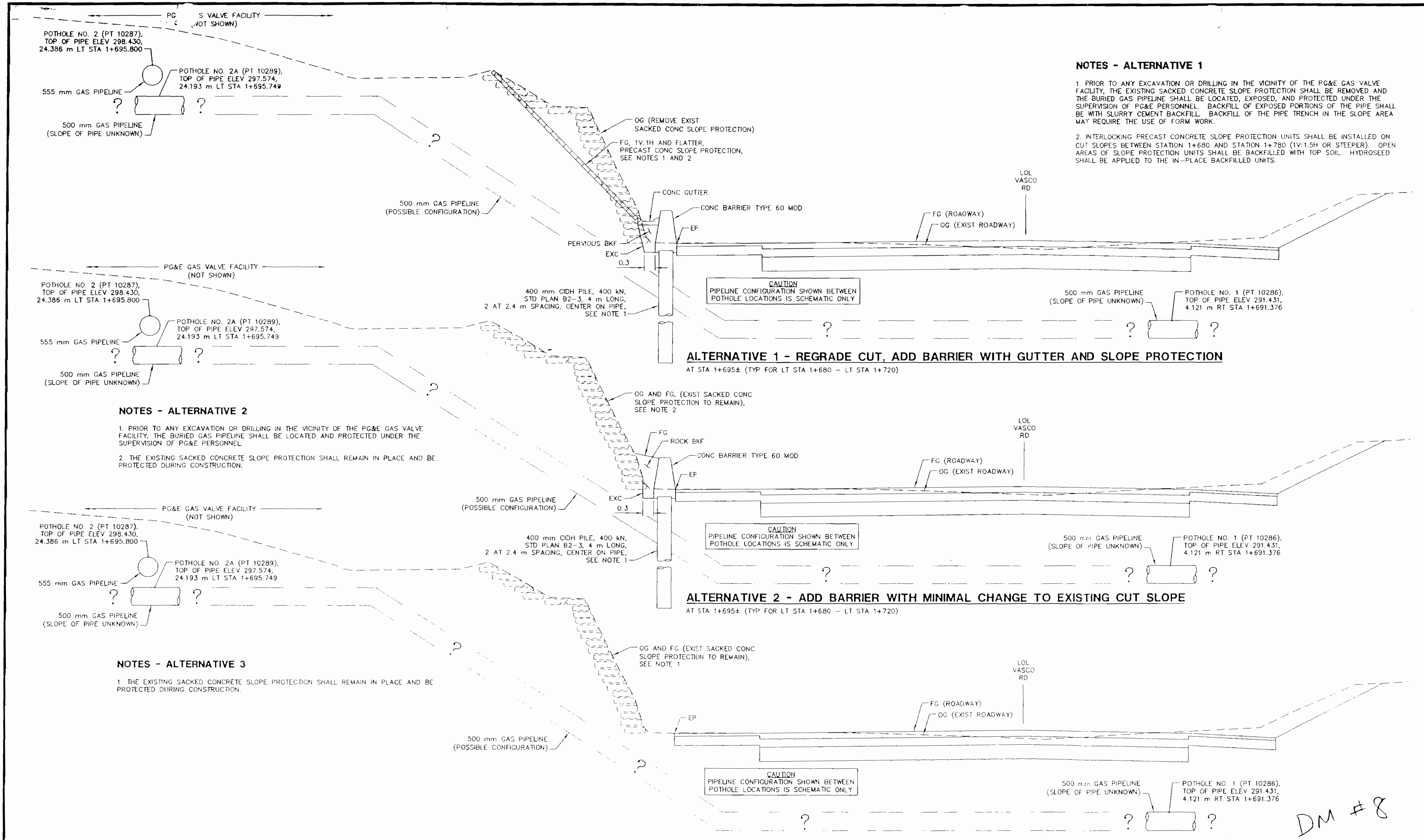
Temporary Cut and Fill Slopes:

We recommend that temporary cut and fill slopes necessary for construction access be 1V:1H or flatter.

Permanent Cut and Fill Slopes:

We recommend that permanent cut slopes less than 5 m tall be 1V:1.5H or flatter. Permanent cut slopes greater than 5 m tall and permanent fill slopes should be 1V:2H or flatter. At locations where cut slopes are higher than approximately 10 m or where there is a significant drainage area above the cut, we recommend that a diversion ditch be constructed at or near the top of the cut slope to minimize erosion.

Please contact us if you have any questions regarding issues presented in this memorandum.



NOTES - ALTERNATIVE 1

1. PRIOR TO ANY EXCAVATION OR DRILLING IN THE VICINITY OF THE PG&E GAS VALVE FACILITY, THE EXISTING SACKED CONCRETE SLOPE PROTECTION SHALL BE REMOVED AND THE BURIED GAS PIPELINE SHALL BE LOCATED, EXPOSED, AND PROTECTED UNDER THE SUPERVISION OF PG&E PERSONNEL. BACKFILL OF EXPOSED PORTIONS OF THE PIPE SHALL BE WITH SLURRY CEMENT BACKFILL. BACKFILL OF THE PIPE TRENCH IN THE SLOPE AREA MAY REQUIRE THE USE OF FORM WORK.

2. INTERLOCKING PRECAST CONCRETE SLOPE PROTECTION UNITS SHALL BE INSTALLED ON CUT SLOPES BETWEEN STATION 1+680 AND STATION 1+780 (1V:1.5H OR STEEPER). OPEN AREAS OF SLOPE PROTECTION UNITS SHALL BE BACKFILLED WITH TOP SOIL. HYDROSEED SHALL BE APPLIED TO THE IN-PLACE BACKFILLED UNITS.

ALTERNATIVE 1 - REGRADE CUT, ADD BARRIER WITH GUTTER AND SLOPE PROTECTION

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

NOTES - ALTERNATIVE 2

1. PRIOR TO ANY EXCAVATION OR DRILLING IN THE VICINITY OF THE PG&E GAS VALVE FACILITY, THE BURIED GAS PIPELINE SHALL BE LOCATED AND PROTECTED UNDER THE SUPERVISION OF PG&E PERSONNEL.

2. THE EXISTING SACKED CONCRETE SLOPE PROTECTION SHALL REMAIN IN PLACE AND BE PROTECTED DURING CONSTRUCTION.

ALTERNATIVE 2 - ADD BARRIER WITH MINIMAL CHANGE TO EXISTING CUT SLOPE

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

NOTES - ALTERNATIVE 3

1. THE EXISTING SACKED CONCRETE SLOPE PROTECTION SHALL REMAIN IN PLACE AND BE PROTECTED DURING CONSTRUCTION.

ALTERNATIVE 3 - NO CHANGE TO EXISTING CUT SLOPE (BEGIN BARRIER AT STA 1+720)

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

DM #8

0 1 2 3 4 5
SCALE METERS

DRAFT FOR DISCUSSION
30 JANUARY 2003

ALAMEDA COUNTY
Metric
UNITS ARE IN METERS
UNLESS OTHERWISE NOTED

PREPARED FOR ALAMEDA COUNTY PUBLIC WORKS AGENCY BY:

CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd
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Phone: (925) 935-9771

DESIGN DEVELOPMENT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
CUT SLOPE ALTERNATIVES AT PG&E FACILITY
LT STA 1+680 - LT STA 1+720

CEG REF NO. 001860 | JANUARY 2003 | FIGURE 1

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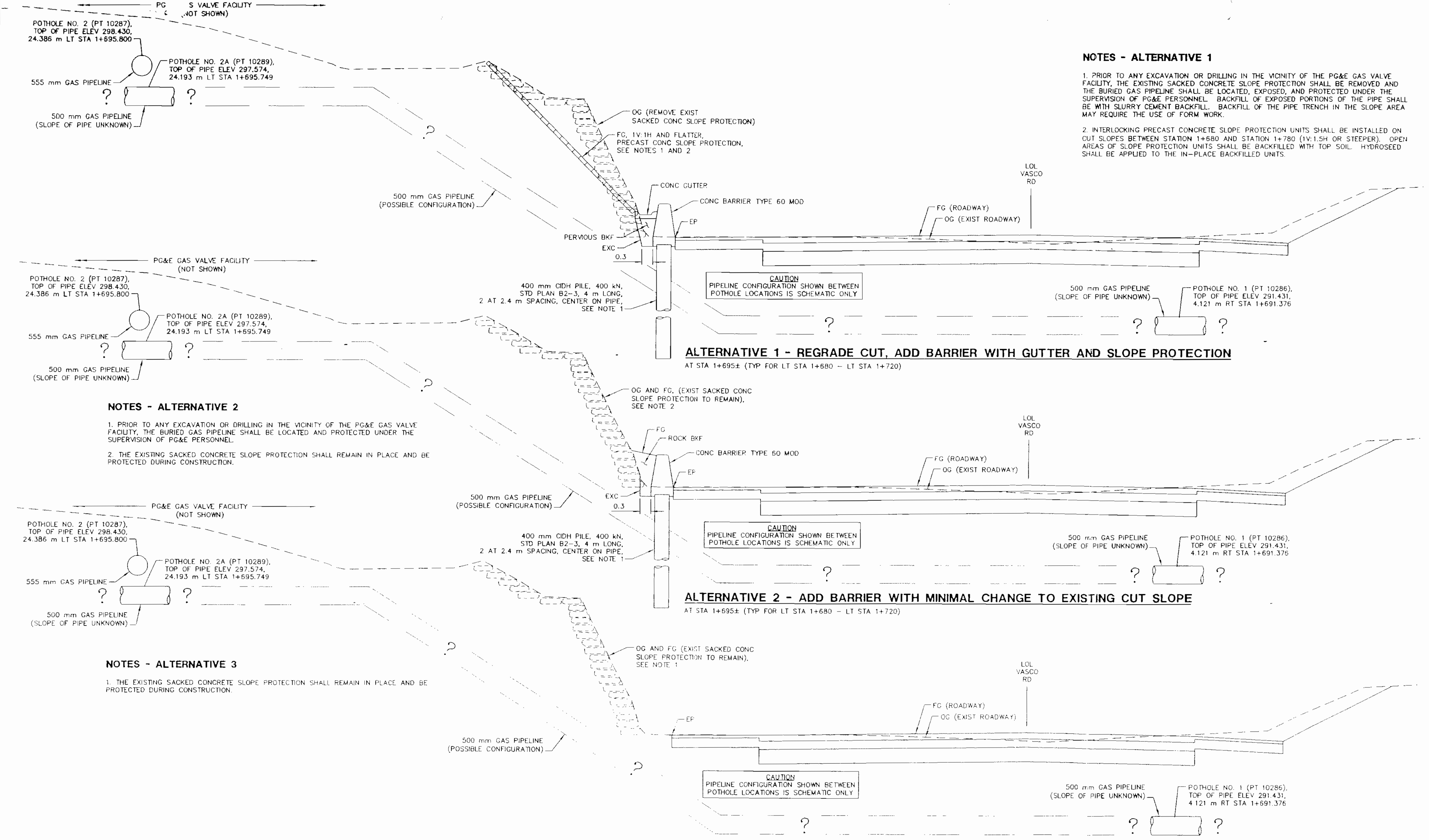

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ALTERNATIVE 1 - REGRADE CUT, ADD BARRIER WITH GUTTER AND SLOPE PROTECTION

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

NOTES - ALTERNATIVE 2

1. PRIOR TO ANY EXCAVATION OR DRILLING IN THE VICINITY OF THE PG&E GAS VALVE FACILITY, THE BURIED GAS PIPELINE SHALL BE LOCATED AND PROTECTED UNDER THE SUPERVISION OF PG&E PERSONNEL.

2. THE EXISTING SACKED CONCRETE SLOPE PROTECTION SHALL REMAIN IN PLACE AND BE PROTECTED DURING CONSTRUCTION.

ALTERNATIVE 2 - ADD BARRIER WITH MINIMAL CHANGE TO EXISTING CUT SLOPE

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

NOTES - ALTERNATIVE 3

1. THE EXISTING SACKED CONCRETE SLOPE PROTECTION SHALL REMAIN IN PLACE AND BE PROTECTED DURING CONSTRUCTION.

ALTERNATIVE 3 - NO CHANGE TO EXISTING CUT SLOPE (BEGIN BARRIER AT STA 1+720)

AT STA 1+695± (TYP FOR LT STA 1+680 - LT STA 1+720)

0 1 2 3 4 5
SCALE METERS

DRAFT FOR DISCUSSION
30 JANUARY 2003

ALAMEDA COUNTY Metric
UNITS ARE IN METERS
UNLESS OTHERWISE NOTED

PREPARED FOR ALAMEDA COUNTY PUBLIC WORKS AGENCY BY:

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DESIGN DEVELOPMENT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
CUT SLOPE ALTERNATIVES AT PG&E FACILITY
LT STA 1+680 - LT STA 1+720

CEG REF NO. 001860	JANUARY 2003	FIGURE 1

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CAL ENGINEERING & GEOLOGY

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TO: Mr. James Chu
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

FROM: Phillip Gregory, P.E., G.E.

DATE: 21 August 2007

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 9
North Extension Grading Recommendations
Permanent and Temporary Cut Slopes

REGISTERED PROFESSIONAL ENGINEER
PHILLIP O. GREGORY
No. Geo GE 2193
No Civil C 40728
Exp. 3/31/09
CIVIL-GEOTECHNICAL
STATE OF CALIFORNIA

As requested we have prepared this design memorandum to present the results of our observations and geologic mapping of the north extension of the Vasco Road Safety Improvement Project. Specifically, we were asked to provide grading recommendations regarding permanent and temporary cut slopes. This area was out of the scope covered in our Geotechnical Report dated October 2002.

General

Our observations and geologic mapping of the existing cuts on the east side of the north end of the project (Sta 1+700 to 2+450 from plans dated 22 May 2007) revealed that weathering of the outer 6 to 18 inches has occurred and minor localized soil slope sloughing has resulted. The weathering appears to primarily be a result of animal burrowing activity (bioturbation) and plant growth. The cuts were made approximatly 10 years ago to facilitate the realignment of Vasco Road as part of the Contra Costa Water District's construction of the Los Vaqueros Reservoir. Overall, the performance of the existing 1V:2H cut slopes appears to have been reasonably good and it appears that little or no maintenance has been required in the 10 plus years since the cut was made.

Permanent Cut Slopes

Based on these observations of the performance of existing 1V:2H cut slopes on the north end of the project, it is our opinion that in order to have low-maintenance performance similar to the existing cut slopes, the new permanent cut slopes on the east side should be limited to no steeper than 1V:2H. In our opinion, benches are not needed for slopes less than 15 meters tall, but consideration should be given to including a concrete barrier and concrete gutter at the base of the cut similar to that current at the site.

If it is acceptable to the County to have increased surface erosion and/or sloughing and increased long-term maintenance, then in our opinion, the inclination of the cut slope could be increased to 1V:1.75 while still maintaining reasonable global stability and serviceability. This will be subject to verification by an engineering geologist when the cut is initially made. The cut should be made from the top down to allow for verification of the bedding by the engineering geologist before the entire cut is completed. If it is decided to make the cuts at this steeper inclination, then a barrier and gutter should be installed at the base of the cut.

Temporary Cut Slopes

Temporary cut slopes (ones that would remain open for approximately two years or less) in this area can be made up to 1V:1.25H but should be mapped by an engineering geologist to confirm the absence of adverse bedding which may be a possibility in some areas.

Please contact us if you have any questions regarding issues presented in this memorandum.

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15 December 2006
File: 001860

Mr. Bond Ng
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544

Re: Geologic and Geotechnical Data
PG&E Gas Line Relocation
Near Roadway Station 25+00
Vasco Road Safety Improvements MP 3.4 to MP 4.3
Alameda County, California

DM #11

Dear Mr. Ng:

At your request, we are providing to you the attached data for use by others for the purpose of evaluating the relocation of a portion of the existing PG&E gas line by Horizontal Directional Drilling. It has been proposed to relocate about 125 m of existing 555 mm PG&E gas line by directional drilling a new alignment in a southeasterly direction from the connection tie in around roadway Station 25+00. We understand the approximate proposed gas line elevation near Station 25+00 is about 291 meters.

The attached geologic and geotechnical data listed below was extracted from existing reports and subsurface evaluations completed by Cal Engineering & Geology, Inc., for the Vasco Road Safety Improvement project.

- Executive Summary presented in the Geotechnical Design and Materials Report;
- Regional Geology and Seismicity Section of the Geotechnical Design and Materials Report;
- Geotechnical Conditions Section of the Geotechnical Design and Materials Report;
- Rippability Section of the Geotechnical Design and Materials Report;
- Appendix E - Seismic Refraction Survey of the Geotechnical Design and Materials Report;
- Figure 4-A, Map of Geologic Features;
- Figure 4-4, Geologic Cross-Sections A-A' and B-B';
- Log of Test Pit TP-1; and
- Sheets C7 and C8, Logs of Test Borings.

Using Figure 4-3 as reference, the gas line will be relocated from about Boring B-7 (near Station 25+00) in a southeasterly direction for about 125 m. Borings B-5 (Sheet C7), B-7 (Sheet C8), and boring B-14 (Sheet C8) are representative borings in the general vicinity of the directional drilling alignment. Because boring B-7 is close to the relocation alignment, we plotted the approximate proposed elevation of the realigned gas line on boring log B-7.

Appendix E presents results of seismic refraction survey lines completed near the PG&E gas line realignment project. The survey line locations are shown on Drawing No. 2 in the Seismic Refraction Survey report. That drawing can be cross-referenced to Figure 4-3 by lining up the broad U-shaped alignment of the existing Vasco Road.

Based on our review of the enclosed data, installation of the realigned gas line by horizontal directional drilling methods is reasonable from a geologic and geotechnical engineering point of view. Given the proposed elevation of the realigned gas line and the size of the gas pipe to be installed by horizontal directional drilling, consideration should be given to deepening the gas line in order to design a bore path that is located entirely within the sandstone/siltstone/claystone deposits of the Kps formation and not the clays that overlie the parent bedrock.

We trust this provides the information you need. Please call if you have any questions or need additional information.

Respectfully,

CAL ENGINEERING & GEOLOGY, INC.

Norman Joyal
Associate Engineer

Attachments

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DRAFT

TO: Mr. Bond Ng
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, California 94544
fax (510) 782-1939

FROM: Phillip Gregory, P.E., G.E.

DATE: 12 Oct 2006

PROJECT: Vasco Road Safety Improvements MP 3.4 - MP 4.3
W.O. No. R23265

SUBJECT: Design Memorandum No. 10
Review of 90% Plans
PG&E Gas Line Relocation Grading Plans

This design memorandum presents our review comments regarding the grading 90% grading plan prepared for the PG&E relocation. Our comments are as follows:

1. The grading plans do not include an overall plan of the realignment grading plan that shows the north and south connections and the existing road etc. Such a plan at an appropriate scale would be very useful.

2. Except for the Title Sheet, there are no north arrows on the individual plan sections for the layout line, grading, or profiles. These should be added.

3. The contractor staging areas identified need to have a note that indicates that the grading design in these areas are the responsibility of the contractor and that a submittal is needed.

4. The stationing on the proposed Vasco Road realignment is only included on the plan and profile sheets and not on the grading plan sheets or construction line layout sheets. It would be useful to have the Vasco Road stationing on these other sheets as well.

5. The stationing shown on the Cross Sections sheets does not correspond to the stationing on the construction line layout sheets, the grading plan sheets, or the plan and profile sheets. This should be corrected.

6. At the north connect, the alignment crosses landslide LS-1. The landslide will be removed when the road is constructed by a design cut. It does not appear to be completely removed by the grading for the gas line. If the road cut will not be made at when the gas line grading is done, this area may need to be stabilized until the final cuts are made.

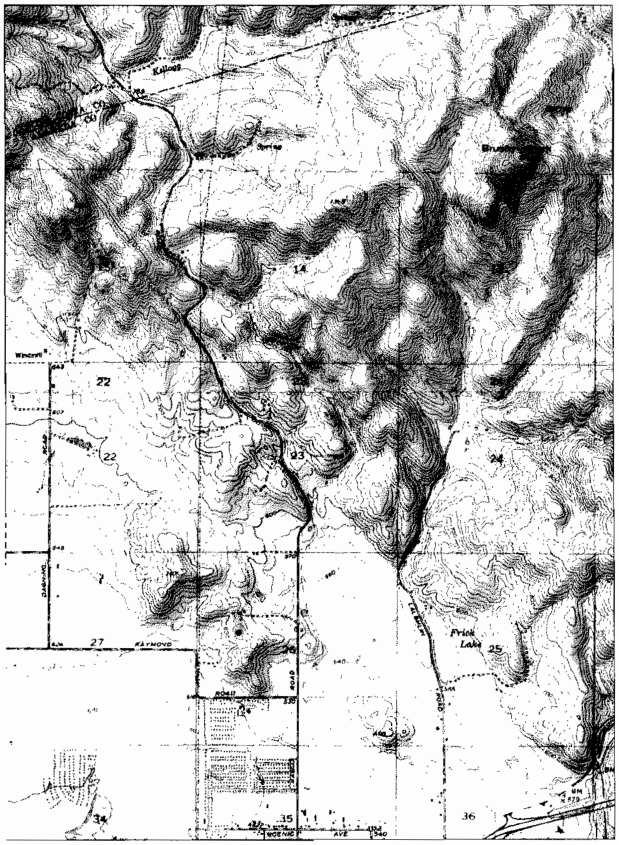
7. The typical section on Sheet 4 shows concrete ditch at the top of a cut slope. There are several areas on the grading plans which show ditches/benches at mid-slope of the cuts. Are concrete ditches to be constructed here as well?

8. The culvert detail on Sheet 3 could be on Sheet 4.

9. The four sections on Sheet 4 are all indicated to be for Line 114. It is unclear where each of the different sections apply.

Please contact us if you have any questions regarding issues presented in this memorandum.

GEOTECHNICAL DESIGN AND MATERIALS REPORT
Vasco Road Safety Improvements in Alameda County From MP 3.4 to MP 4.3



Prepared for:
County of Alameda
Public Works Agency
399 Elmhurst Street
Hayward, California 94544

Prepared by:
Cal Engineering & Geology
1870 Olympic Boulevard
Suite 100
Walnut Creek, California 94596

Phillip G. Gregory
No Geo GE 2193
No Civil C 40728
Exp. 3/31/03

10-22-02

October 2002

GEOTECHNICAL DESIGN AND MATERIALS REPORT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

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Tables

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GEOTECHNICAL DESIGN AND MATERIALS REPORT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

EXECUTIVE SUMMARY

The following Geotechnical Design and Materials Report was prepared for the County of Alameda Public Works Agency to support design of the proposed realignment of a 1.61 km segment of Vasco Road between mileposts 3.4 and 4.3. The proposed improvements include new roadway alignment and grade, widened shoulders, and added passing lanes to mitigate tight curves, inadequate site distance, and narrow shoulders that do not meet current highway standards. The purpose of this report is to document subsurface geotechnical conditions, provide an assessment of anticipated site conditions as they pertain to the project, and to recommend design and construction criteria for the roadway portions of the project. This report also establishes a geotechnical baseline that may be used to evaluate changed conditions that may be encountered during construction.

The information and recommendations presented in the report were developed based on pre-existing information relevant to the project, site surface and subsurface investigations, laboratory testing, and engineering analyses. Prior to completion of this report, a draft report was prepared and submitted to the Alameda County Public Works Agency for review. Alameda County, in turn, retained DCM/Joyal Engineering to provide third party peer-review of the draft report. As described in the correspondence included in Appendix L, the DCM/Joyal Engineering review comments and suggestions have been incorporated in this document. Summary information regarding site conditions and engineering recommendations is presented below.

EXISTING CONDITIONS AND PROPOSED ALIGNMENT

The project area is characterized by rolling hills that are covered by grasslands, scattered chaparral vegetation, and scattered oaks. Elevations in the project area range from about 310 m on the hilltops at the northern end of the area to about 200 m in the drainage swale located at the southern end of the project. Surface drainage along the existing roadway and in the project area occurs primarily in ephemeral drainages and small intermittent streams. Water in the drainages flows generally from north to south.

The existing alignment of Vasco Road in the project area winds around the shoulder of a hill and is located adjacent to two natural drainage swales. Man-made features along the roadway and in the project area include buried high pressure gas lines, overhead electric transmission lines, and a mechanically stabilized embankment. The roadway is approximately 7 m wide and has narrow shoulders. The roadway climbs from an elevation of about 230 m at the southern end of the project area to an elevation of about 290 m at the northern end where the roadway conforms to earlier Vasco Road improvements that were associated with construction of the Los Vaqueros Reservoir. There are no major connector roads, cross streets, or traffic control facilities in the project area.

The preliminary preferred alignment for the project removes the curve around the natural hillside and approximately balances cut and fill quantities. The alignment results in excavations for the proposed alignment up to 28 m below original grade and embankments up to 23 m above original grade at the alignment centerline.

GEOLOGIC CONDITIONS

Geologic materials along the proposed route include recent alluvial deposits, landslide deposits, and clastic sedimentary rocks of the Cierbo and Panoche Formations. The Cierbo Formation occurs in the project area and consists principally of arkosic sandstone and conglomerate. The Cretaceous Panoche Formation consists of two relatively well-defined units that are located in the project area, including: (i) an arkosic sandstone and conglomerate unit that contains large concretions and minor shale units; and (ii) micaceous claystone with minor sandstone layers. As observed in the test trenches and in the cores and bore holes advanced for this investigation, both geologic formations in the alignment area are pervasively fractured and shattered and most bedding and discontinuity surfaces were observed to be smooth, planar, and occasionally polished and slickensided.

Numerous active and potentially active faults are located in the region and two traces or strands of the active Greenville fault cross the project area (one of the strands intersects the proposed alignment). Minor discontinuous surface rupture associated with the Greenville fault was observed during the 1980 Livermore earthquake sequence and consisted of about 2 cm of right-lateral slip and 3 cm to 4 cm of dip slip on the eastern strand at its intersection of Vasco Road and about 2 cm of right-lateral slip on the main strand of the fault at Vasco Road. Based on these observations, future surface rupture may occur during the operational life of the roadway and should be anticipated. Although the main strand and eastern strand of the fault are relatively well defined, potential future ground rupture could occur on either side of the mapped fault traces because the fault likely occurs as a "zone" rather than as singular linear features.

EVALUATIONS

Earthwork Balance

Information provided by Alameda County indicates earthwork quantities for the project are approximately balanced. As a result, additional soil borrow requirements for embankment construction are not anticipated. However, if the final grading plan for the project indicates a fill shortage, one or more of the cut slopes may be flattened to provide any additional extra embankment material that might be needed. If required, it is also possible that adjacent undeveloped areas currently used for ranching could be used as borrow sources. However, investigation the adjacent undeveloped areas was not part of the current investigation and would be required prior to designating these areas as potential borrow sources.

Material Properties

Material properties for use in stability analyses and to support the development of design recommendations were evaluated based on field data, laboratory test results, observations of nearby cut slope performance, and published information. Based on these data, an average unit weight of 1,890 kg/m^3 and an average in-situ moisture content of 18 percent were assumed representative of the cut slope geologic materials. Shear strength properties for analysis of cut slopes in the Panoche Formation between the main and eastern strands of the Greenville fault assumed residual strength conditions and included a cohesion intercept of 2.39 kPa and a friction angle of 20 degrees. These values are generally consistent with the estimated rock mass strength of the material and with the mid range residual strength values estimated using the results of laboratory testing and the Stark and Eids (1998) correlations that relate plasticity and percent clay with residual strength.

Embankment stability analyses also assumed an average unit weight of 1,890 kg/m^3 and an average in-situ moisture content of 18 percent were representative of the compacted embankment fill materials which will be generated from the project excavations. The shear strength properties for analysis of embankments were estimated based on laboratory tests performed on samples recovered from the borings and on published ranges of shear strengths for compacted soils similar to those which will be generated from the excavations at the site. Based on these data, strength properties assumed for analysis of the embankment materials included a cohesion intercept of 7.2 kPa and a friction angle of 26 degrees.

Dynamic Analyses

Potential ground motions associated with an earthquake on one of the major faults in the project area were evaluated based on consideration of the high peak horizontal ground accelerations associated with an earthquake on the adjacent Greenville fault and the relatively lower peak horizontal ground accelerations associated with higher magnitude, more distant earthquakes on the San Andreas fault. The results of these analyses indicate that the earthquake-induced acceleration hazard at the project is dominated by an earthquake on the Greenville fault zone which could result in a project peak horizontal ground acceleration of 0.50g associated with a magnitude 5.9 maximum probable earthquake to about 0.77g associated with a maximum credible earthquake of magnitude 6.9. The analyses also indicate that relatively larger magnitude, far field events on the Hayward, San Andreas, and Calaveras faults could result in maximum median value site peak horizontal ground accelerations on the order of 0.1g to 0.2 for their respective maximum probable and maximum credible earthquakes. By way of comparison, using probablistic methods, the U.S. Geological Survey Seismic Hazard Mapping Project calculates a site peak horizontal ground acceleration of 0.50g has a 10 percent probability of being exceeded in 50 years.

Stability Analyses

For most slopes excavated in competent and intact bedrock, the most probable mode of failure is usually sliding of discrete rock blocks or wedges along discontinuity surfaces. For the proposed Vasco Road realignment, however, the project is located within a fault zone and site observations suggest the rock mass in this area is not characterized by well-defined and/or regular discontinuity sets that would control the stability of cut slopes. As a result, cut slope stability analyses were based on limit equilibrium methods assuming the rock mass strength summarized above and assuming a large number of circular and non-circular (wedge and block shaped) potential failure surfaces. Seismic stability analyses were initially performed using pseudostatic methods. Dynamic deformation analyses were performed for cases where the pseudostatic safety factor was less than 1.2 (these deformation analyses considered potential displacement of the cut slopes and embankments under near-field [Greenville fault] and far-field [San Andreas fault] earthquakes).

The results of the cut slope stability analyses indicated deep surface static safety factors that ranged from about 1.4 to 1.6 for the different conditions that were analyzed. The analyses further indicated shallower surface sliding safety factors that range from about 1.7 to 1.9. Dynamic deformation analyses indicated potential seismic displacements within acceptable limits (less than 30 cm) for the slope conditions that were evaluated. The results of embankment stability analyses indicate static safety factors that range from about 1.5 to 1.7. Seismic deformation assessments indicated potential seismic displacements were within acceptable limits for the embankment slope conditions that were evaluated.

Rippability

The results of a seismic refraction survey indicated three seismic layers could be distinguished below the refraction lines, including: an upper layer between about 2.1 m to 7.9 m thick that had a P-wave velocity ranging between 335 and 396 meters per second (mps); an intermediate layer ranging from about 2.1 m to 7.9 m below the ground surface with a P-wave velocity that ranged from 1,067 to 1,615 mps; and a deeper layer distinguished by P-wave velocities that ranged from 2,103 to 2,774 mps, and that occurred at depths below about 14.3 m to 11.0 m below the ground surface. The 20th edition of the Caterpillar Performance Handbook for the D9N Tractor indicates the first two seismic layers should be rippable with the right combination of tractor and ripper. The results also suggest that the third seismic layer may only be marginally rippable to nonrippable in some locations.

Grading and Compaction

The results of the density and moisture testing completed on samples removed from the areas where excavations are planned indicate an average in situ dry densities of 1,723 kg/m^3. Compaction tests on bulk materials obtained from the exploratory test trenches indicated an average maximum dry density of 1,748 kg/m^3. If the excavated materials are placed at average relative compaction of 92.5 percent, the excavated material will have a net shrinkage of about 2 percent (these calculations were based on a very small sampling of material, and as a result, may not be representative).

Free swell tests completed on core samples of the claystone indicated bedrock heave following deep excavation could be significant if it does not occur in a relatively uniform manner. As a result, inspection of the excavation and alignment subgrade during construction is important to evaluate whether the claystone is interbedded with low or non-expansive bedrock that, in turn, could lead to abrupt changes in the roadbed profile.

RECOMMENDATIONS

Excavations

All excavations (permanent and temporary) should be required to proceed from the top of the cut down to the design toe of the cut and under no circumstance should the excavations be allowed to proceed from the toe to top by excavating a temporary cut that is steeper than the recommended permanent inclination. Excavations made through Panoche Formation materials, or otherwise between the two traces of the Greenville fault, should be designed at a relatively gentle inclination of 1V (vertical):3.5H (horizontal) or flatter. Excavations made in Cierbo Formation materials and other more competent materials can generally be designed at 1V:2H inclinations (horizontal drains should not be necessary in the Cierbo Formation cuts). Based on the conditions observed during this investigation, stability (buttress) fills may be required in localized areas where very weak rock which is subject to failure is exposed by the design excavation.

For the areas where the cuts are greater than 10 m deep, 70 m long horizontal drains spaced at approximately 10 m horizontally should be installed at the base of the cut (just above the roadway) and on each of the drainage and maintenance benches constructed at 8 m vertical intervals on the slope. The horizontal drains should generally be constructed as specified in the Caltrans Standard Specifications, although the actual locations, lengths, and spacing of the horizontal drains may be modified by the Geotechnical Engineer or Engineering Geologist during construction of the excavations.

Embankments

Subsurface exploration, laboratory testing, and stability analyses support embankment design in general accordance with the Caltrans Highway Design Manual (with the exception of the limited special design considerations that are presented in Section 12 of the report). Settlement of the embankments will result from consolidation and compression of colluvial and alluvial foundation soils which are left in place and from consolidation and secondary compression of the embankment fill itself. However, the potential for consolidation and compression of the foundation soils can be reduced and virtually eliminated by removal of shallow soils prior to placement of embankment fills. Compression of the embankment fills will occur almost entirely during construction and can be addressed as the fill is placed. Nonetheless, because the embankment thicknesses will vary along the roadway, some differential settlement of the embankments should be anticipated. Post-construction differential movement of the embankments can be mitigated by placing less expansive soils in the uppermost portions of the embankments and/or by controlling the relative compaction and moisture content of different zones of the embankment.

Earth Retaining Structures

No permanent earth retaining structures are currently planned as part of this project. However, one or more permanent earth retaining structures may eventually be required to limit the lateral extent of one or more of the embankments. In general, any of the following different types of earth retaining structures could effectively be used in the specific sections of embankment where a permanent composite slope steeper that 1V:2H is required: conventional retaining walls such as Caltrans standard cantilever reinforced concrete retaining walls; gravity retaining systems such as Caltrans standard cribwalls or binwalls; proprietary mechanically stabilized embankments; reinforced soil slopes; or properly designed variations or combinations of systems.

Culverts

Culverts planned for this project are anticipated to be 1 m in diameter or smaller. As a result, no special culvert foundation recommendations are necessary. However, the results of laboratory testing indicate that the soil and bedrock at the site are generally acidic and are corrosive to very corrosive to steel and concrete. As a result, culvert steel and concrete should be sulfate and acid resistant (soil chloride test results indicate chloride resistant materials should not be necessary). As an alternative to steel and concrete, plastic culvert pipe may be considered for use on the project to address the aggressive soil conditions.

Pavements

The results of the geotechnical investigation and laboratory testing indicate a pavement structural section consisting of flexible asphalt concrete pavement should be used for the entire length of the alignment. Rigid Portland cement concrete pavement is not recommended due to the variable quality and corrosivity of the basement soil, the likely occurrence of minor differential movement between the cut and fill portions of the alignment, and the presence of several active fault traces that cross the alignment. An asphalt-treated permeable base layer should be placed immediately below the asphalt concrete pavement to intercept surface water seeping through the structural section. In the event adverse groundwater or drainage conditions are encountered that could saturate and soften the subgrade, a prime coat may be applied to limit erosion of fines from the underlying material.

ADDITIONAL WORK

Based on Alameda County comments, some additional geotechnical investigation and evaluation is anticipated prior to finalizing design of the new alignment. This work will likely include: completion of additional exploratory borings at two locations where the County is considering constructing retaining walls; and completion of an additional boring near the top of the planned 1V:3.5H cut slope where representative data are sparse or lacking. The results of the additional investigations will be summarized in design memoranda that will supplement this report.

1.0 INTRODUCTION

Vasco Road is an existing north-to-south arterial that runs between Tesla Road in Alameda County and Camino Diablo Road in Contra Costa County. The road is part of the Metropolitan Transportation System and is also defined as a route of regional significance by Contra Costa County. In 1996, a 20.9 km portion of Vasco Road in Contra Costa County was relocated and improved as a result of the construction of Los Vaqueros Reservoir. The relocated segment from 0.8 km south of the County line to Camino Diablo Road in Brentwood was constructed to current highway standards. The remaining 4.8 km segment in Alameda County does not meet these standards because it has tight curves, inadequate site distance, and narrow shoulders.

As a result of these poor roadway geometrics in Alameda County, public transit does not serve this corridor. Accordingly, improvements to the Alameda County portion of the roadway have been proposed to provide all users of Vasco Road with a safer facility. These improvements include new roadway alignment and grade, widened shoulders, and added passing lanes along an approximately 1.61 km segment of the road within unincorporated Alameda County between milepost (MP) 3.4 and MP 4.3. The location and vicinity of the proposed project are shown in Figure 1-1.

The following Geotechnical Design and Materials Report (GDMR) was prepared for the County of Alameda Public Works Agency to support design of the proposed realignment. The GDMR follows the general format and guidance presented in the Caltrans October 2, 1995 draft document *Geotechnical Design Reports - Purpose, Development, and Application.* Information and recommendations presented in the report were developed based on:

- Review of published data and information relevant to the project and project area;
- Review of unpublished information relevant to the project and project area;
- Site reconnaissance and geologic mapping;

- Subsurface exploration including continuous rock coring, soil boring, and test trenches along the proposed realignment;
- Geophysical testing along the proposed realignment project;
- Laboratory testing of samples recovered from the site corings, borings, and test trenches; and
- Engineering evaluations.

The purpose of the GDMR is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the roadway portions of the project. This report also establishes a geotechnical baseline that may be used to assess changed conditions that may be encountered during construction. The GDMR is intended for use by the project roadway design engineer, construction personnel, bidders, and contractors.

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 EXISTING FACILITIES

The existing alignment of Vasco Road in the project area is shown in Figure 2-1. As shown in this figure, the existing roadway winds around the shoulder of an existing hill and is located adjacent to two natural drainage swales. Presently, the land along the existing roadway is used for livestock grazing and several landslides are located in the natural slopes adjacent to the project. As described in Section 4.3, man-made features along the roadway and in the project area include buried high pressure gas lines, overhead electric transmission lines, and a mechanically stabilized embankment.

The roadway is approximately 7 m wide and has narrow shoulders. The roadway climbs from an elevation of about 230 m at the southern end of the project area to an elevation of about 290 m at the northern end where the roadway conforms to earlier Vasco Road improvements that were associated with construction of the Los Vaqueros Reservoir. There are no major connector roads, cross streets, or traffic control facilities in the project area. An unpaved ranch road is accessed from the western side of Vasco Road near the southern end of the project area and another unpaved ranch road is accessed from the eastern side of the road near the northern end of the project.

The are no major cut slopes adjacent to Vasco Road in the proposed project area. One small cut slope with a maximum height of several meters and an inclination on the order of 1V:2H (vertical: horizontal) is located adjacent to the western shoulder of the current roadway near the midpoint of the project. This cut was excavated in sandstone and site observations do not show evidence of instability or excessive erosion associated with the cut.

At the north end of the project area there is artificial fill which supports the east half of the existing roadway. The fill appears to have slumped previously and there appears to have been a landslide repair in one area. However, maintenance and operations personnel from the County's road department are unaware of any previous remedial grading work which may have been completed in this section of the road.

2.2 PROPOSED IMPROVEMENTS

A 1998 Project Study Report (PSR) to support construction of the proposed project was developed by Alameda County in cooperation with Contra Costa County, the Contra Costa County Transportation Authority, and the Cities of Livermore, Brentwood, and Antioch. The PSR is included in Appendix A, and as shown, identified and defined three potential alternatives for the roadway improvements, including:

(1) **Straight Alignment Basic Profile (Alternative 1).** The alignment of this alternative is generally straight between conform points that connect to the existing pavement with a R-396 m curve and four percent superelevation at each end. Because the profile of this alternative does not fit the existing grade of the newly constructed Vasco Road, about 305 m of the new road may need to be reconstructed. However, this profile would meet existing grade at the south end conform and would provide flexibility for the next phase of the project. The maximum height of cut for this profile would be about 30.5 m and earthwork for this project would require about 420,000 cubic meters (m^3) of roadway excavation.

(2) **Straight Alignment High Profile (Alternative 2).** This alternative is similar to Alternative 1 except that it has a higher profile. As a result, the maximum height of cut is only about 24 m and earthwork is estimated to be about 265,000 m^3. Alternative 2 will require about 610 additional meters to conform at the south end, although only about 180 m of new road reconstruction would be required at the north end of the alignment.

(3) **Reverse Curves Alignment (Alternative 3).** The profile of Alternative 3 is the same as the profile for Alternative 1. However, the alignment of Alternative 3 is for the most part winding, with R-366 m double reverse curves between conform points. Superelevations of four percent are required throughout most of the project and the maximum grade is eight percent. This alternative may require about 305 m of new road reconstruction and the maximum height of cut is about 26 m. Alternative 3 would require about 235,000 m^3 of roadway excavation.

The typical roadway section for each of these alternatives includes two 3.7 m lanes with 2.4 m shoulders, 1V:2H side slopes, and minimum 3.0 m distance between the catch point and the right of way fence line. The straight alignment basic profile and straight alignment high profile are shown in Figure 2-1. The reverse curves alignment is only shown in Appendix A because it was eliminated from consideration by the County prior to initiating the work associated with this GDMR.

2.3 PRELIMINARY PREFERRED ALTERNATIVE

The preliminary preferred alignment (approximately 20 percent design level) for the project is shown in Figure 2-1. (Note that the stationing shown in this figure and report may not correspond with the most recent stationing shown on project plans due to stationing changes made by the County during the completion of the GDMR). This alignment is generally intermediate between the basic profile and the high profile alignment. The alignment results in excavations for the proposed alignment up to 28 m below original grade and embankments up to 23 m above original grade at the alignment centerline. It is our understanding that the preliminary preferred alternative approximately balances cut and fill quantities without regard to bulking or shrinkage factors. The final roadway section and adjacent cut slopes may be modified based on information included in the GDMR.

3.0 PERTINENT REPORTS AND INVESTIGATIONS

Several project-specific reports and relevant investigations for nearby facilities were available for review as part of this project. In addition, stereo-paired aerial photographs were evaluated to better characterize site geomorphic features related to landsliding and fault activity. Principal documents and aerial photographs that were reviewed included:

- The 1998 PSR to support construction of the proposed project that was developed by Alameda County in cooperation with Contra Costa County, the Contra Costa County Transportation Authority, and the Cities of Livermore, Brentwood, and Antioch. The PSR is included in Appendix A.

- Woodward-Clyde Consultants (1992) *Materials Report, Vasco Road Relocation, Contra Costa and Alameda Counties, California*; unpublished report prepared for the Contra Costa Water District Los Vaqueros Project, January 6.

- Woodward-Clyde Consultants (1992) *Foundations Report, Vasco Road Relocation, Contra Costa and Alameda Counties, California*; unpublished report prepared for the Contra Costa Water District Los Vaqueros Project, January 22.

- Pacific Aerial Surveys photographs AV-253-33-29, AV-253-33-30, and AV-253-33-31 dated May 22, 1957 at a scale of 1:12,000 and photographs AV-6100-135-26, AV-6100-135-27, and AV-6100-135-28 dated August 17, 1998 at a scale of 1:12,000.

In addition to these documents, a number of published soils, geologic, and geotechnical data sources were used to support the information, conclusions, and recommendations presented in this report. As applicable, these data sources are referenced throughout this report (a reference list follows the main body of text).

4.0 PHYSICAL SETTING

4.1 CLIMATE

The region of the proposed realignment project has a Mediterranean climate characterized by mild to moderately cold and wet winters, and hot, dry summers. Winds in the area are generally controlled by marine circulation into the Central Valley (located east of the area) and may be very strong in the regional area.

Average daily temperatures typically range from lows of about 4° C in December and January to highs on the order of 24° C to 27° C in July. Temperature extremes in the area range from highs of about 43° C typically occurring from July to September, to lows on the order of -4° C that typically occur in December or January. In general, sub-freezing temperatures occur in short episodes of several days duration. As a result, freeze-thaw conditions are not expected to have a significant influence on the long-term performance of soil or rock materials in the area.

The mean annual precipitation in the area ranges from approximately 25 cm in the valley areas to 51 cm at the higher elevations. Intermittent wet cycles of one to two years duration are known to occur in which rainfall levels can approach twice the mean annual levels.

4.2 TOPOGRAPHY AND DRAINAGE

The topography of the project area is shown in Figure 2-1 and topography in the regional area is shown in Figure 4-2. The topography is characterized by rolling hills covered predominantly by grasslands and scattered chaparral vegetation. Scattered oaks are located throughout the area. Elevations in the project area range from about 310 m on the hilltops at the northern end of the area to about 200 m in the drainage swale located at the southern end of the project.

Surface drainage along the existing roadway and in the project area occurs primarily in ephemeral drainages and small intermittent streams. In the project area, these drainages have developed along approximate traces of the Greenville fault. Water in the drainages flows generally from north to south.

4.3 MAN-MADE AND NATURAL FEATURES OF ENGINEERING AND CONSTRUCTION SIGNIFICANCE

The land along the existing roadway and in the project area is used for livestock grazing and is largely undeveloped. However, several man-made features will affect the project during construction. These features are shown in Figure 4-1 and include:

- A buried Pacific Gas and Electric Company (PG&E) 55.9 cm gas line that is located within and parallels much of the proposed project alignment;
- A buried PG&E 91.4 cm gas line that intersects the proposed alignment near its southern end;
- A buried PG&E 50.8 cm gas line that connects the 55.9 cm and 91.4 cm gas line at the northern end of the project;
- Overhead electric transmission lines that intersect the alignment at the southern end of the project and that trend along the western and eastern edges of the alignment;
- Artificial fill that is present along the east half of the existing road where the new alignment will conform to the existing road on the north end;
- A mechanically stabilized embankment (MSE) retaining wall along the west side of the north end of the project conform area; and
- A livestock pond located west of the alignment at the southern end of the project.

In addition to these features, several unpaved roads used to access ranch property intersect exiting Vasco Road in the project area.

4.4 REGIONAL GEOLOGY AND SEISMICITY

4.4.1 Geologic Setting

The regional geologic setting in the vicinity of the road alignment consists of several formations from Tertiary to Cretaceous in age that have been uplifted and tilted during the formation of the Mount Diablo anticline and the associated Mount Diablo piercement. A regional geologic map is presented in Figure 4-2 and geologic conditions in the vicinity of the road alignment are shown in Figures 4-3 and 4-4 (detailed geologic information along the proposed road alignment is presented in Section 7).

As shown in Figure 4-2, geologic materials along the proposed route include recent alluvial deposits, landslide deposits, and clastic sedimentary rocks of the Cierbo, Neroly, and Panoche Formations. General characteristics of these units (from youngest to oldest) include:

- **Recent Alluvium/Colluvium (Qal/Qc).** Recent alluvial and colluvial deposits exist throughout the area in the valleys, canyons, and washes. The alluvium typically consists of interbedded clay and silt, with lesser amounts of sand.

- **Landslide Deposits (Qls).** Landslides occur in the area as shallow debris slides and as deeper rotational or block features that have developed in the bedrock. The shallow deposits usually consist of clay, silt, and highly weathered bedrock. The deeper deposits typically include the upper soil horizons and variably weathered, sheared, and fractured blocks of the parent bedrock material.

- **Cierbo and Neroly Formations (Tmss).** Within the regional area, the Tertiary age Cierbo and Neroly Formations typically consist of blue to gray pebbly sandstone, pebble conglomerate, arkosic sandstone, and nonmarine and brackish marine claystone, siltstone, and sandstone. The Cierbo Formation occurs in the project area and consists principally of arkosic sandstone and conglomerate.

- **Panoche Formation (Kp, Kps).** The Cretaceous Panoche Formation consists of two relatively well-defined units that are located in the project area, including: (i) an arkosic sandstone and conglomerate unit that contains large concretions and minor shale units; and (ii) micaceous claystone with minor sandstone layers.

4.4.2 Seismic Setting

The San Francisco Bay region is located in an area of high seismicity and has a documented history of strong earthquakes. Numerous active and potentially active faults are located in the region and one active fault (the Greenville fault) crosses the project area (Figure 4-5 and Table 4-1). Most of the regional faults are related to the San Andreas fault system and approximately parallel the northwesterly structural trend of the region. Major regional systems within about 100 km of the project area include the northern San Andreas fault zone, the Hayward fault zone, the Calaveras fault zone, the Healdsburg-Rodgers Creek fault zone, the Concord-Green Valley fault zone, and the Greenville fault zone. The most significant of these faults include:

- **Concord Fault**. The Concord fault is located about 26 km from the site and forms the abrupt and linear eastern boundary between the Ygnacio Valley alluvium and the bedrock of the Diablo Range. This fault may represent a northward extension of the Calaveras fault based on similarities in relative motion and offset (Minch and Turner, 1979; Sharp, 1973). The Concord fault is considered active based on a historic 5.4 Richter magnitude earthquake attributed to the fault, evidence of right-lateral tectonic creep (Pampeyan, 1979; Helley and Herd, 1977), geomorphic features indicative of faulting, and microseismic events along the trace of the fault (Contra Costa County Planning Department, 1975).

- **Green Valley Fault**. The active Green Valley Fault is located about 44 km from the site and is believed to be an en echelon extension of the Concord fault. The fault trace is well-marked by very fresh topographic features such as aligned saddles and notches, linear depressions, springs, sags, and well-defined shutter ridges (Helley and Herd, 1977). According to Pampeyan (1979), several areas of tectonic creep are associated with the Green Valley fault.

- **Greenville Fault**. The active Greenville fault intersects the project site. The Greenville fault is an approximately 94 km long, 1 km wide zone of right-lateral strike-slip faults. The realignment project lies along the 34 km long central Marsh Creek segment of the fault. Surface rupture of this portion of the fault was noted in the realignment area following the January 24, 1980 magnitude 5.8 and January 26, 1980 magnitude 5.2 earthquakes that occurred on the Greenville fault (Bonilla et al., 1980).

- **San Andreas Fault**. At its closest point, the active San Andreas fault is located approximately 61 km west of the site and marks the boundary of the American and Pacific plates of the earth's crust. The fault extends from Mexico to northern California and exhibits geomorphic evidence of recent faulting along much of its length. The San Andreas fault has generated two great historical earthquakes with magnitudes greater than 8 (the 1857 Fort Tejon and the 1906 San Francisco earthquakes).

- **Hayward Fault**. The Hayward fault is located about 29 km west of the site and strikes in a northwesterly direction from southern Santa Clara County to San Pablo. The Hayward fault is active based on tectonic creep along portions of the fault zone and on two historic earthquakes with magnitudes on the order of 6-1/2. These earthquakes occurred in 1836 and 1868 and are believed to have been associated with surface rupture along the trace of the fault.

- **Calaveras Fault**. The active Calaveras fault is located approximately 19 km from the site. A strong historic earthquake occurred on the fault in 1861. The magnitude of this earthquake was on the order of 6-1/2 and was associated with surface rupture along the fault trace (Pampeyan, 1979).

- **Healdsburg-Rodgers Creek Fault**. The Healdsburg-Rodgers Creek fault is a geologically active fault occurring along the west side of the Sonoma Mountains and is located approximately 65 km from the site. The Healdsburg-Rodgers Creek fault is generally parallel to the San Andreas system and is reported by Hart et al (1983) to offset late Cenozoic units and Holocene alluvium, with inferred right-lateral strike-slip movement. In addition to geomorphic evidence, historic seismicity has been reported for the Santa Rosa area.

4.5 SOIL SURVEY MAPPING

Soils in the project area are included in the Altamont-Diablo Association (Welch et al., 1996) that consists of about 25 percent Altamont soils, about 25 percent Diablo soils, about 30 percent Linne soils, and about 20 percent Los Osos, Pescadero, and Solano soils. The Altamont, Diablo, and Linne soils formed in material that weathered from interbedded sedimentary rock. They are generally moderately fine to fine textured, neutral to mildly alkaline, and very hard. The Welch et al. (1996) soil survey maps indicate the project area is underlain primarily by Altamont clay. The representative profile for this soil includes:

- From 0 to 71 cm is a dark-brown clay with a strong to moderate prismatic structure that breaks to a strong to moderate blocky structure. This soil horizon is very hard when dry, very firm when moist, sticky and very plastic when wet, and is neutral to mildly alkaline.

- From 71 to 94 cm, the soil is a finely mottled dark-brown and dark yellowish-brown clay with a few whitish lime films and nodules. The soil exhibits a weak prismatic structure that breaks to a moderate blocky structure that is very hard when dry, very firm when moist, sticky and very plastic when wet, and is mildly alkaline.

- From 94 to 127 cm, the soil is a yellowish-brown silty clay with many whitish lime segregations and nodules. This horizon shows a weak blocky structure that is very hard when dry, very firm when moist, plastic and sticky when wet, and is moderately alkaline.

- Soil at depths greater than 127 cm typically consists of shattered shale and fine-grained sandstone.

5.0 FIELD EXPLORATION

The field exploration program for the project included the following four phases of work:

- The first phase of field exploration was performed between September 20 and October 24, 2000 and included using global positioning satellite (GPS) equipment to mark the proposed centerlines of the preliminary alignment alternatives and the proposed test boring locations.

- The second phase of field exploration was performed between October 25, 2000 and December 19, 2000 and included advancing 16 continuous cores and exploratory borings to characterize the subsurface materials and to recover samples of soil and bedrock for laboratory testing. The locations of borings are shown in Figure 4-3 and the logs of borings are included in Appendix C. Photographs of the recovered cores are included in Appendix H.

- The third phase of the field exploration was performed between November 20, 2000 and December 19, 2000 and included excavating and logging six exploratory trenches to assess soil overburden depth, identify fracture zones, measure bedrock orientations, and recover samples for laboratory testing along the proposed alignments. Trench locations are shown in Figure 4-3 and the trench logs are included in Appendix D.

- The fourth phase of field exploration was performed between December 4, 2000 and January 9, 2001 and included completion of a seismic refraction survey to assess the depth and rippability of the subsurface materials along the proposed alignments. The results of the seismic refraction survey are included in Appendix E.

Information and data from these phases of work are included in the appendices to this report and summary information is presented below.

5.1 SUBSURFACE EXPLORATION

5.1.1 Drilling and Sampling

Test borings for this evaluation were advanced by PC Exploration, Inc. of Roseville, California using rotary wash, hollow stem auger, or solid stem auger drilling techniques. Upon completion of drilling activities, all borings with the exception of B-5 were backfilled to the ground surface with cement-bentonite grout. As described in Section 5.4, Boring B-5 was completed as a standpipe piezometer following completion.

All drilling operations were observed in the field by Cal Engineering & Geology personnel. Logging, classification, and storage of soil and bedrock samples was performed in general conformance with the guidelines and procedures presented in the Caltrans *Soil and Rock Logging Classification Manual - Field Guide* and the U.S. Bureau of Reclamation *Engineering Geology Field Manual*. Logs of the borings are included in Appendix C and Appendix H includes photographs of selected samples recovered during drilling operations.

Depending on boring location and type, samples were either collected continuously using HQ wireline core equipment or collected at selected intervals with a Modified California Sampler that was driven into the subsurface materials at the bottom of the boring using a 63.5 kg safety hammer with a free-fall of 762 mm. The blow counts required to embed the sampler in intervals of 152 mm (or less) were recorded on the field exploratory test boring logs included in Appendix C.

5.1.2 Trenches

Six exploratory trenches were excavated by Williams Grading of Byron, California using a Hitachi 160LC excavator equipped with an approximately 0.8 m wide bucket. The trench depths ranged from about 1.5 m to 4.6 m below the ground surface and temporary shoring was installed as necessary to allow access to the trenches. Following wall cleaning, the trench walls were logged by Cal Engineering & Geology personnel and bulk samples of the excavated materials were collected for laboratory testing. Upon completion, the excavations were backfilled with the excavated materials. The backfill was generally placed in thin lifts and compacted with the bucket of the excavator, with the upper 0.5 m of backfill additionally compacted by track-walking with the excavator.

5.2 GEOLOGIC MAPPING

Surface geologic mapping was performed along the proposed alignments between October 2000 and December 2000. The geologic mapping was supplemented by evaluation of aerial photographs of the project area. The purpose of this work was to map geologic conditions exposed at the ground surface and to collect geologic structure information for use in evaluating the alternative alignments. However, because few bedrock outcrops were observed in the field and only very limited bedrock was exposed in road cuts along Vasco Road, only limited geologic information and data were collected during this effort. The geologic map for the site is presented in Figure 4-3. Geologic cross sections through the area with the highest anticipated cut slopes are shown in Figure 4-4.

5.3 GEOPHYSICAL STUDIES

A seismic refraction survey was performed between December 4, 2000 and January 9, 2001 by JR Associates of San Jose, California to assess bedrock depth and rippability along the proposed alignments (the JR Associates report is included in Appendix E). Data were collected along two seismic refraction lines that were about 244 m long and contained 24 geophones and three shot points. Shot points were at the beginning, middle, and end of each line. The locations of the seismic refraction lines are shown in Appendix E and in Figure 4-4. Seismic energy was created using small charges consisting of 0.2 kg of ammonium-nitrate based explosives. Vibration monitoring was performed during the seismic survey to assess shot vibrations along the PG&E gas transmission line. As described in Appendix E, the vibration monitoring indicated peak particle velocities at the transmission line were on the order of 0.018 cm per second (cps) to 0.18 cps.

5.4 INSTRUMENTATION

Boring B-5 was converted to a 31.5 mm standpipe piezometer at the completion of drilling to evaluate the depth to groundwater along the alignment. The piezometer consisted of a 6 m section of slotted PVC pipe that was threaded to about 16.8 m of solid PVC casing. The piezometer was backfilled with clean, medium-grained sand to a depth of approximately 13 m below the ground surface. Bentonite pellets were placed on top of the sand to approximately 7.5 m below the ground surface, and the remainder of the boring was backfilled with cement-bentonite grout to the ground surface.

6.0 GEOTECHNICAL TESTING

6.1 IN SITU TESTING

In situ geotechnical testing performed for this study included Standard Penetration Testing (SPT) during soil boring operations and the geophysical testing described in Section 5.3.

6.2 LABORATORY TESTING

Laboratory tests were performed on selected samples recovered from the borings. Table 6-1 summarizes the tests performed and the test sample locations. As summarized in this table, laboratory tests included R-value, compaction, unconsolidated-undrained triaxial shear, direct shear, unconfined compression, compression-swell, moisture-density, Atterberg limits, grain size, and corrosion testing. Complete laboratory tests results are presented in Appendix F and summary results are presented below.

6.2.1 Index Properties

Index property tests performed for this study included moisture-density, hydrometer, and Atterberg limits evaluations. The results of these tests are summarized in Table 6-2 and Table 6-3. The moisture-density data are plotted vs. sample depth in Figure 6-1. Atterberg limits test results are plotted in Figure 6-2.

6.2.2 Strength Properties

Shear strength tests performed for this evaluation included direct shear and unconsolidated-undrained triaxial tests. The results of these tests are summarized in Table 6-4. The results of unconfined compression tests are summarized in Table 6-5 and are plotted vs. depth in Figure 6-3.

Tables 6-3 and 6-4 also summarize the inferred residual friction angle for six samples based on plasticity index and the percent of clay (soil finer than 0.005 mm) present in the sample.

6.2.3 Compaction and Consolidation

Compaction tests were performed on bulk samples recovered from the test pits and from a bulk sample composited from Borings B-3 and B-4. Limited consolidation tests were performed because most of the alignment will be constructed on excavated bedrock or fill placed on bedrock. However, two tests were performed to evaluate the swell properties of the materials. The results of the compaction and consolidation tests are summarized in Table 6-6.

6.2.4 Durability and Corrosive Properties

Slake tests were performed to evaluate native material durability and native material corrosive properties were evaluated based on pH, resistivity, electrical conductivity, sulfate, and chloride tests on samples recovered from the borings and test pits. The results of these tests are summarized in Table 6-7. The corrosion test results are included in Appendix G.

6.2.5 Resistance Testing

R-value tests were performed on selected samples recovered from the test pits to provide resistance information for pavement design. The results of these tests are included in Table 6-7 and the laboratory data sheets are included in Appendix F.

7.0 GEOTECHNICAL CONDITIONS

7.1 SITE GEOLOGY

Geology of the project area is shown in Figures 4-2 and 4-3. Geologic formations exposed in the project include bedrock of the Panoche and Cierbo Formations. As shown in the geologic map, alluvium is present in the draw near the southern end of the alignment and several apparent landslides were observed in the project area. Lithologic and structural features of the different units are summarized below.

7.1.1 Lithology

7.1.1.1 Cierbo Formation (Tmss)

As described by Dibblee (1980), the Tertiary Upper Miocene age Cierbo Formation consists of blue to gray pebbly sandstone, nonmarine and brackish marine claystone, siltstone, sandstone, and pebble conglomerate, and arkosic sandstone. In the project area, the formation consists principally of arkosic sandstone and conglomerate. The Cierbo Formation is generally equivalent to the Briones Formation of Crane (1990) and Majmumdar (1991).

Where exposed in the test trenches, the Cierbo Formation typically consisted of mottled whitish-grey to orange-brown pebble conglomerate in a fine- to medium-grain sand matrix that was highly weathered, soft, and friable. Occasional round to subround cobbles were noted in some horizons. No discernable structure was noted in the test trenches and all trenches were dry. Tan to whitish-grey massive sandstone was observed less frequently than the conglomerate. The sandstone was generally fine- to medium-grain, highly weathered, soft, friable, and showed no discernable structure.

Logs of borings typically describe the Cierbo Formation material as fine to medium-grained orange-brown sandstone with occasional pebbles. Several borings advanced through the Cierbo Formation encountered light brown to yellow-brown clay and claystone horizons.

7.1.1.2 Panoche Formation (Kp, Kps)

The Cretaceous Panoche Formation consists of two relatively well-defined units: (i) an arkosic sandstone and conglomerate unit that contains large concretions and minor shale units; and (ii) micaceous claystone with minor sandstone layers. The Panoche Formation present in the immediate vicinity of the alignment consisted primarily of the micaceous claystone with minor sandstone units (Kps in Figure 4-3). Near-surface material encountered in the test trenches included highly weathered, soft, and friable fine-grained sandstone and highly weathered interbedded siltstone, sandstone, and claystone. In all cases, the Panoche Formation materials exposed in the trenches were pervasively fractured and broke apart under a light hammer blow. Panoche Formation materials encountered in the borings were most frequently described as thinly bedded claystone, with lesser sandstone and siltstone horizons and interbeds.

7.1.2 Structure

Only very limited geologic structure could be observed at the ground surface and in the near surface test trenches. The near surface information indicated the geologic units east of the Greenville fault trend in a northwesterly direction and dip about 40 to 50 degrees to the west. Bedding dips measured on samples of Panoche Formation recovered from the core holes varied from about 20 to 70 degrees and averaged about 40 degrees (because oriented core drilling techniques were not used on this project, the strike of bedding could not be evaluated based on the boring samples). As shown in Figure 4-3, bedding did not appear to be continuous between drilling locations and it was not possible to correlate the different claystone and sandstone horizons across the site. As observed in the test trenches and in the cores and bore holes, both geologic formations in the alignment area were pervasively fractured and shattered, most likely due to tectonic shearing associated with the Greenville fault. In general, most bedding and discontinuity surfaces were smooth, planar, and occasionally polished and slickensided. Shear zones were identified in boring B-3 and in test trenches TP-1 and TP-2.

7.1.3 Landslides

Natural slope stability in the project area was evaluated based on site reconnaissance, review of published information, and review of aerial photographs of the site and surrounding area. Regional landslides occurring in natural slopes around the project area are shown in Figure 7-1.[1] As shown in the site geologic map (Figure 4-3), several landslides not identified in Figure 7-1 were observed in the project area (for the purposes of this project, these landslides are identified as LS-1, LS-2, LS-3, and LS-4).

Landslide LS-1 intersects the northern end of the proposed alignment and appears to be a near-surface feature that developed in colluvium and the underlying weathered bedrock of the Panoche Formation clayey shale and siltstone unit (Kps). Boring B-7 was advanced through this landslide. Although the slide plane was not conclusively identified in this boring, the location of the landslide toe approximately at the existing roadway, the loss of circulation at shallow depths, and review of the core photographs for this boring suggest that the base of the landslide is on the order of 3 to 5 m below the ground surface at this location.

Landslide LS-2 developed in the Cierbo Formation (Tmss) and is located near the central portion of the project, west of the proposed alignment. This landslide appears to be an old feature (not recently active) based on its subdued geomorphic characteristics and lack of evidence of recent movement. The toe of this landslide probably occurred in the drainage that is coincident with the main strand of the Greenville fault. As currently defined, the proposed roadway alignments should not intersect this landslide and it is unlikely that the landslide will affect the roadway.

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[1] Figure 7-1 is a reproduction of a published regional landslide map and provides indication of local large-scale regional landslides mapped by others (Nilsen, 1975). As a result, this map is not intended to illustrate site-specific landslides mapped as part of this project.

As shown in Figure 4-3, two landslides (LS-3 and LS-4) were tentatively located between the main and eastern strands of the Greenville fault. The presence of these landslides is questionable because definitive geomorphic evidence of landsliding was not apparent on the ground surface and clear evidence of sliding was not noted in the borings or test trenches in this area. However, evaluation of aerial photographs provides some indistinct evidence of past slides in this area. These slides, if present, are likely very old features that developed in the Panoche or Cierbo Formations and may represent zones of relatively weaker bedrock that may be encountered during the roadway realignment.

7.1.4 Rock Mass Strength

The strength of *intact rock* estimated by laboratory testing is frequently higher than the strength of a *rock mass* because of the discontinuities such as bedding planes and fractures within a rock mass body. Because the strength of the rock mass in the re-alignment area is probably lower than the strength of the intact rock, the rock mass strength may be more appropriate for use in stability analyses.[2] However, because of the large sample size required to be representative, it is difficult (if not impossible) to determine the shear strength of fractured rock masses by conventional testing methods. For this reason, empirical methods have been developed to estimate this property (these empirical methods have been widely used for rock mechanics applications in civil and mining projects).

Commonly used methods for the evaluation of rock mass shear strength have been developed by Hoek and Bray (1977), Hoek and Brown (1988, 1980), Bieniawski (1989), and Serafim and Pereira (1983). All of the methods used to assess the strength of the rock mass rely on the Geomechanics Classification System, or Rock Mass Rating System (RMR) shown in Table 7-1. As shown in this table, a number of different parameters are used to classify the rock mass including: the uniaxial

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[2] This is because stability analyses using rock mass strengths will typically give lower factors of safety than stability analyses performed using the results of strength tests on intact rock (use of intact rock strength would be appropriate for rock masses without discontinuities).

compressive strength of the rock material; the rock quality designation (RQD) of the rock mass; the spacing and condition of discontinuities within the rock mass; groundwater conditions anticipated for the excavation; and the orientation of bedrock discontinuities with respect to the excavation orientation(s). Based on data collected during field and laboratory testing programs for the re-alignment project, the following properties were used to classify the rock mass:

- **Uniaxial Compressive Strength of Rock Material.** Data from laboratory testing performed on samples collected from borings advanced in the area of maximum cut indicate the unconfined compressive strength of the Panoche Formation claystone, siltstone, and sandstone varies from about 0.058 MPa to 1.51 MPa, with average values on the order of 0.350 MPa. Based on these data, uniaxial compressive strengths less than 1 MPa were judged to be representative of the overall rock mass in the project area.

- **Rock Quality Designation (RQD).** RQD data from the different borings advanced in the project area indicate RQD that varied from 0 to 100 percent and averaged about 77 percent.

- **Spacing and Condition of Discontinuities Within the Rock Mass.** Observations from the test pits and borings in the project area indicate the rock mass is generally highly fractured, with discontinuity spacing that varies from less than 2.5 cm to more than 1 meter in the greatest dimension. Although relatively massive beds of sandstone are present, site observations indicate these massive beds only occur locally. Discontinuity surfaces observed in the borings were frequently smooth and polished.

- **Anticipated or Observed Groundwater Conditions.** No groundwater was encountered in any of the test trenches at the time of logging. However, the piezometer installed in Boring B-5 indicates groundwater occurs above the bottom of the proposed excavation. Accordingly, it is unlikely that the excavation would be completely dry and adverse groundwater conditions were assumed for this analysis.

- **Orientation of Discontinuities with Respect to the Proposed Excavation.** The orientation of the discontinuities with respect to the excavation will depend on the orientation of the excavation. Because the orientation of excavated slopes in the re-alignment area will vary and the rock mass is highly fractured with a number of possible kinematically unfavorable orientations, the discontinuity orientation factor assumed for this evaluation was assumed to be fair.

Based on these assumptions and the RMR system shown in Table 7-1, the rock mass underlying the proposed expansion area is classified as poor (Class IV) to very poor (Class V) rock. Strength properties for these classifications are summarized below:

APPROXIMATE ROCK MASS STRENGTH PROPERTIES BASED ON ROCK MASS RATING		
STRENGTH COMPONENT	CLASS IV (Poor Rock)	CLASS V (Very Poor Rock)
Cohesion of Rock Mass (kPa)	100 to 200	<100
Friction Angle of Rock Mass (degrees)	15 to 25	<15

Table 7-2 further breaks down rock quality data by boring for Borings B-2, B-3, B-4, and B-5 (the borings located in the area of maximum excavation). These data suggest that the overall rock mass strength in the area of maximum excavation increases to the north.

7.2 SUBSURFACE SOIL CONDITIONS

The results of field boring and test trench excavations indicate soil in the project area is limited to a variably thick veneer of colluvial soil overlying weathered bedrock. The soil typically was on the order of less than 0.5 m to about 1.5 m thick. Where developed on Cierbo Formation bedrock, the soil typically consisted of dark grey to tan very fine-grained to medium-grained sandy clay with occasional to frequent pebbles and cobbles derived from the underlying bedrock. Where developed on Panoche Formation, the soil tends towards dark grey to black fine-grained sandy clay with occasional sandstone clasts. No borings or test trenches were advanced or excavated in the alluvium located east of the proposed alignment. The alluvium reportedly consists of interbedded clay and silt, with lesser amounts of sand.

7.3 WATER

7.3.1 Surface Water

Existing drainage facilities in and around the realignment area consist of lined and unlined ditches, asphalt-concrete berms adjacent to Vasco Road, and several small culverts which discharge onto the downslope ground surfaces. Drainage within the project area consists of incised channels that parallel the trend of the Greenville fault. These drainage channels merge into a single drainage approximately at Vasco Road. After passing under Vasco Road, this single drainage channel flows in a southwesterly direction along the eastern side of the road. Limited side slope erosion of the drainage channels was noted during the field work. Significant erosion or scour was not noted.

7.3.2 Groundwater

A detailed groundwater investigation was beyond the scope of this investigation. However, a standpipe piezometer was installed in Boring B-5. Water level measurements in this piezometer indicate groundwater occurred approximately 15.8 m below the ground surface on November 7, 2000 and about 17.1 m below the ground surface on January 8, 2001. The highest measured groundwater level is shown in Figure 4-4.

7.4 PROJECT SEISMICITY

The seismic hazard analysis for this project included the following general steps:

- Identification of faulting in the project area;
- Identification of seismic sources capable of strong ground motions at the project site; and
- Evaluation of the intensity of the design ground motions at the project site.

7.4.1 Project Area Faulting and Ground Rupture

Faulting in the realignment project area was evaluated based on review of relevant publications, evaluation of aerial photographs, field reconnaissance, and subsurface investigation. As shown in the geologic map, the main strand and the eastern strand of the Greenville fault pass through the project area and intersect the proposed alignments at two locations. The Greenville fault is active and has been zoned by the California Division of Mines and Geology for Special Studies pursuant to the Alquist-Priolo Special Studies Zone Act. Regionally, as well as in the project area, the fault juxtaposes the Cretaceous Panoche Formation and the Miocene Cierbo Formation.

Minor discontinuous surface rupture was observed along the fault during the 1980 Livermore earthquake sequence (Bonilla et al.,1980) approximately at the locations shown in Figure 7-2 (this figure also shows geomorphic features associated with the fault in the project area). As shown, displacement was observed on both the main strand and eastern strand of the fault and consisted of about 2 cm of right-lateral slip and 3 cm to 4 cm of dip slip on the eastern strand at the intersection of Vasco Road and about 2 cm of right-lateral slip on the main strand of the fault at Vasco Road. Although the main strand and eastern strand of the fault are relatively well defined, potential future ground rupture could occur on either side of the mapped fault traces because the fault likely occurs as a "zone" rather than as singular linear features. For example, reasonably defined shear zones were identified in test trenches TP-1 and TP-2 north and east of the mapped eastern strand of the fault that may represent zones of past movement. Based on these observations, future surface rupture may occur during the operational life of the roadway and should be considered during design of the roadway and during development of maintenance and operations plans.

7.4.2 Seismic Sources and Site Ground Motion

Seismic sources of possible significance to the project include the major faults within about 100 km of the site that are listed in Table 4-1. This table also lists the closest distance of the fault to the site and the maximum credible earthquake (MCE) and maximum probable earthquake (MPE) associated with each fault. Based on these data, a site-specific deterministic seismic analysis was performed to assess potential ground and bedrock motions associated with the MCE and MPE for the active faults. The peak bedrock accelerations were estimated based on site-to-source distance and MCE/MPE magnitudes using the Abrahamson and Silva (1997) acceleration attenuation equation that relates earthquake magnitude, fault style, source-to-site distance, and local site conditions to derive an estimate of peak acceleration.

The results of these analyses are summarized in Table 4-1 and indicate that the earthquake-induced acceleration hazard at the project is dominated by an earthquake on the Greenville fault zone which could result in a project PHGA of 0.50g associated with a MPE of magnitude 5.9 to about 0.77g associated with a MCE of magnitude 6.9. The analyses also indicate that relatively larger magnitude, far field events on the Hayward, San Andreas, and Calaveras faults could result in maximum median value site PHGAs on the order of 0.1g to 0.2 for their respective MPEs and MCEs. By way of comparison, using probablistic methods, the U.S. Geological Survey Seismic Hazard Mapping Project calculates a site PHGA of 0.50g has a 10 percent probability of being exceeded in 50 years.

8.0 GEOTECHNICAL ANALYSIS AND DESIGN

8.1 DYNAMIC ANALYSIS

Seismic analyses for this project included pseudostatic and seismic deformation analyses of the cut slopes. Analysis procedures and results are presented in the Sections 8.2 and 8.3. Liquefaction analyses were not performed because loose, saturated sand deposits are not present in the project area.

Although MCE magnitudes are usually the regulatory design-basis earthquake in California for major bridges (e.g. toll bridges) and other critical facilities such as hospitals and large earth dams, the MCE is generally not used for other highway or earthwork structures (U.S. Department of Transportation, 1997). Additionally, use of probablistic map values by themselves are not sufficient because the maps and analyses do not provide information on the magnitude, distance, or duration of the earthquake associated with the acceleration values.[3] As a result, these values are limited for geotechnical purposes because most geotechnical analyses use earthquake magnitude as a measure of duration. Accordingly, it is our opinion that dynamic analysis of project should be based on the PHGA associated with the MPE earthquake. Additionally, to encompass a representative suite of ground motions, we recommend that analyses consider the relatively high PHGAs associated with the low magnitude nearby events and the relatively lower PHGAs associated with higher magnitude, more distant events. Based on the data presented in Table 4-1, the following parameters are recommended for near-field, intermediate field, and far field events:

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[3] The acceleration values given by the U.S. Geological Survey Seismic Hazard Mapping Project are composed of contributions of earthquakes of different magnitudes at different distances from a given site.

EVENT	FAULT	MPE MAGNITUDE	PHGA	DURATION[4]
Near Field	Greenville	5.9	0.50g	<5 sec
Intermediate Field	Calaveras	6.5	0.18g	8 sec
Far Field	San Andreas	7.4	0.08g	20 sec

8.2 CUTS AND EXCAVATIONS

8.2.1 Stability Analysis

8.2.1.1 Stability Analysis Methods

For most slopes excavated in competent and intact bedrock, the most probable mode of failure is usually sliding of discrete rock blocks or wedges along discontinuity surfaces. A slope that is kinematically stable is cut at such an angle that there is no freedom of movement along relatively weak surfaces such as bedding planes or the intersection of bedding planes or fractures. This type of analysis is appropriate for slopes where the rock mass is characterized by relatively well-defined and regular sets of discontinuities. For the proposed Vasco Road realignment, however, sufficient structural measurements could not be collected to provide a reliable and valid characterization of the rock mass discontinuities. Moreover, the project is located within a fault zone and site observations suggested that the rock mass in this area is not characterized by relatively well-defined and/or regular discontinuity sets. As a result, it was not possible to perform a kinematic assessment of the realignment area based on data from the field mapping and the test trenches.

Static stability of representative cross sections was evaluated based on limit equilibrium methods using the computer program GSLOPE (v. 4.07j). For the purposes of this project, three alternative slope configurations for the maximum height cut slope were analyzed, including:

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[4] Based on duration vs earthquake magnitude curves (Dobry et al., 1978).

(1) A composite cut slope that included a buttressed 1V:2.5H lower slope and an unbuttressed 1V:3.5H upper slope that included 50 m hydraugers (horizontal drains) extending into the cut;

(2) An unbuttressed 1V:3.5H cut slope that included 50 m hydraugers extending into the cut;

(3) An unbuttressed 1V:3.5H cut slope that included hydraugers extending 70 m into the cut.

The evaluations were based on Bishop's Modified Method of analysis and search routines were used to evaluate a large number of failure surfaces and identify the most critical surface for a given slope. Both circular and non-circular potential failure surfaces were considered. The GSLOPE computer output is included in Appendix I.

Pseudostatic stability analyses were based on a seismic coefficient of 0.15g and for cases where the pseudostatic safety factor was less than 1.2, seismic deformation analyses were performed using the generally accepted procedure described by Makdisi and Seed (1978). Because the amount of deformation calculated by the Makdisi and Seed method depends on the duration of ground shaking (which is related to the magnitude of the earthquake) as well as the peak horizontal ground acceleration associated with the earthquake, analyses were performed to assess potential displacements of the realignment cut slopes under the design near-field, intermediate-field, and far-field earthquakes.

8.2.1.2 Material Properties Assumed for Analysis

In situ unit weight and moisture content were evaluated based on the test data summarized in Table 6-1 and included in Appendix F. Based on these an average unit weight of 1,890 kg/m^3 at an average in-situ moisture content of 18 percent were assumed representative of the cut slope geologic materials.

The shear strength properties assumed for analysis of cut slopes within the Panoche Formation bedrock or for slopes excavated between the main and eastern strands of the Greenville fault were based on consideration of several different factors, including:

- Several 1V:2H cut slopes that were on the order of 45 m high and that were excavated in Panoche Formation bedrock on nearby properties reportedly failed very shortly after construction. Failure of these slopes shortly after construction indicates the bedrock is relatively weak and may be at or near its residual strength;

- The presence of active faulting, shear zones, and possible landslides within the area of the proposed maximum cut that indicate the bedrock in this area may have undergone previous displacement. This displacement may have resulted in reducing bedrock shear strength to values at or close to residual strength;

- The empirical evaluation of rock mass shear strength based on boring log observations and laboratory test results that was described in Section 7;

- Laboratory shear strength from tests performed on samples recovered from the borings; and

- Residual shear strength inferred from measured index properties for the cut slope geologic materials.

Shear strength properties are plotted in cross section in the area of maximum cut slope in Figure 4-4 and Figure 8-1 shows the range of shear strength properties evaluated by the different methods. Based on these figures and site observations, strength properties assumed for analysis of cut slopes in the Panoche Formation and in the area between the main and eastern strands of the Greenville fault include a cohesion intercept of 2.39 kPa and a friction angle of 20 degrees. These values are generally consistent with the estimated rock mass strength of the material and with the mid range residual strength values estimated using the results of laboratory testing and the Stark and Eids (1998) correlations that relate plasticity and percent clay with residual strength.

8.2.1.3 Groundwater Conditions Assumed for Analysis

Groundwater conditions assumed for analysis were based on the data collected from the temporary piezometer that indicated at the time of the field exploration activity, groundwater occurred at a depth of about 16 m to 17 m below the ground surface. Because the site piezometric data are limited, groundwater elevations were varied during the analyses to evaluate changes increased groundwater levels may have on stability of the proposed cuts.

8.2.1.4 Results of Analysis

The results of analysis are summarized in Table 8-1 and indicate deep surface static safety factors that range from about 1.4 to 1.6 for the different conditions that were analyzed. The analyses further indicated shallower surface sliding safety factors that range from about 1.7 to 1.9. Displacement evaluations indicated potential seismic displacements were within generally acceptable limits for the three slope conditions that were considered.[5]

8.2.1.5 Unstable Areas Uncovered During Excavation

The subsurface exploration and testing program was intended to characterize the soil and rock along the proposed alignment. The stability analyses performed were based on this geologic characterization and the results of the analyses reflect the assumed geologic model. However, due

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[5] According to California Division of Mines and Geology (1997), calculated displacements of 0 to 10 cm are unlikely to correspond to serious movement and damange. In the 10 to 100 cm range, slope deformation may be sufficient to cause serious ground cracking or enough strength loss to result in continuing (post-seismic) failure. Determining whether displacements in this range can be accommodated requires judgement. Calculated displacements greater than 100 cm are very likely to correspond to damaging landslide movement, and such slopes should be considered unstable.

to the complex geologic conditions at the site, it is possible localized areas of less stable bedrock which require remedial stabilization measures may be discovered during excavation of the planned cuts. In the event that localized problem areas are discovered, stability fills may need to be constructed. Recommendations for stability fills are presented in Section 11.

8.2.2 Rippability

The results of the seismic refraction survey (see Appendix E) suggested three seismic layers beneath the refraction lines could be distinguished by compressional (P) wave velocities. These layers included:

- Layer 1 was between 2.1 m to 7.9 m thick, included the ground surface, and had a P-wave velocity ranging between 335 and 396 meters per second (mps). The P-wave velocity indicated this layer consisted of dry to partially saturated colluvium and highly weathered bedrock.

- Layer 2 was distinguished by a P-wave velocity that ranged from 1,067 to 1,615 mps, suggestive of moderately weathered and/or fractured sandstone. The top of the second layer occurred at depths ranging from about 2.1 m to 7.9 m below the ground surface.

- Layer 3 was distinguished by P-wave velocities that ranged from 2,103 to 2,774 mps, indicative of moderately weathered and/or fractured sandstone to relatively unweathered sandstone. The top of the third layer occurred at depths from about 14.3 to 11.0 m below the ground surface.

Based on the 20th edition of the Caterpillar Performance Handbook for the D9N Tractor, the first two seismic layers should be rippable with the right combination of tractor and ripper. The results also suggest that the third seismic layer beneath line SL-2 (see Appendix E) also should be rippable with the right combination of tractor and ripper. However, the third seismic layer beneath line SL-1 may only be marginally rippable to nonrippable.

8.2.3 Grading Factors

The results of the density and moisture testing completed on samples removed from the areas where excavations are planned indicate an average in situ dry densities of 1,723 kg/m3. Compaction tests on bulk materials obtained from the exploratory test trenches indicated an average maximum dry density of 1,748 kg/m3. If the excavated materials are placed at average relative compaction of 92.5 percent, the excavated material will have a net shrinkage of about 2 percent. It should be recognized that these calculations are based on a very small sampling of materials and are subject to relatively large variation.

8.2.4 Rebound/Swell of Excavation

The proposed maximum excavation depth of approximately 28 m at the roadway centerline will result in a significant reduction in overburden pressure on the Panoche Formation claystone. In addition, it is possible that the claystone could be exposed to more free water once the cut has been excavated. These changes in loading have the potential to cause elastic rebound and/or swelling of the bedrock. Because the majority of the elastic rebound should occur during construction and shortly following completion of the excavations, the finish grade of the roadway should be largely unaffected by rebound.

To assess the potential for bedrock heave of the claystone, free swell tests were completed on core samples of the claystone. The results of the tests indicated that the amount of swell that may occur at the 28 m cut is on the order of ½ to 2 percent. We estimate that this rebound will result in a net heave of the bottom of the excavation of between 100 and 400 mm. This amount of bedrock heave could be significant if it does not occur in a relatively uniform manner. As a result, inspection of the excavation and alignment subgrade during construction is important to evaluate whether the claystone is interbedded with low or non-expansive bedrock that, in turn, could lead to abrupt changes in the roadbed profile.

8.2.5 Weathering of Cuts

The Cierbo and Panoche Formation materials encountered during our subsurface exploration are known to weather rapidly when exposed to air and water. Observation of highway cut slopes excavated into similarly aged sedimentary rock within Alameda and Contra Costa Counties suggests that the where exposed, siltstone and claystone units will weathered into soil-like material after only a few years. The potential for significant weathering of the exposed cut materials was evaluated by completing slake durability tests on selected samples. The test results confirm that significant weathering should be anticipated to occur after the cut slopes have been completed.

In our judgement, within 20 to 40 years, the weathering can be expected to degrade the outermost 1 to 1.5 m of the cuts. The effect of this degree of weathering was considered in the slope stability analyses by assuming that the bedrock acts as a soil-like material with poor shear strength characteristics. Despite the relatively flat inclination recommended for the cut slopes, it should still be anticipated that localized portions of the weathered materials will eventually fail as shallow (less than 1.5 m deep) erosional features or slumps. To improve the maintenance of the cut slopes after weathering has occurred, relatively wide drainage/maintenance terraces will be needed. Recommendations for these benches are provided in Section 11.

8.3 EMBANKMENTS

Subsurface exploration, laboratory testing, and stability analyses support embankment design in general accordance with the Caltrans Highway Design Manual (with the exception of the limited special design considerations that are presented in Section 12). The recommended special design considerations were based on the stability and settlement analyses methods described below.

8.3.1 Stability Analyses

8.3.1.1 Analysis Methods

Static and pseudostatic stability of representative cross sections were evaluated based on the methods described in Section 8.2.1.1. Proposed embankment configurations for three areas where the embankment height is at or near maximums were analyzed, including:

(1) An approximately 20 m high, two sided 1V:2H sidehill embankment situated on relatively level Panoche Formation-derived materials;

(2) An approximately 24 m high 1V:2H, two-sided sidehill embankment situated on moderately inclined Cierbo Formation materials; and

(3) An approximately 24 m high 1V:2H, one-sided sidehill embankment situated on relatively steeply inclined Cierbo Formation materials.

The generalized cross-section developed for each configuration was prepared assuming that unsuitable colluvial/alluvial soils were removed from the foundation and that the embankment was keyed into competent underlying bedrock materials. In addition, it was assumed that the embankments would incorporate underdrain provisions. A discussion of the recommended special grading requirements are included in Section 11.

The evaluations were based on Bishop's Modified Method of analysis and search routines were used to evaluate a large number of failure surfaces and identify the most critical surface for a given slope. Both circular and non-circular potential failure surfaces were considered. The GSLOPE computer output is included in Appendix I.

8.3.1.2 Material Properties Assumed for Stability Analysis

In situ unit weight and moisture content was evaluated based on the test data summarized in Table 6-1 and included in Appendix F. Based on these data, an average unit weight of 1,890 kg/m^3 at an average in-situ moisture content of 18 percent were assumed representative of the compacted embankment fill materials which will be generated from the project excavations. The shear strength properties assumed for analysis of embankments constructed of compacted material from the project excavations were based on:

- Laboratory shear strength from tests performed on samples recovered from the borings; and
- Published ranges of shear strengths for compacted soils similar to those which will be generated from the excavations at the site.

Based on these figures and site observations, strength properties assumed for analysis of the embankment materials include a cohesion intercept of 7.2 kPa and a friction angle of 26 degrees. In areas where the embankment will be underlain by the weaker Panoche formation materials, the strength parameters discussed in Section 8.2.1.2 were assumed for those materials. In the areas where the embankments will overly the Cierbo formation materials, those materials were assumed to have the same shear strength as the embankment fill.

8.3.1.3 Groundwater Conditions Assumed for Stability Analysis

Groundwater conditions assumed for within the embankments were based on the construction of effective underdrains below the embankments. Groundwater conditions assumed for the foundation materials underlying the embankments were based on interpretation geologic conditions along different parts of the alignment. Because the site piezometric data are limited, groundwater elevations were varied during the analyses to evaluate impacts increased groundwater levels may have on the stability of the proposed embankments.

8.3.1.4 Results of Stability Analysis

The results of analysis are summarized in Table 8-2 and indicate static safety factors that range from about 1.5 to 1.6 for the different conditions that were analyzed. Pseudostatic safety factors were greater than 1.2 for all conditions analyzed and seismic displacement analyses were not necessary.

8.3.2 Post-Construction Embankment Movements

Settlement of the embankments will result from consolidation and compression of colluvial and alluvial foundation soils which are left in place, and from consolidation and secondary compression of the embankment fill itself. The potential for consolidation and compression of the foundation soils can be reduced and virtually eliminated by removal of shallow soils prior to placement of embankment fills. We estimate that removal of the colluvial/alluvial soils prior to embankment construction will limit settlement of the foundation materials underlying the embankments to less than 50 mm.

Compression of the embankment fills will occur almost entirely during construction and can be addressed as the fill is placed. During construction and for a considerable time thereafter, consolidation of the embankment fill will occur in the lower parts of the embankments. Conversely, post-construction heave of the embankment fills will occur in the upper parts of the embankments as the embankment gets wet and the expansive claystone/siltstone-derived fill swells. Because the embankment thickness will vary along the roadway, differential settlement of the embankments should be anticipated.

Post-construction differential movement of the embankments can be reduced to acceptable levels by placing the less expansive soils in the uppermost portions of the embankments and by controlling the relative compaction and moisture content of different zones of the embankment. Differential movements can be most effectively reduced by the use of select non-expansive fill materials in the uppermost 5 m of the embankments and by requiring greater relative compaction in the lowermost 5 m. However, the use of selected non-expansive fills will be difficult to effectively enforce during construction and may also inadvertently cause the contractors to complete their work inefficiently. In lieu of requiring the use of select materials in the upper parts of the embankments, it is our opinion that post construction differential movements can be effectively reduced by using general embankment fill materials (i.e. non-select) and controlling the relative compaction and moisture contents at which the zones are placed. The following zoning and fill control measures are recommended:

EMBANKMENT LOCATION	RELATIVE COMPACTION*	MOISTURE CONTENT*
Uppermost 5m**	90% to 93%	+4% to +6% of optimum
Mid-embankment	90% or greater	+2% to +4% of optimum
Lowermost 5m	93% or greater	+2% to +6% of optimum

*Caltrans 216 Test Method
**excludes pavement structural section

8.4 EARTH RETAINING STRUCTURES

As of the date of this report, no permanent earth retaining structures are planned. However, as discussed in Section 12.2, one or more permanent earth retaining structures may eventually be required to limit the lateral extent of one or more of the embankments. It is also likely that temporary relocation of the road during construction of the improvements may require the construction of one or more temporary earth retention structures. It does not appear that any earth retention structures will be required along the cut sections of the project.

In general, any of the following different types of earth retaining structures could effectively be used in the specific sections of embankment where a permanent composite slope steeper that 1V:2H is required:

- Conventional retaining walls such as Caltrans standard cantilever reinforced concrete retaining walls;

- Gravity retaining systems such as Caltrans standard cribwalls or binwalls;
- Proprietary mechanically stabilized embankments (MSE) using pre-cast panel systems, segmental pre-cast concrete masonry units or welded wire facing elements;
- Reinforced soil slopes (RSS) using geosynthetic reinforcement placed within the embankment fill and a permanent erosion control system on the face of the slope; and
- A properly designed variation of two of the systems mentioned above.

Final design recommendations can be developed following selection of the preferred system(s). Caltrans design methods and standard plans can be used for conventional cantilever retaining walls and gravity walls. Design of MSE-type walls and reinforced soil slopes (RSS) structures should be done in conformance with the FHWA Demo 82 Guidelines (Elias and Christopher, 1996). For preliminary design of retaining systems, the parameters presented in Table 8-3 can be assumed. Once a specific earth retaining structure type has been selected and the locations and configuration determined, we can provide final design recommendations.

8.5 CULVERTS

8.5.1 Culvert Foundations

The planned culverts will generally be 1 m in diameter or smaller. As a result, no special culvert foundation recommendations will be necessary. However, as noted in the following sections, the soil chemistry at the site indicates that sulphate resistant concrete be used for all concrete foundations.

8.5.2 Culvert Materials

8.5.2.1 Corrosion Testing and Analysis

Thirteen soil and bedrock samples recovered from subsurface exploration operations were analyzed to estimate the degree of corrosivity to steel and concrete structures. The samples were tested by Environmental Technical Services (ETS) of Petaluma, California for pH, minimum resistivity, sulfate content, and chloride content in general conformance with procedures outlined California Test Methods 412, 422, 523, and 643. A discussion of the testing procedures and ETS's analyses of the results are presented in Appendix G. Descriptions of the samples tested and a summary of the test results are presented in Table 8-4.

The results of the corrosion tests indicate that the soil and bedrock are generally corrosive to steel and concrete, and that some of the material is very corrosive to steel and concrete. As shown in Table 6-7, the pH of the samples ranged from 3.05 to 7.05, the minimum resistivity values ranged from 909 to 4880 ohm-cm, the sulfate concentrations ranged from <1 to 1,860 ppm, and the chloride concentrations ranged from <1 to 42 ppm.

The very acidic pHs require the use of acid resistant steel and concrete. The low minimum resistivity values will require the use of corrosion resistant materials and/or special design considerations. The high level of sulfates require the use of sulfate resistant concrete and sulfate resistant reinforced concrete pipe (RCP). Chloride concentrations of all of the samples were well below the 500 ppm threshold level that would require the use of chloride resistant materials and/or design.

8.5.2.2 Service Life Analysis

Caltrans' software program CULVERT4, California Test Method 643, and Section 854 of the Caltrans Highway Design Manual (HDM) were used to estimate the maintenance-free service design life of corrugated steel pipe (CSP) and alternative culvert materials. The results of the analysis are included in Appendix G and summarized in Table 8-5.

8.6 MINOR STRUCTURE FOUNDATIONS

The preliminary plans on which this report was based do not indicate any significant minor structure foundations for which geotechnical design is required. Geotechnical design analyses for minor structures may be provided in the future, as warranted.

8.7 PAVEMENTS

8.7.1 Basement Soil R-Value Testing and Results

Selected samples of soil and bedrock materials recovered during our subsurface exploration operations were tested to evaluate material resistance values (R-value) to support pavement design of the roadway. A total of three samples were tested by Cooper Testing Laboratories in Mountain View, California in accordance with the procedures presented in the California Test Method 301 (March 2000). The approximate locations of the samples and the results of the tests are summarized in the table below. The laboratory R-value test sheets are included in Appendix F. A description of the samples tested and a summary of the test results are presented below.

SUMMARY OF R–VALUE TEST RESULTS

SAMPLE LOCATION	SAMPLE DESCRIPTION	R-VALUE	EXPANSION PRESSURE (MPa)
TP-2 0.0 - 0.6m	Brown clayey sand (Panoche Formation)	25	0.86
TP-4 0.0 - 0.6m	Brown silty sand, slightly clayey (weathered sandstone - Cierbo Formation)	55	0.14
TP-5 0.0 - 0.6m	Brown clayey sand with gravel (Cierbo Formation)	23	0.00

It should be noted that R-values of materials generated from the shale and claystone bedrock can be significantly lower than materials generated from the sandstone bedrock. Additional R-value tests should be performed during construction to determine the representative R-value of the as-built basement soil along representative segments of the alignment and the pavement sections should be designed accordingly.

8.7.2 Lime Treated Basement Soil

When the basement soil has a very low R-value, lime treatment can reduce the structural section thickness and overall cost. An analysis of the effects of lime treatment on the on-site materials was outside the contracted scope of work. However, testing of samples of clayey soil and claystone mixed with 2 to 6 percent Type S hydrated lime for the earlier Vasco Road relocation project associated with the Los Vaqueros Reservoir (Woodward-Clyde, 1992) revealed a significant improvement in basement soil strength. Those results suggest that, if needed, lime treatment could be viable means of improving the resistance of the basement soil resistance. If lime treatment is considered during construction, a testing program using the actual basement soil should be performed to evaluate the actual percentage of lime required to allow reduction of the roadway structural section.

8.7.3 Recommended Pavement Type

Based upon the results of the geotechnical investigation and laboratory testing, we recommend that a pavement structural section consisting of flexible asphalt concrete pavement (ACP) be used for the entire length of the alignment. Considering the variable quality and corrosivity of the basement soil, the likely occurrence of minor differential movement between the cut and fill portions of the alignment, and the presence of several active fault traces that cross the alignment, it is our opinion that the use of rigid Portland cement concrete pavement (PCCP) would result in higher costs for both construction and maintenance when compared to ACP.

8.7.4 Structural Section Design

8.7.4.1 Design R-value and Traffic Index

The design Traffic Index for the project, as indicated in the PSR, is 10.5. Given the relatively short length of the proposed alignment, in our design of preliminary pavement sections we have assumed a design R-value of 20 for the entire length of the realignment. Prior to final structural section design additional R-value tests should be performed during construction to determine the validity of the assumed R-value. If the results of the tests during construction indicate a lower R-value is appropriate, the pavement section design will have to be adjusted accordingly.

8.7.4.2 Drainage Considerations

The HDM recommends that as part of a subsurface drainage system, an asphalt treated permeable base (ATPB) layer be placed immediately below the ACP to intercept surface water seeping through the structural section. Due to the generally impermeable nature of the basement soils along the alignment, in accordance with the HDM, all pavement structural sections should include a drainage layer consisting of at least 75 mm of ATPB placed immediately below the ACP. The drainage layer should connect to a subsurface drainage system.

Where adverse groundwater or drainage conditions are encountered that may saturate and soften the basement soil, base, or subgrade, a prime coat should be applied to the surface of material on which the ATPB layer is placed to prevent erosion of fines from the underlying material.

8.7.4.3 Pavement Section Analysis

Caltrans' software program NEWCOM90 was used to analyze pavement section combinations and their relative costs. Structural section materials used in the analysis were plant-mixed Type A asphalt concrete (AC), Class 2 aggregate base (AB), and Class 2 aggregate subbase (AS). The Traffic Index was fixed at 10.5 and the R-value was varied between 5 and 50. The results of the analysis are presented in Appendix K. The estimated pavement section cost in \$/m² shown in the appendix tables are for relative cost comparisons only.[6] The results of the analysis indicate that for the assumed design R-value of 20, the following structural section is the most cost effective based on the input unit costs:

- AC = 195 mm
- ATPB = 75 mm
- AB = 105 mm
- AS = 225 mm

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[6] The actual cost of pavement section layers could vary substantially from the values indicated and should be estimated during design using current local costs and factors.

9.0 MATERIAL SOURCES

Materials meeting the requirements for concrete, asphalt concrete, asphalt treated permeable base, aggregate base, aggregate subbase, permeable material, and selected material are available from several regional commercial quarries and plants in Alameda, Contra Costa, and San Joaquin counties. Commercial sources within 50 km of the project are listed in Table 9-1.

It is not anticipated that the project will be unbalanced and require borrow for construction of embankments. If the final grading balance indicates a fill shortage, one or more of the cut slopes may be flattened to provide any additional extra embankment material that might be needed. If required, it is also possible that adjacent undeveloped areas currently used for ranching could be used as borrow sources. However, investigation of the adjacent undeveloped areas was not part of the current investigation and would be required prior to designating the areas as potential borrow sources.

10.0 MATERIAL DISPOSAL

As indicated in Section 9, the results of initial calculations indicate earthwork quantities approximately balance. As a result, significant off-site material disposal is likely to be unnecessary. However, in the event off-site disposal is necessary, the Vasco Road Sanitary Landfill is located less than 1 km from the project area. This Class II facility currently accepts clean soil, with disposal prices dependent on landfill soil requirements and availability at the time.

11.0 CONSTRUCTION CONSIDERATIONS

11.1 CONSTRUCTION ADVISORIES

11.1.1 Water in Excavations

The proposed excavations are up to 25 m below the original ground along the centerline of the new alignment. At least one of the boring encountered free water within the depth of the design excavation. In addition, the presence of the Greenville fault increases the likelihood of a localized groundwater barrier(s) or traps within the planned excavations. Therefore, it should be anticipated that free groundwater may be encountered in some areas as the excavation is lowered. As described in Section 12, the groundwater should be controlled by the use of horizontal drains which are installed as the excavation drops. Until the drains are installed, free water that develops in the excavation should be controlled by the contractor using well points or alternative methods as appropriate for the encountered conditions.

11.1.2 Sheared and Weak Rock

The complex geology and presence of Greenville fault traces create the potential for localized adverse geologic conditions within the planned excavations for the project. Such conditions may require over-excavation and replacement with a stability fill. Because this type of operation may alter the method in which a contractor completes the grading, the contractor's bid should include a contingency for such a situation.

It should also be noted that for temporary excavations, some of the materials may have time-dependent strength. For example, a relatively moderately inclined (1V:2H) excavation made in similar geologic materials at the nearby landfill reportedly failed within several days after originally being cut. Therefore, the contractor should carefully plan out excavation activity so that inadvertent oversteepening of cut slopes does not occur.

11.1.3 Existing Fill Embankments

Just south of the north end conform, there is an existing embankment fill along the east side of the road that shows evidence of past downslope creep or failure. This area of the existing road is the most likely location of a temporary relocation at the north end of the project. As a result, if the temporary connection requires placement of additional fill, it may be necessary to remove and replace some of the existing fill prior to placing any new fill.

11.2 CONSTRUCTION CONSIDERATIONS THAT INFLUENCE DESIGN

11.2.1 Excavation Configuration

Site observations, subsurface exploration, and laboratory testing indicate areas within the proposed excavations consist of highly fractured and sheared soil-like claystone with low shear strength. In addition, the limited groundwater data collected along the alignment as part of this study suggest it is likely the natural groundwater level is above the base of the design excavation in some areas. As a result of these factors, special design of the cut slopes for the road is necessary. Recommendations for design of the cuts along the length of the project are presented in Section 12.1.

11.2.1.1 Drainage and Maintenance Terraces

Weathering of the rock materials which will be exposed by the cuts will result in deterioration of the outermost 1.5 m of the slope. It should be anticipated that the weathered skin of the cut slope will eventually erode or slump down. The recommended 5 m width of the benches on large cut slopes reflect the anticipated result of the weathering.

11.2.1.2 Horizontal Drains

The presence of free ground water above the elevation of the planned excavation indicates that permanent dewatering of the lower portions of the slope should be planned and incorporated to the final design of the cut slopes.

11.2.2 Order of Work - Excavations

All excavations (permanent and temporary) should be required to proceed from the top of the cut down to the design toe of the cut. Under no circumstance should the excavations be allowed to proceed from the toe to top by excavating a temporary cut that is steeper than the recommended permanent inclination.

11.2.3 Existing Utilities

A large PG&E gas main exists along the design excavations. As currently configured, the excavations would expose the pipeline over a significant distance. Because there is no practical way to protect or support the gas line, the pipeline should be relocated. If the gas pipe line relocation consists of an overland route that is within or skirts the project cuts and fills, the physical location and the type of backfill material used needs to be given special consideration to avoid having the relocated pipeline contribute to an unstable condition.

11.2.4 Encroachment into Undesirable Areas

The presence of a stock pond located west of the site will require either removal of the stock pond and associated sediment therein or construction of an earth retaining structure as part of the planned embankment. Removal of the stock pond would likely expose areas of weak soil which would need to be removed and replaced, thus increasing the height of the embankment significantly. This situation can be avoided by use of an earth retaining structure.

11.2.5 Underdrains for Fills Across Drainages

Some of the major fill embankments cross existing ephemeral drainages. Even after these areas are filled in, the tendency will still be for water to flow down into the old drainage beneath the embankment. Therefore, underdrains should be incorporated into the design of the embankments in these areas.

11.2.6 Balance of Project Grading

The planned configuration of excavations and embankments roughly balances. Grading factors indicates a net shrinkage factor of about two percent. However, those results were developed based on very limited compaction data and the in-place compaction of the embankment materials may differ from that used in the analysis, thereby causing the calculated factor to be inaccurate. The possibility of the project earthwork being unbalanced should be included in the special provisions and a contingency for this possibility should be included in contractor bids for the work.

If the project is long on excavation and results in net export, the extra material could either be hauled to the nearby Vasco Road Landfill (at a cost) for use as daily cover, or one of more embankment slopes could be flattened. To account for this possibility, a contingency for disposable of excess excavation material and a source for import fill should be developed. If the project falls short of material, then excavations can be flattened or material can be imported from offsite. Another possibility would be to develop an onsite borrow area that could also be used to generate fill.

The onsite solutions for excess fill or a fill shortage both will require that the embankments or excavations extend laterally beyond their design configuration. This means that additional right-of-way would need to be purchased. This possibility should be considered by the County when purchasing right-of-way.

11.3 CONSTRUCTION CONSIDERATIONS THAT INFLUENCE SPECIFICATIONS

11.3.1 Order of Work - Excavation

The stability of the relatively weak bedrock materials in the area of the deepest planned excavation requires the order in which the excavation is made to be controlled. In addition, the installation of horizontal drains must take place as the excavation is progressing. The special provisions must carefully address the timing of these excavation conditions to reduce the potential for cut slope failure during construction.

11.3.2 Balance of Project Grading

See discussion in Section 11.2.6.

11.3.3 Earth Retaining Structures

If earth retaining structures are required along the embankment, special provisions will need to be provided for the type of earth retaining structure selected.

11.3.4 Corrosive Soils

The presence of corrosive and acid soils requires that the materials for various structures such as culvert, pavements, and minor structures account for these conditions. All concrete should be sulphate resistant and any steel structures should be properly designed to account for loss of steel due to corrosion.

11.4 CONSTRUCTION MONITORING AND INSTRUMENTATION

11.4.1 Monitoring of Groundwater Levels

The elevations of groundwater across the site will likely vary due to fault traces and sheared bedrock. Consideration should be given to requiring the contractor install a series of standing head piezometers along the critical areas within and just outside of the larger excavations. The piezometers should provide information regarding the initial groundwater elevations and may be used to assess the effectiveness of horizontal drains which are installed at different elevations. The configuration and layout of the horizontal drains may also be evaluated and/or refined based on information from the piezometers.

11.4.2 Mapping of Excavation Slopes

As discussed above, it should be anticipated that conditions will vary within the excavations. Evaluation of the significance of the variations and/or differing conditions may be accomplished by mapping during excavation by the Engineering Geologist. The specifications should require that excavation slopes be limited in height until mapped and approved by the Engineering Geologist retained by the County for this purpose.

11.5 HAZARDOUS WASTE CONSIDERATIONS

There are not believed to be special hazardous waste considerations at this project site. However, this investigation did not evaluation the possibility for the presence of hazardous materials at the site, and as a result, a specific hazardous materials assessment is recommended before completing final plans and specifications for the project.

11.6 DIFFERING SITE CONDITIONS

The greatest potential for differing site conditions is the variable nature of the bedrock materials present across the site. Significant changes could warrant modification during construction of the configuration of the excavation. It is likely that the contractor will become aware of changes in bedrock excavation conditions before the inspector. As a result, it is important that the special provisions stress the importance of contractor reporting once a differing condition is suspected or has been encountered.

12.0 RECOMMENDATIONS AND SPECIFICATIONS

12.1 EXCAVATION RECOMMENDATIONS

All excavation work should conform with Section 19 of the Caltrans Standard Specifications except as modified in accordance with the recommendations presented below.

12.1.1 Order of Work

All excavations (permanent and temporary) should be required to proceed from the top of the cut down to the design toe of the cut. Under no circumstance should the excavations be allowed to proceed from the toe to top by excavating a temporary cut that is steeper than the recommended permanent inclination (this requirement should be included in the Special Provisions). All excavations greater than 5 m deep should be mapped by the Engineering Geologist during construction and the geologist should confirm that the geologic conditions exposed in the excavation are consistent with the conditions assumed for analysis and design. Installation of horizontal drains should proceed coincident with excavation as specified in Section 68-2 of the Standard Specifications.

12.1.2 Cut Slope Configurations

Excavation design recommendations are presented in Table 12-1 and are summarized below.

12.1.2.1 Panoche Formation and Highly Sheared Areas

Excavations made through Panoche Formation materials, or that are otherwise located between the two traces of the Greenville fault, should be designed at a relatively gentle inclination of 1V:3.5H or flatter. Intermediate, 5 m wide drainage and maintenance benches spaced at about 8 m vertically should be provided and horizontal drains should be constructed as recommended below or as determined during construction by the Engineering Geologist.

12.1.2.2 Cierbo Formation Materials

Excavations made in Cierbo Formation materials and other more competent materials can generally be designed at 1V:2H inclinations. Horizontal drainage is not anticipated to be necessary in the Cierbo Formation cuts, although some drainage provisions may ultimately be required based on observations made in the field during construction.

12.1.3 Horizontal Drains

In areas where free ground water will be encountered (generally in excavations greater than 10 m deep), horizontal drains should be installed as needed to reduce the potential for build-up of hydrostatic pressure within the rock mass. Therefore, the horizontal drains should be included in the bid schedule as a contingent bid item with a base amount evaluated pursuant to the configuration described below.

For the areas where the cuts are greater than 10 m deep, 70 m long horizontal drains spaced at approximately 10 m horizontally should be installed at the base of the cut (just above the roadway) and on each of the drainage/maintenance benches. The horizontal drains should be constructed as specified in Section 68-2 of the Standard Specifications although the actual locations, lengths, and spacing of the horizontal drains should be determined by the Geotechnical Engineer or Engineering Geologist during construction of the excavations. Water from the horizontal drains should discharge directly into concrete drainage swales located on the benches.

12.1.4 Stability Fills

Stability (buttress) fills should be constructed in localized areas where very weak rock which is subject to failure is exposed by the design excavation. The need for and configuration of stability fills should be determined during construction by the Engineering Geologist. The stability fills should be measured and paid for as indicated in Section 19-2.04 "Slides and Slipouts," of the Standard Specifications.

12.1.5 Temporary Excavations

Any temporary excavations which are necessary for installation of utilities or other minor structures and which need to be steeper than the recommended permanent cut inclination should be designed by a registered civil engineer working for the contractor.

12.1.6 Erosion Control

Permanent erosion control measures should consist of appropriate vegetation which require little if any irrigation. Soil chemistry should be considered in the selection of plants and vegetation. Temporary erosion control should be designed to minimize rutting and rilling of the slope before maturation of the permanent vegetation and plants. The design of all temporary erosion control measures should be based on best management practices.

12.2 EMBANKMENT RECOMMENDATIONS

Embankment construction should conform with Section 19 of the Standard Specifications, except as modified in accordance with the recommendations presented in Table 12-1. Compaction specifications for embankment fill should be as shown in the table included in Section 8.3.2.

12.3 EARTH RETAINING STRUCTURES

Any one of several types of earth retaining structure could be used on the project. Selection should be based on the required geometry, location, and parameters provided in Table 8-3. The Geotechnical Engineer should be consulted during design regardless of the type of structure selected or proposed.

12.4 CULVERTS

Based on the tests performed for this project, acid-resistant, corrosion-resistant, and sulfate-resistant concrete and steel should be required for construction (recommendations for 50-year service life culvert and drain material alternatives are presented in Table 12-2). Additional corrosivity tests should be completed as part of final design following identification of final culvert and/or concrete structure locations. Alternatively, plastic culvert pipe may be considered for use on the project due to the aggressive soil conditions.

12.5 PAVEMENTS

Recommended pavement structural sections are discussed in Section 8.7. As indicated in this section, Type A asphalt concrete pavement should be used on the project. Aggregate base and aggregate subbase should be Class 2 and treated permeable base should be asphalt treated.

12.6 SERVICES DURING FINAL DESIGN AND CONSTRUCTION

12.6.1 Design Consultations

Cal Engineering & Geology should be provided the opportunity to review those portions of the plans and special provisions that pertain to earthwork and related operations and items of work to determine whether they are consistent with the recommendations of this report. It is the County's responsibility to provide plans and specification documents for our review prior to their issuance for construction bidding purposes. In the event Cal Engineering & Geology is not retained for review, we assume no liability for the misrepresentation of our conclusions and recommendations.

12.6.2 Construction Monitoring

It is recommended that Cal Engineering & Geology be retained to observe the excavation, earthwork, and foundation phases of work to determine that the subsurface conditions are compatible with those used in our analysis and design.

12.7 NOTIFICATION AND LIMITATIONS

The conclusions and recommendations presented in this report are based on the information provided regarding the proposed construction, and the results of the geologic mapping, subsurface exploration, and testing, combined with interpolation of the subsurface conditions between boring and trench locations. This information notwithstanding, the nature and extent of subsurface variations between borings may not become evident until construction. If variations are encountered during construction, Cal Engineering & Geology should be notified promptly so that conditions can be reviewed and recommendations reconsidered, as appropriate.

This report was prepared based on preliminary design information which is subject to change during the design process. At approximately the 90 percent design level, Cal Engineering & Geology should review the design assumptions made in this report and prepare addenda or memoranda as appropriate. Any modifications included in these addenda or memoranda should be carefully reviewed by the project designers to make sure that any conclusions or recommendations that are modified are accounted for in the final design of the project.

This report presents the results of a geotechnical and geologic investigation only and should not be construed as an environmental audit or study. The conclusions and recommendations contained in this report are valid only for the project described in this report. We have employed accepted geotechnical engineering procedures, and our professional opinions and conclusions are made in accordance with generally accepted geotechnical engineering principles and practices. This standard is in lieu of all other warranties, either expressed or implied.

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Tables

Table 4-1

SUMMARY OF ACTIVE AND POTENTIALLY ACTIVE FAULTS WITHIN 100 KILOMETERS OF THE PROJECT

Vasco Road Safety Improvements
Alameda County, California

FAULT NAME	DISTANCE (kilometers)	MAXIMUM CREDIBLE EARTHQUAKE		MAXIMUM PROBABLE EARTHQUAKE	
		Moment Magnitude	Peak Site Acceleration (g)	Moment Magnitude	Peak Site Acceleration (g)
Great Valley Segment 4	61.7	6.6	0.07	5.7	0.04
West Napa	63.8	6.5	0.05	5.4	0.01
Rodgers Creek	64.8	7.0	0.06	6.5	0.05
Ortigalita	66.7	6.9	0.06	5.6	0.02
San Andreas (Santa Cruz Mountains)	68.9	7.0	0.06	6.7	0.05
Sargent	71.2	6.8	0.05	6.1	0.03
San Gregorio	72.5	7.3	0.06	6.5	0.04
San Andreas (North Coast)	76.0	7.6	0.07	7.4	0.07
Zayante - Vergeles	77.3	6.8	0.05	4.5	<0.01
Hunting Creek - Berryessa	87.5	6.9	0.04	6.4	0.03
San Andreas (Pajaro)	89.3	6.8	0.04	6.6	0.03
Foothills Fault System	91.1	6.5	0.04	5.2	0.01
Great Valley Segment 9	97.3	6.6	0.04	5.6	0.02
Quien Sabe	98.0	6.4	0.03	5.3	0.01
Point Reyes	99.0	6.8	0.05	4.9	0.01

Table 4-1
SUMMARY OF ACTIVE AND POTENTIALLY ACTIVE FAULTS WITHIN 100 KILOMETERS OF THE PROJECT
Vasco Road Safety Improvements
Alameda County, California

FAULT NAME	DISTANCE (kilometers)	MAXIMUM CREDIBLE EARTHQUAKE		MAXIMUM PROBABLE EARTHQUAKE	
		Moment Magnitude	Peak Site Acceleration (g)	Moment Magnitude	Peak Site Acceleration (g)
Monterey Bay - Tularcitos	99.1	7.1	0.05	5.3	0.01

NOTES:

1. MCE fault magnitudes from U.S. Geological Survey (1996) and The Working Group on Northern California Earthquake Potential (1996).
2. MPE fault magnitudes approximately equal to earthquake with 100 year recurrence intervals.
3. Peak site acceleration associated with MCE and MPE based on Abrahamson and Silva (1997) attenuation relationship for rock sites.
4. Faults within about 30 km of the project site are shown in Figure 4-5.

Table 6-1
SUMMARY OF LABORATORY TESTS PERFORMED
Vasco Road Safety Improvements
Alameda County, California

SAMPLE LOCATION	SAMPLE DEPTH		TESTS												
	Feet	Meters	Moisture Content	Dry Density	Atterberg Limits	No. 200 Wash	Hydrometer	Unconfined Compression	Direct Shear	UU Triaxial	Compaction	Consolidation	Slake	Corrosion	R-Value
B-1	5.5	1.7	♦	♦				♦							
	13.5	4.1	♦	♦				♦							
	29.5	9.0	♦	♦				♦							
B-2	17.5	5.3	♦	♦	♦			♦							
	19.0	5.8	♦	♦				♦							
	26.5	8.1	♦	♦				♦							
	35.0	10.7	♦	♦				♦							
	39.5	12.0	♦	♦				♦							
	47 to 48	14.3 to 14.6								♦					
	48.5	14.8	♦	♦				♦							
	55.0	16.8	♦	♦				♦							
	69.0	21.0	♦	♦				♦							
B-3	8.5	2.6	♦	♦				♦							
	14.0	4.3	♦	♦	♦			♦							
	21.5	6.6	♦	♦				♦							
	29.5	9.0	♦										♦		
	35.0	10.7	♦	♦				♦							
	45.5	13.9	♦										♦		
	46.5	14.2	♦	♦	♦		♦	♦							
	47.0	14.3							♦						
	58.0	17.7	♦	♦				♦							
	62.0	18.9	♦	♦	♦		♦	♦							
	71.5	21.8	♦	♦				♦							
	82.0	25.0	♦	♦				♦							
	3.0	0.9	♦	♦				♦							
	12.0	3.7	♦	♦				♦							
	14.0	4.3	♦	♦				♦							
	17.0	5.2	♦	♦									♦		
	17.5	5.3	♦	♦	♦		♦	♦							
	27.0	8.2	♦	♦				♦							
	27.0	8.2	♦	♦									♦		
	28.0	8.5							♦						
	30.0	9.1	♦	♦	♦		♦	♦							
	35.5	10.8													

Table 6-1
SUMMARY OF LABORATORY TESTS PERFORMED
Vasco Road Safety Improvements
Alameda County, California

SAMPLE LOCATION	SAMPLE DEPTH		TESTS												
	Feet	Meters	Moisture Content	Dry Density	Atterberg Limits	No. 200 Wash	Hydrometer	Unconfined Compression	Direct Shear	UU Triaxial	Compaction	Consolidation	Slake	Corrosion	R-Value
B-4	37 to 38	11.3 to 11.6								♦		♦			
	39.0	11.9	♦	♦				♦							
	40.0	12.2							♦						
	44.0	13.4	♦	♦	♦		♦	♦							
	44.5	13.6	♦										♦		
	49.0	14.9	♦	♦				♦							
	56.0	17.1	♦	♦				♦							
	62.5	19.1							♦						
	64.5	19.7	♦	♦				♦							
	64.5	19.7	♦										♦		
	66.5	20.3	♦	♦				♦							
	70.5	21.5	♦	♦	♦		♦	♦							
	75.5	23.0	♦	♦				♦							
	79.5	24.2	♦	♦				♦							
	83.4	25.4	♦	♦				♦							
B-5	0.5	0.2												♦	
	8.0	2.4	♦	♦				♦							
	25.0	7.6												♦	
	27.0	8.2	♦	♦				♦							
	31.5	9.6												♦	
	36.5	11.1	♦	♦				♦							
	41.0	12.5	♦	♦				♦							
	44.0	13.4												♦	
	44.5	13.6							♦						
	47.5	14.5	♦	♦				♦							
	55.0	16.8	♦	♦				♦							
	62.0	18.9							♦						
	62.5	19.1	♦	♦				♦							
	66.5	20.3	♦	♦				♦							
	69.5	21.2												♦	
	75.0	22.9	♦	♦				♦							
	79.0	24.1												♦	
	80.5	24.5	♦	♦				♦							
	81.5	24.8												♦	

Table 6-1
SUMMARY OF LABORATORY TESTS PERFORMED
Vasco Road Safety Improvements
Alameda County, California

SAMPLE LOCATION	SAMPLE DEPTH		TESTS													
	Feet	Meters	Moisture Content	Dry Density	Atterberg Limits	No. 200 Wash	Hydrometer	Unconfined Compression	Direct Shear	UU Triaxial	Compaction	Consolidation	Slake	Corrosion	R-Value
B-6	84.5	25.8												◆	
	30 to 66	9.1 to 20.1									◆				
	6.5	2.0												◆	
	17.5	5.3	◆	◆											
	18.5	5.6												◆	
	28.5	8.7	◆	◆				◆							
B-7	13.0	4.0	◆	◆				◆							
	18.0	5.5	◆	◆				◆							
B-8	3.0	0.9	◆	◆											
	6.0	1.8	◆	◆											
	8.5	2.6	◆	◆		◆						◆			
	10.5	3.2	◆	◆											
	11.0	3.4	◆	◆											
	13.5	4.1	◆	◆											
	14.5	4.4							◆						
	15.3	4.6	◆	◆				◆							
	18.5	5.6	◆	◆				◆							
	20.0	6.1	◆	◆											
B-9	3.5	1.1	◆	◆											
B-10	6.5	2.0	◆	◆											
	10.0	3.0	◆	◆											
	14.5	4.4	◆	◆											
B-11	2.5	0.8	◆	◆											
	5.0	1.5	◆	◆											
B-12	3.5	1.1	◆	◆											
	5.5	1.7	◆	◆											
	10.5	3.2	◆	◆											
B-13	3.5	1.1	◆	◆											
	5.0	1.5												◆	
	5.5	1.7	◆	◆											
	10.5	3.2	◆	◆											
B-14	3.0	0.9	◆	◆											
	9.0	2.7	◆	◆				◆							
	14.0	4.3	◆	◆				◆							

Table 6-1
SUMMARY OF LABORATORY TESTS PERFORMED
Vasco Road Safety Improvements
Alameda County, California

SAMPLE LOCATION	SAMPLE DEPTH		TESTS													
	Feet	Meters	Moisture Content	Dry Density	Atterberg Limits	No. 200 Wash	Hydrometer	Unconfined Compression	Direct Shear	UU Triaxial	Compaction	Consolidation	Slake	Corrosion	R-Value
B-15	19.0	5.8	♦	♦											
	1.0	0.3	♦	♦											
	6.0	1.8	♦	♦											
	10.0	3.0	♦	♦											
TP-1														♦	
TP-2											♦				♦
TP-4											♦				♦
TP-5											♦			♦	♦
B-3 and B-4											♦				

Table 6-2
SUMMARY OF MOISTURE-DENSITY TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		MOISTURE CONTENT (percent)	DRY DENSITY	
	Feet	Meters		(pcf)	(kg/m3)
B-1	5.5	1.7	17.8	103.5	1,658
	13.5	4.1	21.5	104.1	1,668
	29.5	9.0	19.6	111.3	1,783
B-2	17.5	5.3	23.3	104.6	1,676
	19.0	5.8	17.8	111.3	1,783
	26.5	8.1	17.5	112.7	1,805
	35.0	10.7	20.4	107.1	1,716
	39.5	12.0	18.6	113.9	1,825
	48.5	14.8	11.3	128.8	2,063
	55.0	16.8	17.2	116.4	1,865
	69.0	21.0	13.3	114.9	1,841
B-3	8.5	2.6	14.6	116.6	1,868
	14.0	4.3	18.9	104.1	1,668
	21.5	6.6	15.9	115.2	1,845
	29.5	9.0	18.6		
	35.0	10.7	18.8	113.4	1,816
	45.5	13.9	17.0		
	46.5	14.2	33.2	90.0	1,442
	58.0	17.7	25.3	99.6	1,595
	62.0	18.9	30.2	94.5	1,514
	71.5	21.8	17.4	114.0	1,826
	82.0	25.0	17.3	114.4	1,833
B-4	3.0	0.9	10.8	115.4	1,849
	12.0	3.7	25.0	100.1	1,603
	14.0	4.3	12.7	120.8	1,935
	17.0	5.2	24.8		
	17.5	5.3	27.9	94.9	1,520
	27.0	8.2	24.6	100.8	1,615
	27.0	8.2	22.5		
	30.0	9.1	21.3	107.3	1,719
	39.0	11.9	18.6	112.2	1,797
	44.0	13.4	17.3	115.7	1,853
	44.5	13.6	17.2		
	49.0	14.9	18.3	112.5	1,802
	56.0	17.1	17.2	114.9	1,841
	64.5	19.7	13.8	120.7	1,933
	64.5	19.7	13.2		
	66.5	20.3	19.4	111.7	1,789
	70.5	21.5	17.3	115.4	1,849
	75.5	23.0	17.5	115.1	1,844
	79.5	24.2	15.5	117.9	1,889

Table 6-2
SUMMARY OF MOISTURE-DENSITY TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		MOISTURE CONTENT (percent)	DRY DENSITY	
	Feet	Meters		(pcf)	(kg/m3)
	83.4	25.4	16.6	114.6	1,836
B-5	8.0	2.4	25.5	97.9	1,568
	27.0	8.2	18.7	113.3	1,815
	36.5	11.1	11.0	128.2	2,054
	41.0	12.5	19.9	110.6	1,772
	47.5	14.5	17.9	114.2	1,829
	55.0	16.8	19.0	112.3	1,799
	62.5	19.1	16.9	115.7	1,853
	66.5	20.3	17.1	115.9	1,857
	75.0	22.9	15.2	117.5	1,882
	80.5	24.5	14.6	115.7	1,853
B-6	17.5	5.3	15.0	115.2	1,845
	28.5	8.7	18.5	105.4	1,688
B-7	13.0	4.0	5.8	134.1	2,148
	18.0	5.5	8.6	131.8	2,111
B-8	3.0	0.9	8.9	101.9	1,632
	6.0	1.8	9.6	114.2	1,829
	8.5	2.6	14.4	108.8	1,743
	10.5	3.2	21.6	105.7	1,693
	11.0	3.4	9.1	123.7	1,981
	13.5	4.1	11.0	117.7	1,885
	15.3	4.6	15.9	114.2	1,829
	18.5	5.6	15.9	115.3	1,847
	20.0	6.1	18.0	109.6	1,756
B-9	3.5	1.1	13.0	112.4	1,800
B-10	6.5	2.0	5.4	112.8	1,807
	10.0	3.0	6.0	117.5	1,882
	14.5	4.4	15.0	106.7	1,709
B-11	2.5	0.8	6.0	110.1	1,764
	5.0	1.5	8.0	118.4	1,897
B-12	3.5	1.1	4.3	114.3	1,831
	5.5	1.7	5.7	122.3	1,959
	10.5	3.2	4.8	128.2	2,054
B-13	3.5	1.1	16.8	106.8	1,711
	5.5	1.7	17.5	101.7	1,629
	10.5	3.2	6.9	110.8	1,775
B-14	3.0	0.9	10.2	114.4	1,833
	9.0	2.7	18.6	110.7	1,773
	14.0	4.3	21.2	105.2	1,685
	19.0	5.8	16.9	104.0	1,666
	1.0	0.3	4.5	101.8	1,631

Table 6-2
SUMMARY OF MOISTURE-DENSITY TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		MOISTURE CONTENT (percent)	DRY DENSITY	
	Feet	Meters		(pcf)	(kg/m3)
B-15	6.0	1.8	6.8	111.4	1,784
	10.0	3.0	7.5	122.4	1,961

Table 6-3
SUMMARY OF ATTERBERG LIMITS TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		ATTERBERG LIMITS			FINE-GRAINED FRACTION	INFERRED RESIDUAL FRICTION ANGLE (degrees per Stark and Eid, 1994)
	Feet	Meters	Liquid Limit	Plastic Limit	Plasticity Index	Percent Finer Than 0.005 mm	
B-2	17.5	5.3	42	18	24		
B-3	14.0	4.3	45	19	26		
	46.5	14.2	99	20	79	73	8
	62.0	18.9	86	23	63	40	14
B-4	17.5	5.3	56	21	35	42	20
	30.0	9.1	45	18	27	52	18
	44.0	13.4	42	20	22	58	18
	70.5	21.5	35	12	23	40	24

Table 6-4
SUMMARY OF SHEAR STRENGTH TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		DIRECT SHEAR STRENGTH						UNCONSOLIDATED-UNDRAINED TRIAXIAL SHEAR STRENGTH			INFERRED RESIDUAL FRICTION ANGLE (degrees per Stark and Eid, 1994)
	Feet	Meters	Peak Friction Angle (degrees)	Peak Cohesion (psf)	Peak Cohesion (kPa)	Large Displacement Friction Angle (degrees)	Large Displacment Cohesion (psf)	Large Displacement Cohesion (kPa)	Cohesion (ksf)	Cohesion (kPa)	Friction Angle (degrees)	
B-2	47 to 48	14.3 to 14.6							3.8	181.9	17.8	
B-3	46.5	14.2										8
	47.0	14.3	20	720	34.5	8	292	14.0				
	62.0	18.9										14
B-4	17.5	5.3										20
	28.0	8.5	25	474	22.7	29	104	5.0				
	30.0	9.1										18
	37 to 38	11.3 to 11.6							1.36	65.1	9.6	
	40.0	12.2	26	538	25.8	26	538	25.8				
	44.0	13.4										18
	62.5	19.1	35	1543	73.9	32	199	9.5				
	70.5	21.5										24
B-5	44.5	13.6	38	419	20.1	35	122	5.8				
	62.0	18.9	34	1105	52.9	35	0	0.0				
B-8	14.5	4.4	46	184	8.8	36	0	0.0				

Table 6-5
SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	GEOLOGIC UNIT	ELEVATION (meters)	SAMPLE DEPTH		SAMPLE ELEVATION	MOISTURE - DENSITY			UNCONFINED COMPRESSIVE STRENGTH		
			Feet	Meters	Meters	Moisture Content (percent)	Dry Density (pcf)	Dry Deusity (kg/m3)	qu (psf)	qu (kPa)	Strain (percent)
B-1	Tmss	264.0	5.5	1.7	262.3	17.8	103.5	1658	1572	75.3	1.6
			13.5	4.1	259.9	21.5	104.1	1668	1668	79.9	1.2
			29.5	9.0	255.0	19.6	111.3	1783	1783	85.4	1.5
B-2	Kps	303.5	17.5	5.3	298.2	23.3	104.6	1676	1675	80.2	1.7
			19.0	5.8	297.7	17.8	111.3	1783	1783	85.4	1.3
			26.5	8.1	295.4	17.5	112.7	1805	1805	86.4	2.2
			35.0	10.7	292.8	20.4	107.1	1716	1715	82.1	1.8
			39.5	12.0	291.5	18.6	113.9	1825	1825	87.4	1.6
			48.5	14.8	288.7	11.3	128.8	2063	2063	98.8	4.1
			55.0	16.8	286.7	17.2	116.4	1865	1865	89.3	3.9
			69.0	21.0	282.5	13.3	114.9	1841	1840	88.1	2.1
B-3	Kps	300.5	8.5	2.6	297.9	14.6	116.6	1868	10402	498.1	1.8
			14.0	4.3	296.2	18.9	104.1	1668	5290	253.3	1.8
			21.5	6.6	293.9	15.9	115.2	1845	5290	253.3	2
			35.0	10.7	289.8	18.8	113.4	1816	1284	61.5	1.7
			46.5	14.2	286.3	33.2	90	1442	1317	63.1	2.1
			58.0	17.7	282.8	25.3	99.6	1595	5469	261.9	1.8
			62.0	18.9	281.6	30.2	94.5	1514	3080	147.5	2.2
			71.5	21.8	278.7	17.4	114	1826	5512	263.9	1.8
			82.0	25.0	275.5	17.3	114.4	1833	3387	162.2	1
B-4	Kps	317.5	3.0	0.9	316.6	10.8	115.4	1849	3556	170.3	2.3
			12.0	3.7	313.8	25.0	100.1	1603	2324	111.3	1.3
			14.0	4.3	313.2	12.7	120.8	1935	4958	237.4	2
			17.5	5.3	312.2	27.9	94.9	1520	1226	58.7	3.3
			27.0	8.2	309.3	24.6	100.8	1615	2371	113.5	3.5
			30.0	9.1	308.4	21.3	107.3	1719	1240	59.4	1.7
			39.0	11.9	305.6	18.6	112.2	1797	5042	241.4	1.7
			44.0	13.4	304.1	17.3	115.7	1853	2254	107.9	0.8
			49.0	14.9	302.6	18.3	112.5	1802	6234	298.5	6
			56.0	17.1	300.4	17.2	114.9	1841	3227	154.5	4
			64.5	19.7	297.8	13.8	120.7	1933	13236	633.7	1.9
			66.5	20.3	297.2	19.4	111.7	1789	11400	545.8	5.2
			70.5	21.5	296.0	17.3	115.4	1849	13326	638.1	3.7
			75.5	23.0	294.5	17.5	115.1	1844	17206	823.8	5.7
			79.5	24.2	293.3	15.5	117.9	1889	11804	565.2	5.4
			83.4	25.4	292.1	16.6	114.6	1836	17723	848.6	2.3
B-5	Kps	311.5	8.0	2.4	309.1	25.5	97.9	1568	3309	158.4	2.3
			27.0	8.2	303.3	18.7	113.3	1815	4062	194.5	4.2
			36.5	11.1	300.4	11.0	128.2	2054	6583	315.2	1.3
			41.0	12.5	299.0	19.9	110.6	1772	11541	552.6	2.5
			47.5	14.5	297.0	17.9	114.2	1829	8370	400.8	2.3
			55.0	16.8	294.7	19.0	112.3	1799	10645	509.7	4.9
			62.5	19.1	292.5	16.9	115.7	1853	10714	513.0	1.7
			66.5	20.3	291.2	17.1	115.9	1857	14620	700.0	2.8
			75.0	22.9	288.6	15.2	117.5	1882	12042	576.6	1.9
			80.5	24.5	287.0	14.6	115.7	1853	10213	489.0	1.9
B-6	Tmss	272.5	28.5	8.7	263.8	18.5	105.4	1688	2479	118.7	2.2
B-7	Kps	293.0	13.0	4.0	289.0	5.8	134.1	2148	31512	1508.8	0.9
			18.0	5.5	287.5	8.6	131.8	2111	22284	1067.0	1.3
B-8	Tmss	266.3	15.3	4.6	261.7	15.9	114.2	1829	1763	84.4	1.9
			18.5	5.6	260.7	15.9	115.3	1847	1633	78.2	1.9
B-14	Kps	284.8	9.0	2.7	282.1	18.6	110.7	1773	18364	879.3	4.9
			14.0	4.3	280.5	21.2	105.2	1685	6415	307.2	6.1

Table 6-6
SUMMARY OF COMPACTION AND CONSOLIDATION TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	SAMPLE DEPTH		COMPACTION PER ASTM D1557			CONSOLIDATION			
	Feet	Meters	Maximum Dry Density (pfc)	Maximum Dry Density (kg/m3)	Optimum Water Content (percent)	Coefficient of Consolidation (in2/min)	Coefficient of Consolidation (cm2/min)	Compression Index (Cc)	Recompression Index (Cr)
B-4	35.5	10.8						0.060	0.018
B-5	30 to 66	9.1 to 20.1	118	1890	13				
B-8	8.5	2.6				0.308 (@6400psf)	1.99 (@306kPa)	0.082	0.014
TP-2			117	1874	12				
TP-4			110	1762	15				
TP-5			125	2002	9				
B-3 and B-4			118	1890	13				

Table 6-7
SUMMARY OF DURABILITY AND CORROSION TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

BORING	DEPTH		SLAKE TESTS		CORROSIVITY					R-VALUE
	Feet	Meters	Si	Ij	Soil pH (units)	Minimum Resistivity (ohm-cm)	Electric Conductivity (umhos/cm)	Sulfate SO4 (ppm)	Chloride (ppm)	
B-3	29.5	9.0	87.4	1						
	45.5	13.9	88.5	1						
B-4	17.0	5.2	85.1	1						
	27.0	8.2	78.4	1						
	44.5	13.6	80.3	1						
	64.5	19.7	85.4	1						
B-5	0.5	0.2			6.58	1140	[880]	54	5	
	25.0	7.6			6.50	1520	[660]	117	5	
	31.5	9.6			6.87	1280	[782]	312	8	
	44.0	13.4			6.67	1520	[658]	105	6	
	69.5	21.2			6.41	1020	[982]	840	6	
	79.0	24.1			5.71	909	[1100]	1800	9	
	81.5	24.8			5.96	943	[1060]	1860	7	
	84.5	25.8			5.69	2020	[494]	105	24	
B-6	6.5	2.0			7.05	1690	[591]	<1	<1	
	18.5	5.6			6.31	3250	[308]	24	5	
B-13	5.0	1.5			3.05	3310	[3022]	69	42	
TP-1					6.46	2410	[415]	45	8	
TP-2										25
TP-4										55
TP-5					3.8	4880	[205]	81	33	23

Table 7-1
THE ROCK MASS RATING SYSTEM (GEOMECHANICS CLASSIFICATION OF ROCK MASSES)
(After Bieniawski, 1989)
Vasco Road Safety Improvements
Alameda County, California

<table>
<tr><th colspan="10">CLASSIFICATION PARAMETERS AND THEIR RATINGS</th></tr>
<tr><th colspan="3">Parameter</th><th colspan="7">Range of Values</th></tr>
<tr><td rowspan="3">1</td><td rowspan="2">Strength of Intact Rock Material</td><td>Point-Load Strength Index (MPa)</td><td>>10</td><td>4 to 10</td><td>2 to 4</td><td>1 to 2</td><td colspan="3">For this low range, uniaxial compressive test is preferred</td></tr>
<tr><td>Uniaxial Compressive Strength (MPa)</td><td>>250</td><td>100 to 250</td><td>50 to 100</td><td>25 to 50</td><td>5 to 25</td><td>1 to 5</td><td><1</td></tr>
<tr><td colspan="2">Rating</td><td>15</td><td>12</td><td>7</td><td>4</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">2</td><td colspan="2">Drill Core Quality</td><td>90 to 100</td><td>75 to 90</td><td>50 to 75</td><td>25 to 50</td><td colspan="3"><25</td></tr>
<tr><td colspan="2">Rating</td><td>20</td><td>17</td><td>13</td><td>8</td><td colspan="3">3</td></tr>
<tr><td rowspan="2">3</td><td colspan="2">Spacing of Discontinuities</td><td>>2m</td><td>0.6 to 2m</td><td>200 to 600 mm</td><td>60 to 200 mm</td><td colspan="3"><60 mm</td></tr>
<tr><td colspan="2">Rating</td><td>20</td><td>15</td><td>10</td><td>8</td><td colspan="3">5</td></tr>
<tr><td rowspan="2">4</td><td colspan="2">Condition of Discontinuities</td><td>Very rough surfaces
Not continuous
No separation
Unweathered wall rock</td><td>Slightly rough surfaces
Separation <1mm
Slightly weathered walls</td><td>Slightly rough surfaces
Separation <1mm
Highly weathered wall</td><td>Slickensided surfaces
or
Gouge <5mm thick
or
Separation 1 to 5mm
Continuous</td><td colspan="3">Soft gouge > 5mm thick
or
Separation > 5mm
Continuous</td></tr>
<tr><td colspan="2">Rating</td><td>30</td><td>25</td><td>20</td><td>10</td><td colspan="3">0</td></tr>
<tr><td rowspan="4">5</td><td rowspan="3">Groundwater</td><td>Inflow per 10m Tunnel Length (L/min)</td><td>None
or</td><td><10
or</td><td>10 to 25
or</td><td>25 to 125
or</td><td colspan="3">>125
or</td></tr>
<tr><td>Joint Water Pressure
Ratio-----------------------
Major Principal Stress</td><td>0
or</td><td><0.1
or</td><td>0.1 to 0.2
or</td><td>0.2 to 0.5
or</td><td colspan="3">>0.5
or</td></tr>
<tr><td>General Conditions</td><td>Completely Dry</td><td>Damp</td><td>Wet</td><td>Dripping</td><td colspan="3">Flowing</td></tr>
<tr><td colspan="2">Rating</td><td>15</td><td>10</td><td>7</td><td>4</td><td colspan="3">0</td></tr>
</table>

Table 7-2
SUMMARY OF ROCK MASS STRENGTH INFORMATION
Vasco Road Safety Improvements
Alameda County, California

VALUE	B-2		B-3		B-4		B-5	
	RQD	UNCONFINED COMPRESSIVE STRENGTH (kPa)	RQD	UNCONFINED COMPRESSIVE STRENGTH (kPa)	RQD	UNCONFINED COMPRESSIVE STRENGTH (kPa)	RQD	UNCONFINED COMPRESSIVE STRENGTH (kPa)
Maximum	98	99	100	264	100	823	100	700
Minimum	1	80	16	62	20	59	70	158
Average	65	87	82	183	78	317	93	488
Median	80	87	93	162	85	237	96	512
Standard Deviation	30	6	28	87	24	253	9	158
Total Hoek & Bray Rating	21		29		32		40	
Hoek & Bray Classification	Very Poor to Poor Rock		Poor Rock		Poor Rock		Poor Rock	
Cohesion (kPa)	<100		100 to 200		100 to 200		100 to 200	
Friction Angle (degrees)	<15		15 to 25		15 to 25		15 to 25	

NOTES:

1. Rock mass rating system summarized in Table 7-1. Total rating value equal to unconfined compressive strength rating + RQD rating + discontinuity spacing rating + discontinuity rating + groundwater rating + discontinuity orientation rating.
2. Discontinuity spacing rating qualitatively evaluated based on boring logs and assumed to be 8 assumed for B-2, 12 for B-3, and 15 for B-4 and B-5.
3. Discontinuity condition rating qualitatively evaluated based on boring logs and assumed to be 15 for B-2, B-3, and B-4 and 20 for B-5.
4. Groundwater rating value of 10 assumed for all borings.
5. Discontinuity orientation rating assumed to be fair (-25) for all borings.

Table 8-1
SUMMARY OF CUT SLOPE STABILITY ANALYSIS RESULTS
Vasco Road Safety Improvements
Alameda County, California

SLOPE	STATIC SAFETY FACTOR		SEISMIC STABILITY		
	Deep Surface	**Shallow Surface**	**Pseudostatic Safety Factor Deep Surface (Far/Intermediate/Near Field)**	**Pseudostatic Yield Coefficient, k_y**	**Max Displacement (cm) (Far/Intermediate/Near Field)**
Composite Buttressed 2.5:1 Lower Slope and Unbuttressed 3.5:1 Upper Slope	1.51	1.93	1.27 / 1.10 / 1.03	0.11	NA / 1 cm/ 1cm
3.5:1 Cut Slope With 50 m Hydraugers at Each Bench	1.44	1.69	1.22 / 1.06 / 1.00	0.10	NA / NA / 1 cm
3.5:1 Cut Slope With 70 m Hydraugers at Each Bench	1.55	1.69	1.32 / 1.15 / 1.07	0.123	Na / NA / 1cm

NOTES:

1. Safety factors calculated using the computer program GSLOPE. See Appendix 1 for discussion of input parameters for pseudostatic analyses.
2. Potential seismic displacement calculated based on procedure described in Makdisi and Seed (1978).
3. Stability analyses performed for maximum east-facing cut slope that is shown as Section A-A' in Figures 4-3 and 4-4.

Table 8-2
SUMMARY OF EMBANKMENT STABILITY ANALYSIS RESULTS
Vasco Road Safety Improvements
Alameda County, California

SECTION LOCATION	STATIC SAFETY FACTOR	SEISMIC STABILITY (Far/Intermediate/Near Field)
Sta 0+800	1.57	1.41 / 1.28 / 1.22
Sta 1+080	1.53	1.38 / 1.23 / 1.16
Sta 1+160	1.54	140 / 1.27 / 1.21

NOTES:

1. Safety factors calculated using the computer program GSLOPE.
2. Displacement analysis not required because seismic global stability analyses indicate safety factors greater than 1.15.

Table 8-3
PRELIMINARY EARTH RETAINING STRUCTURE DESIGN PARAMETERS
Vasco Road Safety Improvements
Alameda County, California

EARTH RETAINING STRUCTURE TYPE	COMMENTS	PARAMETERS FOR PRELIMINARY DESIGN					
		Allowable Bearing	**Base Friction**	**Active Equivalent Fluid Pressure**	**Passive Equivalent Fluid Pressure**	**Soil Strength**	**Unit Densities**
Reinforced concrete cantilever wall	Use Caltrans Standard Plans, sulphate resistant concrete req'd.	120 kPa	0.35	8 kN/m^3/m for flat 12 kN/m^3/m for 1V:2H	48 kN/m^3/m	not req'd	not req'd
Gravity wall / Cribwall	Use Caltrans Standard Plans, sulphate resistant concrete req'd.	120 kPa	0.35	8 kN/m^3/m for flat 12 kN/m^3/m for 1V:2H	48 kN/m^3/m	not req'd	not req'd
MSE-type wall Panel face or SRW	Select backfill req'd, corrosivity of on-site soil problematic for steel reinforcement. Design using FHWA Demo 82 Guidelines.	Determine based on soil strengths, see FHWA Demo 82	not req'd	not req'd	not req'd	Embankment: ϕ=26° , c=2.5 kPa Reinforced Zone: ϕ=30° , c=0 Foundation: ϕ=30° , c=2.5 kPa	20 kN/m^3
RSS	Use on site soils with geosynthetic reinforcement. Design using FHWA Demo 82 Guidelines.	Determine based on soil strengths, see FHWA Demo 82	not req'd	not req'd	not req'd	Embankment: ϕ=26° , c=2.5 kPa Reinforced Zone: ϕ=26° , c=2.5 kPa Foundation: ϕ=30° , c=2.5 kPa	20 kN/m^3

Table 8-4
SUMMARY OF CORROSION TEST RESULTS
Vasco Road Safety Improvements
Alameda County, California

SAMPLE ID	SAMPLE LOCATION	SAMPLE DESCRIPTION	SOIL pH -log[H+]	MINIMUM RESISTIVITY (ohm-cm)	SULFATE SO_4 (ppm)	CHLORIDE Cl (ppm)
VR1	B-5 0.2 m	Dk. brown sandy clay	6.58	1140	54	5
VR2	B-5 7.6 m	Dk. yellow-brown sandy clay with weathered yellow-brown claystone	6.50	1520	117	5
VR3	B-5 9.6 m	Gray-brown weathered claystone	6.87	1280	312	8
VR4	B-5 13.4 m	Mottled gray-brown, dk. yellow-brown, and lt. gray clayey sandstone/sandy claystone	6.67	1520	105	6
VR5	B-5 21.2 m	Mottled lt. gray-brown and yellow-brown clayey sandstone	6.41	1020	840	6
VR6	B-5 24.1 m	Gray clayey sandstone	5.71	909	1800	9
VR7	B-5 24.8 m	Gray claystone with white tuff	5.96	943	1860	7
VR8	B-5 25.8 m	Gray sandstone	5.69	2020	105	24
VR9	B-6 2.0 m	White, gray, and yellow-brown weathered sandstone	7.05	1690	< 1	< 1
VR10	B-6 5.6 m	White-gray and dk. yellow-brown weathered sandstone	6.31	3250	24	5
VR11	B-13 1.5 m	Pale brown/red-brown and yellow-brown weathered sandstone	3.05	3310	69	42
VR12	TP-1 0-1.8 m	Yellow-brown and white weathered friable sandstone (trench spoil)	6.46	2410	45	8
VR13	TP-5 0-1.2 m	Brown residual silty sand with yellow-brown and white weathered friable sandstone (trench spoil)	3.80	4880	81	33

Table 8-5
SUMMARY OF ESTIMATED SERVICE LIFE OF CSP AND ALTERNATIVE CULVERT MATERIALS WITH A 50 YEAR SERVICE LIFE
Vasco Road Safety Improvements
Alameda County, California

SAMPLE ID	CORRUGATED STEEL PIPE (CSP) EST. SERVICE LIFE (yrs)												ALTERNATIVE MATERIALS			
	Galvanized CSP, 57 g						Exterior Bitumen Coated Galvanized CSP, 57 g									
	18 Gage 1.3 mm	16 Gage 1.6 mm	14 Gage 2.0 mm	12 Gage 2.8 mm	10 Gage 3.5 mm	8 Gage 1.3 mm	18 Gage 1.3 mm	16 Gage 1.6 mm	14 Gage 2.0 mm	12 Gage 2.8 mm	10 Gage 3.5 mm	8 Gage 1.3 mm	RCP	CAP	CASP	PLASTIC
VR1	13	17	21	29	37	45	38	42	46	54	62	70	Y(2)	NR	NR	Y
VR2	14	18	23	31	40	49	39	43	48	56	65	74	Y(2)	Y	Y	Y
VR3	15	20	25	34	44	54	40	45	50	59	69	79	Y(2)	NR	NR	Y
VR4	15	20	25	34	44	53	40	45	50	59	69	78	Y(2)	Y	Y	Y
VR5	11	14	18	25	32	38	36	39	43	50	57	63	Y(2)	NR	NR	Y
VR6	7	9	11	15	19	24	32	34	36	40	44	49	Y(2)	NR	NR	Y
VR7	8	10	13	18	23	28	33	35	38	43	48	53	Y(2)	NR	NR	Y
VR8	11	15	18	26	33	40	36	40	43	51	58	65	Y(2)	Y	Y	Y
VR9	21	27	34	46	59	72	46	52	59	71	84	97	Y(1)	Y	Y	Y
VR10	17	23	28	39	49	60	42	48	53	64	74	85	Y(2)	Y	Y	Y
VR11	7	9	11	16	20	25	32	34	36	41	45	50	Y(3)	NR	NR	Y
VR12	16	22	27	37	47	57	41	47	52	62	72	82	Y(2)	NR	NR	Y
VR13	11	14	18	25	32	39	36	39	43	50	57	64	Y(3)	NR	NR	Y

NOTES:

Pipe thicknesses listed above are for corrosive breakthrough only and do not take into account the structural strength which may be needed for overburden or loading conditions;

NR Not recommended for use due to corrosive conditions;

Y Yes, use of the indicated material is generally acceptable given the corrosive conditions;

(1) pH mitigation measures required for concrete and RCP: Use Type IP (MS) Modified Cement or Type II Modified Cement, cement content as required by Caltrans Std. Spec. 90-1.01;

(2) pH mitigation measures required for concrete and RCP: Use Type IP (MS) Modified Cement or Type II Modified Cement, minimum cement content as required by Caltrans Std. Spec. 90-1.01, maximum water/cement ratio of 0.45;

(3) pH mitigation measures required for concrete and RCP: Use Type II Modified Cement or Type V Cement, minimum cement content 400 kg/m^3 with 25% mineral admixture replacement (by weight), maximum water/cement ratio of 0.40

Table 9-1
COMMERCIAL MATERIAL SOURCES WITHIN 50 KM OF THE PROJECT
Vasco Road Safety Improvements
Alameda County, California

SOURCE	LOCATION	APPROXIMATE ONE-WAY HAUL DISTANCE (km)	PRODUCTS
RC Readymix Livermore Plant	1227 Greenville Rd., Livermore	7.9	Aggregates and Concrete
Vulcan Materials Pleasanton Plant	501 El Charro Rd., Pleasanton	16.3	Aggregates, Asphalt-Concrete, and Recycled Concrete
RMC Lonestar Eliot Plant	1544 Stanley Blvd., Pleasanton	16.7	Aggregates and Ready-Mix Concrete
Hanson Aggregates Pleasanton Plant	3000 Busch Rd., Pleasanton	16.7	Aggregates and Ready-Mix Concrete
RMC Lonestar San Ramon Plant	4700 Norris Canyon Rd., San Ramon	32.5	Ready-Mix Concrete
RMC Lonestar Sunol Plant #120	6527 Calaveras Rd., Sunol	35.9	Aggregates
Mission Valley Rock & Asphalt	7999 Athenour Way,Sunol	37.7	Aggregates and Asphalt-Concrete
RMC Lonestar Kerlinger Aggregate and Hot Plant #562	30350 S. Tracy Blvd., Tracy	38.3	Aggregates and Asphalt-Concrete
Granite Construction Tracy Rock and Asphalt Plant	30909 S. Tracy Blvd.,Tracy	38.9	Aggregates and Asphalt-Concrete
Teichert Aggregates Tracy Plant	29099 S. MacArthur Dr., Tracy	41.4	Aggregates and Asphalt-Concrete
Teichert Aggregates Veralis Plant	36314 South Bird Rd.,Tracy	43.5	Aggregates and Asphalt-Concrete
Dutra Materials Hayward RecyclePlant	4001 West Winton Ave., Hayward	49.9	Recycled Aggregate Base and Drain Rock

Table 12-1
SUMMARY OF CUT AND FILL SLOPE RECOMMENDATIONS
Vasco Road Safety Improvements
Alameda County, California

STATION (approx)		GRADING GEOMETRY	MAX HT.	COMMENTS / RECOMMENDATIONS
From	To			
0+080	0+280	minor cut/fill grading	4m	over excavate 1 m where cut/fill transitions through road
0+280	0+370	side hill cut on two sides	12m	use 1V:2H cut with 5m benches at 8m vert spacing
0+370	0+480	side hill fill on two sides	6m	use 1V:2H fill, no benches needed
0+480	0+590	side hill cut on both sides	7m	use 1V:2H cut, no benches needed
0+590	1+050	side hill fill on both sides	22m	sta 0+620 to 0+660 over excavate colluvial soil, use 1V:2H fill w/ 4m benches at 8m vert spacing sta 0+700 to 0+750 over excavate colluvial soil, use 1V:2H fill w/ 4m benches at 8m vert spacing sta 0+780 to 0+880 deep colluvial soil w/ stock pond below, use retaining wall or steepened reinforced slope to avoid or over excavate colluvial soil and use 1V:2H fill w/ 4m benches at 8m vert spacing sta 0+880 to 1+050 use 1V:2H fill w/ 4m benches at 8m vert spacing
1+050	1+080	side hill cut	9m	use 1V:2H cut with 4m benches at 8m vert spacing
1+080	1+345	side hill fill on both sides	23m	sta 1+080 to 1+180 use1V: 2.5H fill over ravine/creek - possible wetland, alternatively use retaining wall or steepened reinforced slope to avoid use underdrain along length of fill to drain existing drainage which will be filled fill crosses main strand of Greenville fault
1+345	1+580	side hill cut	28m	large cut crosses fault shear zone - very poor rock use 1V:3.5H cut w/ 5m benches at 8m vert spacing install 70m long hydraugers at roadway and at benches as determined in field 5m wide stability fills may be needed in areas depending upon quality of material exposed in cut
1+580	1+690	side hill fill	13m	sta 1+590 to 1+680 over excavate existing fill and underlying colluvial soil use 1V:2H fill w/ 4m benches at 8m vert spacing
1+690	1+840	cut on both sides		sliver cut of existing cut slopes, use 1V:2H with 4m benches at 8m vert spacing

Table 12-2

RECOMMENDED ALTERNATIVES FOR CULVERT AND DRAIN MATERIALS

Vasco Road Safety Improvements
Alameda County, California

TYPE OF INSTALLATION	SERVICE LIFE (yrs)	RECOMMENDED ALTERNATIVES	JOINT TYPE		
			Standard	Positive	Downdrain
Culvert & Drainage Systems	50	CSP (1, 2) - 8 gage/1.3 mm, w/ exterior bitumen coating; NRCP (1, 3, 4); RCP (1, 4); RCB (1, 4); PPC (1)	X(5)	X(5)	--
Overside Drains	50	CSP (1, 2) - 8 gage/1.3 mm, w/ exterior bitumen coating	--	--	X(5)
Underdrains	50	PPET (1); PPVCP (1)	X(5)	--	--
Arches (Culverts & Drainage Systems	50	CSPA (1, 2); RCA (1, 4)	X(5)	X(5)	--

LEGEND

ASRP	- Aluminum Spiral Rib Pipe (NR)	PSP	- Perforated Steel Pipe (NR)
CAP	- Corrugated Aluminum Pipe (NR)	RCA	- Reinforced Concrete Arch (1, 4)
CAPA	- Corrugated Aluminum Pipe Arch (NR)	RCB	- Reinforced Concrete Box (1, 4)
CASP	- Corrugated Aluminized Steel Pipe, Type 2 (NR)	RCP	- Reinforced Concrete Pipe (1, 4)
CIPCP	- Cast-in-Place Concrete Pipe (NR)	SAPP	- Structural Aluminum Plate Pipe (NR)
CSP	- Corrugated Steel Pipe (1, 2)	SAPPA	- Structural Aluminum Plate Pipe Arch (NR)
CSPA	- Corrugated Steel Pipe Arch (1, 2)	SSPA	- Structural Steel Plate Arch (NR)
NRCP	- Non-Reinforced Concrete Pipe (1, 3, 4)	SSPP	- Structural Steel Plate Pipe (NR)
PAP	- Perforated Aluminum Pipe (NR)	SSPPA	- Structural Steel Plate Pipe Arch (NR)
PCC	- Plastic Pipe Culvert (1)	SSRP	- Steel Spiral Rib Pipe (NR)
PPET	- Perforated Polyethylene Tubing (1)	X	- Permissible Joint Type for the type of installation indicated (5)
PPVCP	- Perforated Polyvinyl Chloride Pipe (1)		

NOTES:

NR Not recommended for use due to corrosive conditions;

(1) Pipe thicknesses (if listed) are for corrosive breakthrough only. Designer should specify thickness that addresses both corrosive and overburden/loading conditions;

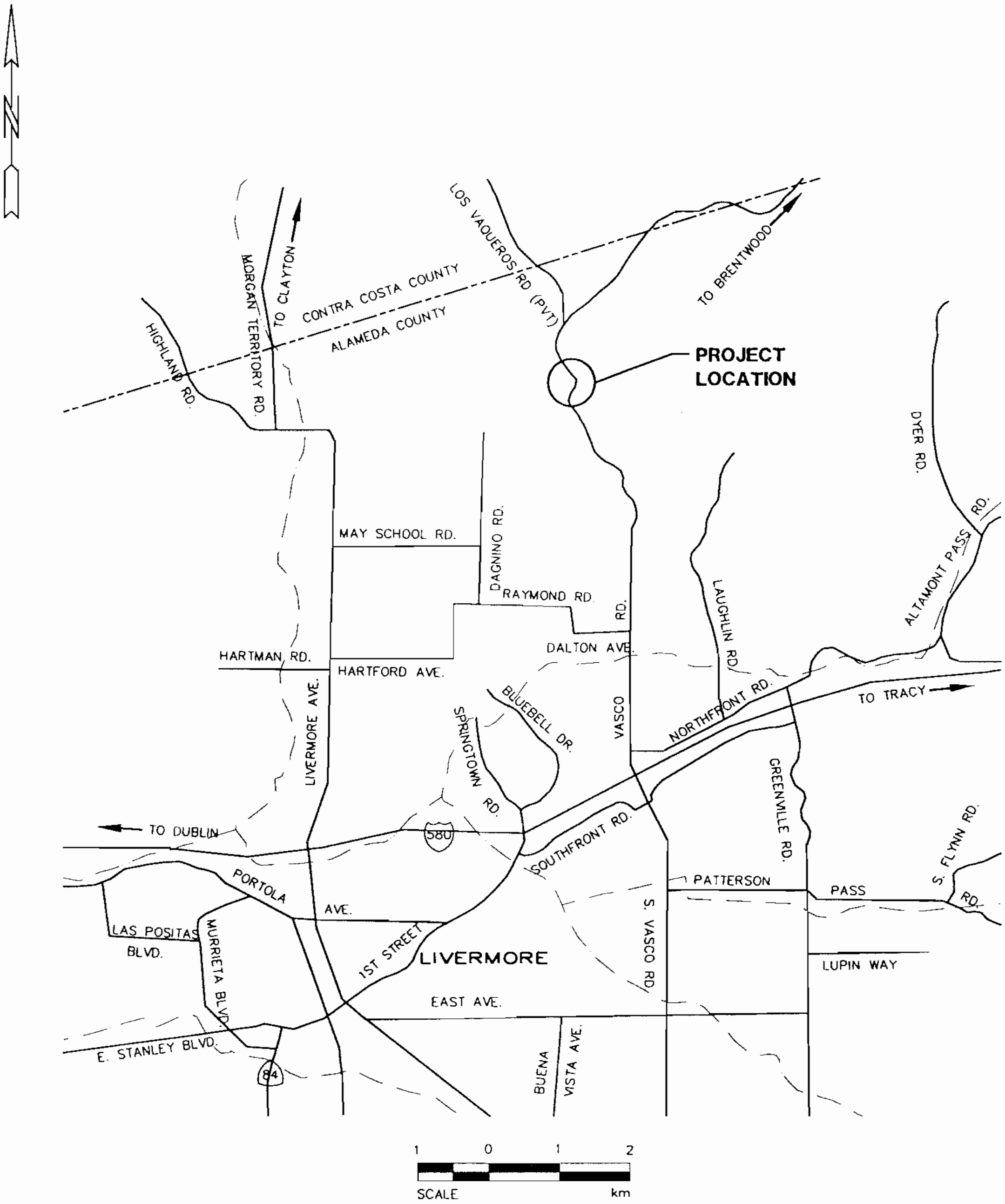
(2) Additional corrosion testing should be performed prior to the use of CSP;

(3) Use permitted under special conditions in accordance with HDM Section 854.1(5);

(4) Type II Modified Cement or Type V Cement, minimum cement content 400 kg/m³ with 25% mineral admixture replacement (by weight), maximum water/cement ratio of 0.40;

(5) Designer should specify the most cost-effective option. For "Normal" joints below grade, Designer should specify filter fabric wrap at joint per HDM Section 831.4.

Figures



UNITS ARE IN METERS
UNLESS OTHERWISE NOTED

...\CEG\0D1860\DRAFT\FIG1-1.dwg

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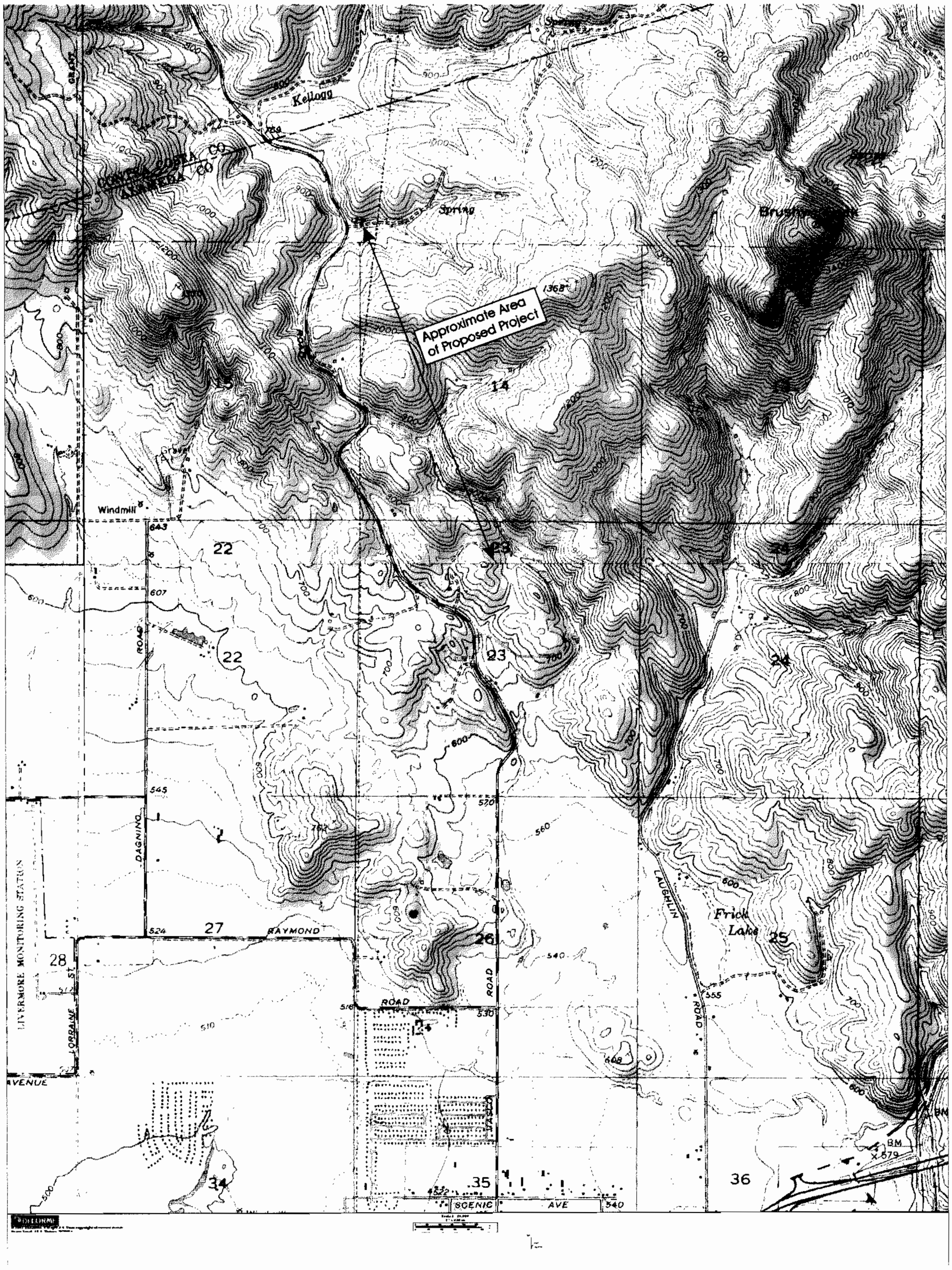
GEOTECHNICAL DESIGN REPORT
VASCO ROAD SAFETY IMPROVEMENTS PROJECT IN ALAMEDA COUNTY FROM MP 3.4 TO 4.3

PROJECT LOCATION MAP

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 1-1



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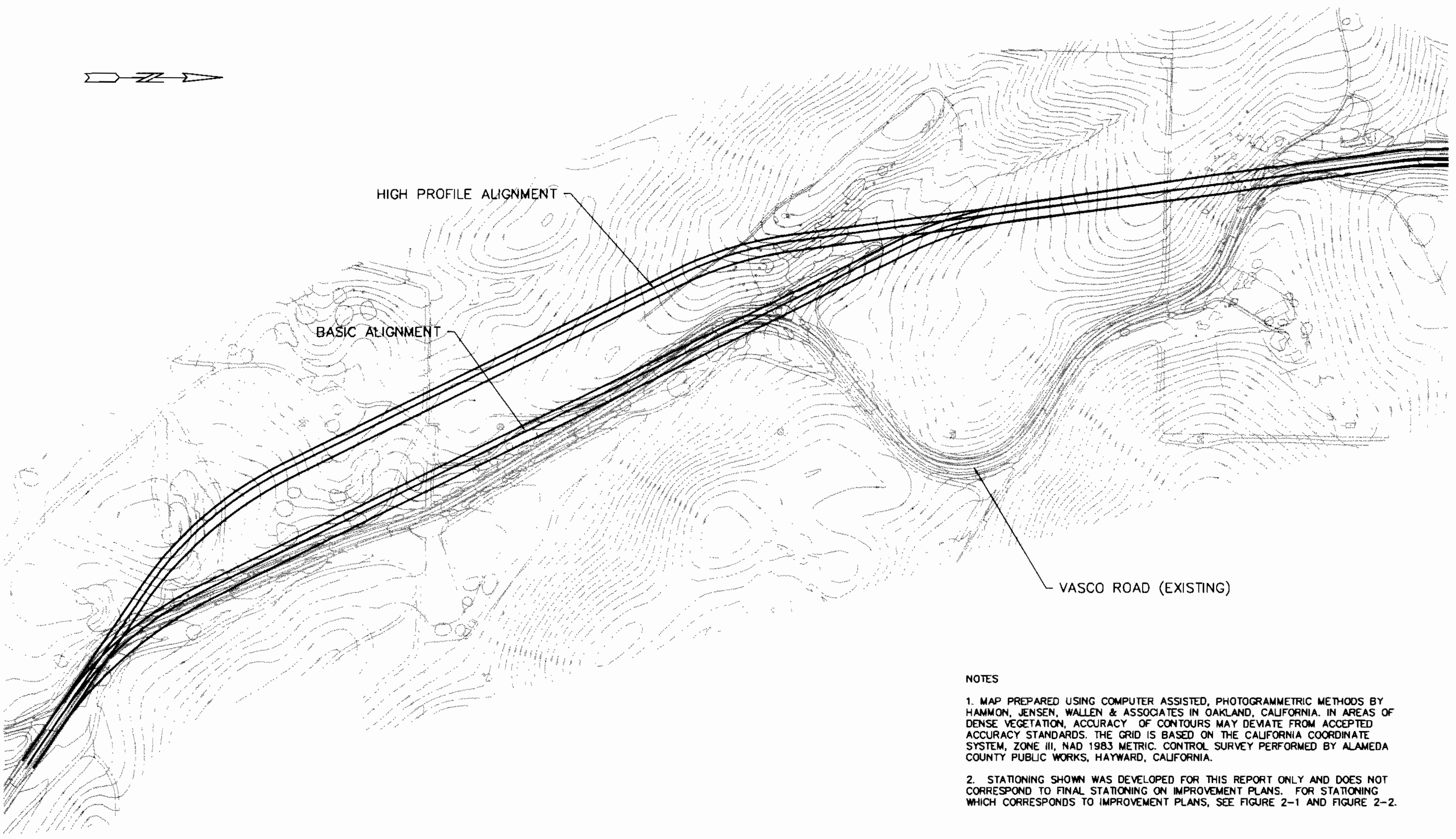
GEOTECHNICAL DESIGN REPORT
Vasco Road Safety Improvements in Alameda County From MP 3.4 to MP 4.3

PROJECT VICINITY MAP

JOB NUMBER R23265	SEPTEMBER 2002	FIGURE 1-2



NOTES

1. MAP PREPARED USING COMPUTER ASSISTED, PHOTOGRAMMETRIC METHODS BY HAMMON, JENSEN, WALLEN & ASSOCIATES IN OAKLAND, CALIFORNIA. IN AREAS OF DENSE VEGETATION, ACCURACY OF CONTOURS MAY DEVIATE FROM ACCEPTED ACCURACY STANDARDS. THE GRID IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 1983 METRIC. CONTROL SURVEY PERFORMED BY ALAMEDA COUNTY PUBLIC WORKS, HAYWARD, CALIFORNIA.

2. STATIONING SHOWN WAS DEVELOPED FOR THIS REPORT ONLY AND DOES NOT CORRESPOND TO FINAL STATIONING ON IMPROVEMENT PLANS. FOR STATIONING WHICH CORRESPONDS TO IMPROVEMENT PLANS, SEE FIGURE 2-1 AND FIGURE 2-2.

ALAMEDA COUNTY Metric
UNITS ARE IN METERS
UNLESS OTHERWISE NOTED

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GEOTECHNICAL DESIGN REPORT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

PRELIMINARY ALIGNMENTS

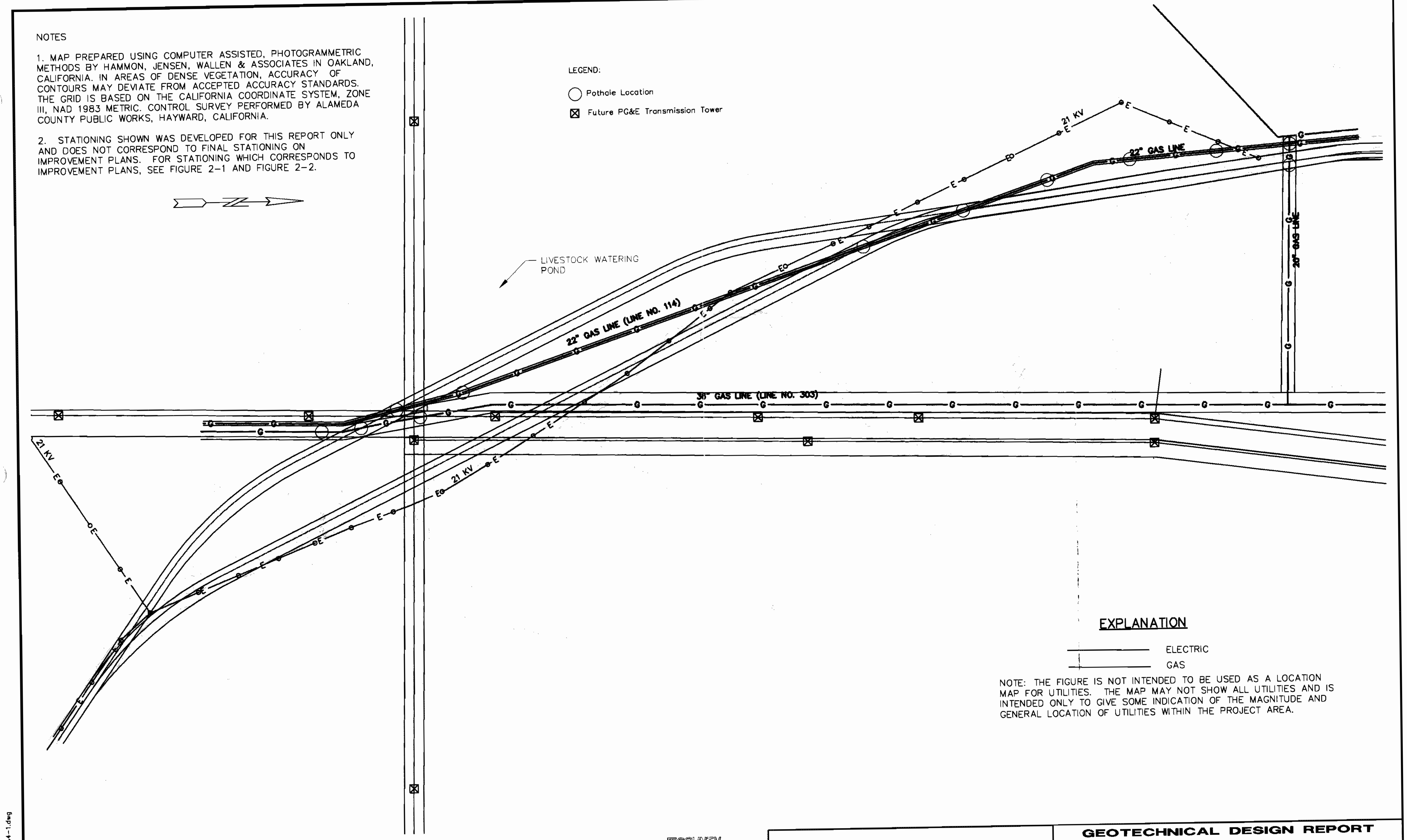
JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 2-1

...\CEG\001880\DRAFT\f102-1.dwg

NOTES

1. MAP PREPARED USING COMPUTER ASSISTED, PHOTOGRAMMETRIC METHODS BY HAMMON, JENSEN, WALLEN & ASSOCIATES IN OAKLAND, CALIFORNIA. IN AREAS OF DENSE VEGETATION, ACCURACY OF CONTOURS MAY DEVIATE FROM ACCEPTED ACCURACY STANDARDS. THE GRID IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 1983 METRIC. CONTROL SURVEY PERFORMED BY ALAMEDA COUNTY PUBLIC WORKS, HAYWARD, CALIFORNIA.

2. STATIONING SHOWN WAS DEVELOPED FOR THIS REPORT ONLY AND DOES NOT CORRESPOND TO FINAL STATIONING ON IMPROVEMENT PLANS. FOR STATIONING WHICH CORRESPONDS TO IMPROVEMENT PLANS, SEE FIGURE 2-1 AND FIGURE 2-2.



LEGEND:

○ Pothole Location

☒ Future PG&E Transmission Tower

EXPLANATION

——	ELECTRIC
—+—	GAS

NOTE: THE FIGURE IS NOT INTENDED TO BE USED AS A LOCATION MAP FOR UTILITIES. THE MAP MAY NOT SHOW ALL UTILITIES AND IS INTENDED ONLY TO GIVE SOME INDICATION OF THE MAGNITUDE AND GENERAL LOCATION OF UTILITIES WITHIN THE PROJECT AREA.

ALAMEDA COUNTY Metric

UNITS ARE IN METERS UNLESS OTHERWISE NOTED

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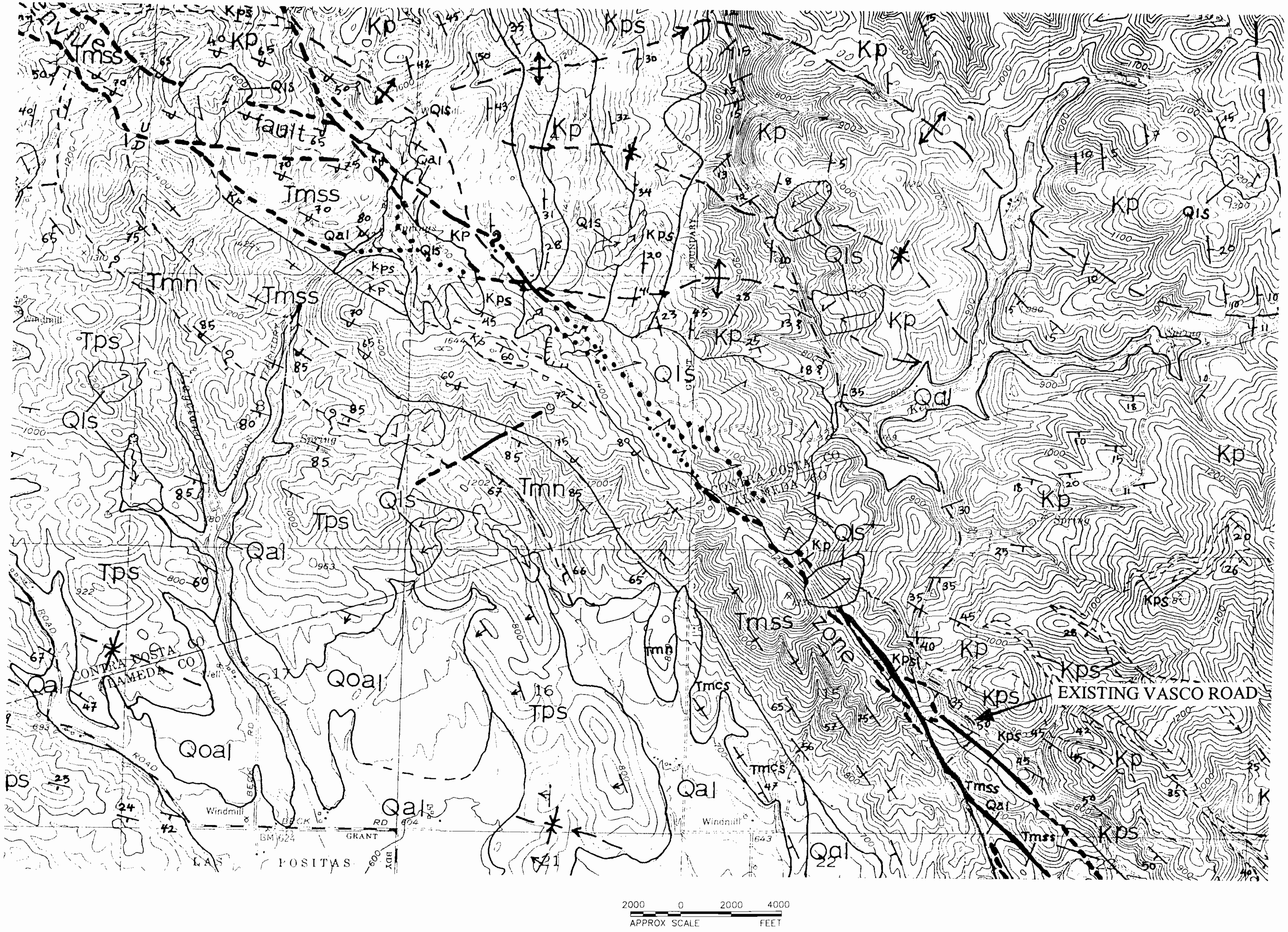
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

MAN-MADE FEATURES OF SIGNIFICANCE TO PROJECT

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 4-1

..\CEG\001860\DRAF[illegible]4-1.dwg



Qal	ALLUVIUM
Qls	LANDSLIDE DEPOSITS
Qoal	OLDER ALLUVIUM
Tps	NONMARINE SEDIMENTARY ROCKS
Tmn	NEROLY SANDSTONE
Tmcs	NONMARINE SEDIMENTARY ROCKS
Tmss	CIERBO FORMATION
Kp	MICACEOUS CLAY SHALE
Kps	SANDSTONE

Note: Complete discriptions can be found on source map.

N

SOURCE: MAJMUNDAR, HASMUKHRAI H. (1991) "LANDSLIDE HAZARDS IN THE TASSAJARA AND BYRON HOT SPRINGS 7.5' QUADRANGLES, ALAMENDA AND CONTRA COSTA COUNTIES, CALIFORNIA"; CALIFORNIA DIVISION OF MINES AND GEOLOGY OPEN FILE REPORT 92-05, 3 PLATES, SCALE 1:12,000.

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REGIONAL GEOLOGIC MAP

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 4–2

NOTES

1. MAP PREPARED USING COMPUTER ASSISTED, PHOTOGRAMMETRIC METHODS BY HAMMON, JENSEN, WALLEN & ASSOCIATES IN OAKLAND, CALIFORNIA. IN AREAS OF DENSE VEGETATION, ACCURACY OF CONTOURS MAY DEVIATE FROM ACCEPTED ACCURACY STANDARDS. THE GRID IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 1983 METRIC. CONTROL SURVEY PERFORMED BY ALAMEDA COUNTY PUBLIC WORKS, HAYWARD, CALIFORNIA.

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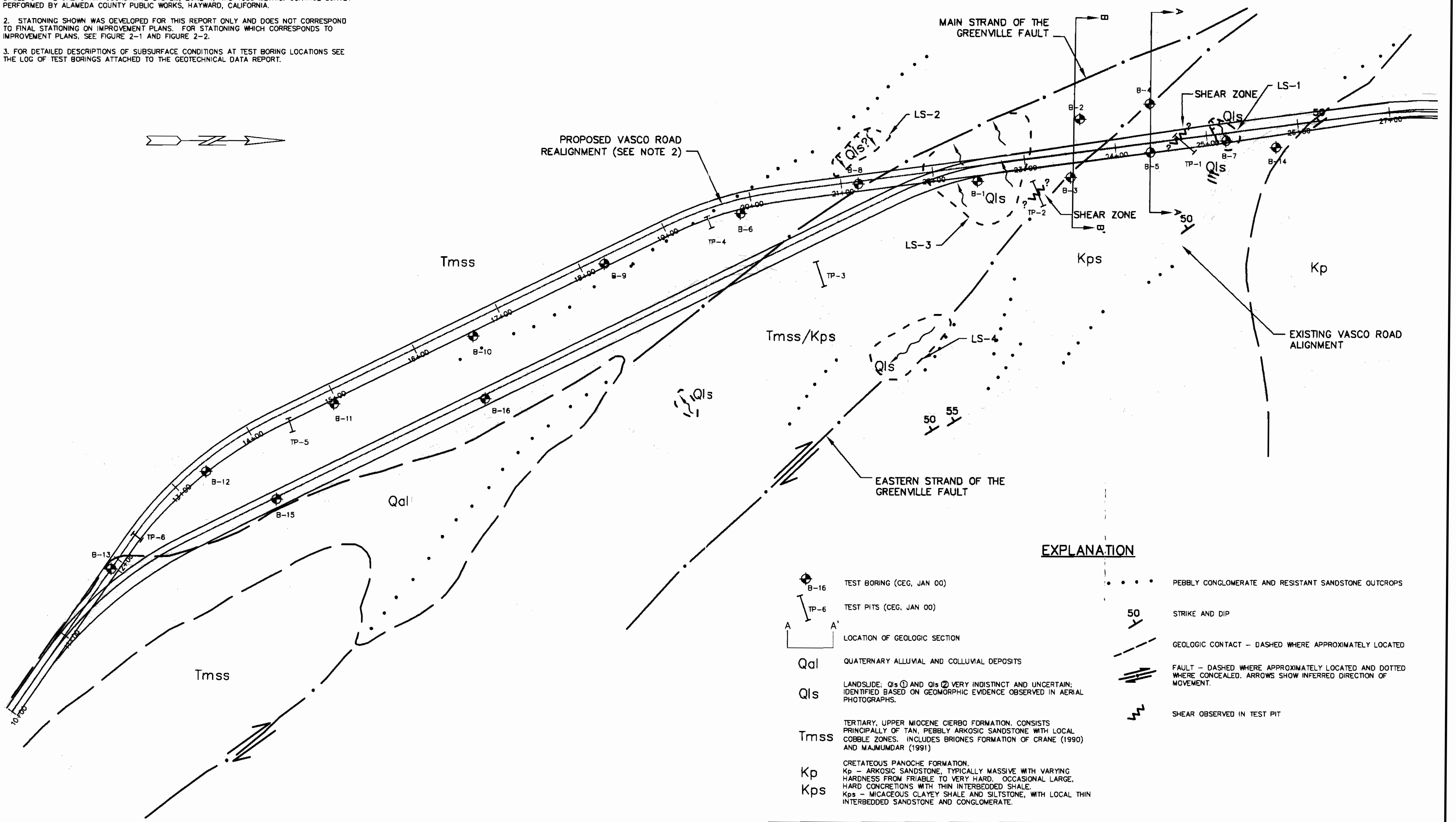
3. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS AT TEST BORING LOCATIONS SEE THE LOG OF TEST BORINGS ATTACHED TO THE GEOTECHNICAL DATA REPORT.



EXPLANATION

B-16	TEST BORING (CEG, JAN 00)
TP-6	TEST PITS (CEG, JAN 00)
A A'	LOCATION OF GEOLOGIC SECTION
Qal	QUATERNARY ALLUVIAL AND COLLUVIAL DEPOSITS
Qls	LANDSLIDE; Qls ① AND Qls ② VERY INDISTINCT AND UNCERTAIN; IDENTIFIED BASED ON GEOMORPHIC EVIDENCE OBSERVED IN AERIAL PHOTOGRAPHS.
Tmss	TERTIARY, UPPER MIOCENE CIERBO FORMATION. CONSISTS PRINCIPALLY OF TAN, PEBBLY ARKOSIC SANDSTONE WITH LOCAL COBBLE ZONES. INCLUDES BRIONES FORMATION OF CRANE (1990) AND MAJMUNDAR (1991)
Kp Kps	CRETATEOUS PANOCHE FORMATION. Kp – ARKOSIC SANDSTONE, TYPICALLY MASSIVE WITH VARYING HARDNESS FROM FRIABLE TO VERY HARD. OCCASIONAL LARGE, HARD CONCRETIONS WITH THIN INTERBEDDED SHALE. Kps – MICACEOUS CLAYEY SHALE AND SILTSTONE, WITH LOCAL THIN INTERBEDDED SANDSTONE AND CONGLOMERATE.
• • • •	PEBBLY CONGLOMERATE AND RESISTANT SANDSTONE OUTCROPS
50	STRIKE AND DIP
— —	GEOLOGIC CONTACT – DASHED WHERE APPROXIMATELY LOCATED
⇄	FAULT – DASHED WHERE APPROXIMATELY LOCATED AND DOTTED WHERE CONCEALED. ARROWS SHOW INFERRED DIRECTION OF MOVEMENT.
⌇	SHEAR OBSERVED IN TEST PIT

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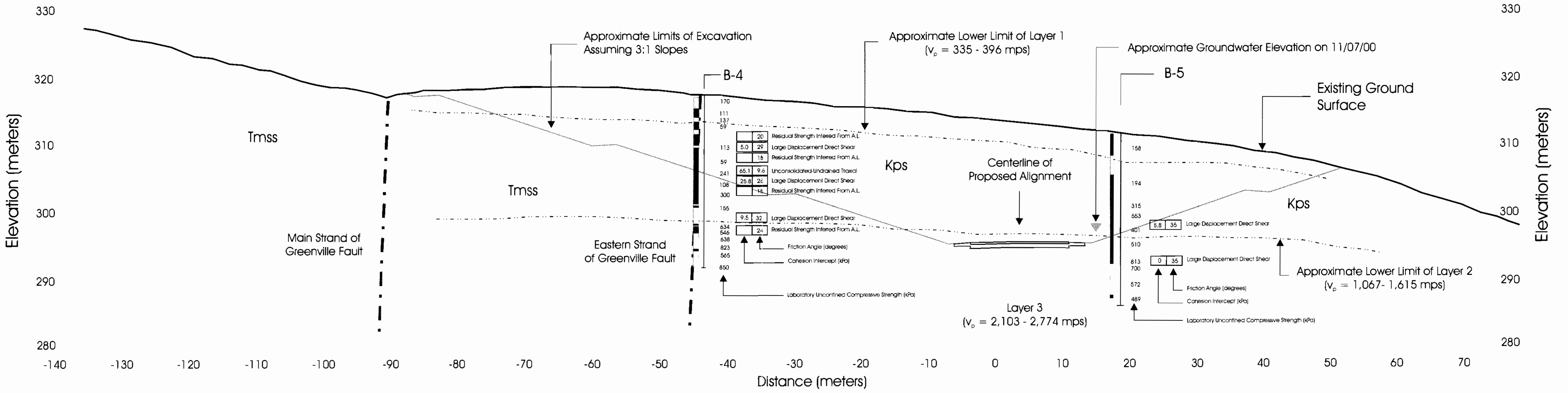
VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3
MAP OF GEOLOGIC FEATURES

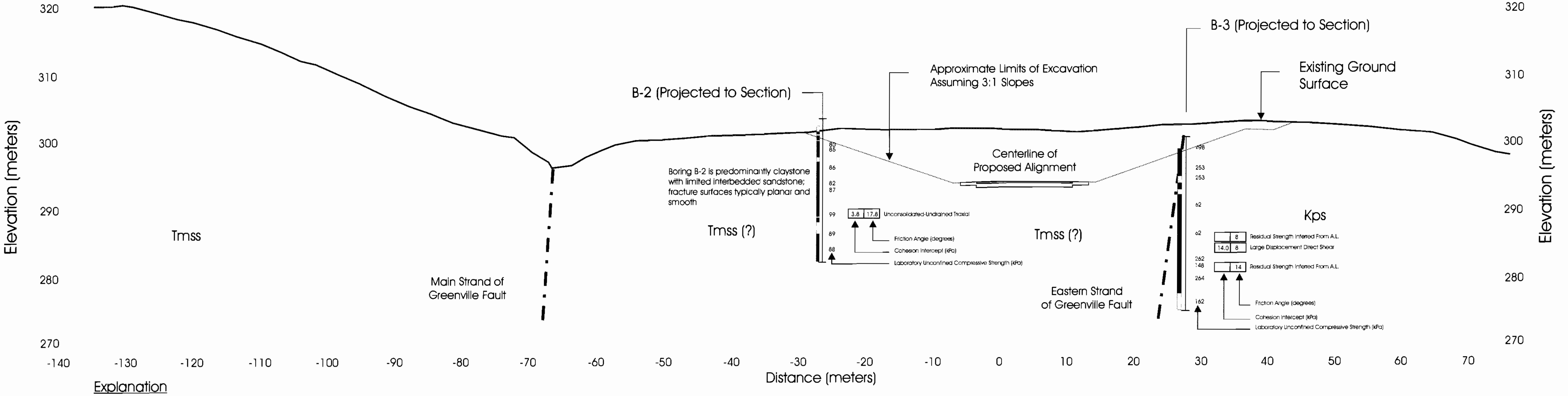
JOB NO. R23265	SPEC NO. 1903	JUNE 2001	FIGURE 4-3

...\CEG\990850\Conc...\ll2.dwg

CROSS SECTION A-A'



CROSS SECTION B-B'



Explanation

- ▯ Predominantly Sandstone
- ■ Predominantly Claystone
- ▌ Predominantly Interbedded Claystone and Sandstone

NOTES:
1. See Figure 4-3 for Locations of Sections
2. Greenville fault shown as "near-vertical" feature.
3. Orientation of fault in subsurface not known.

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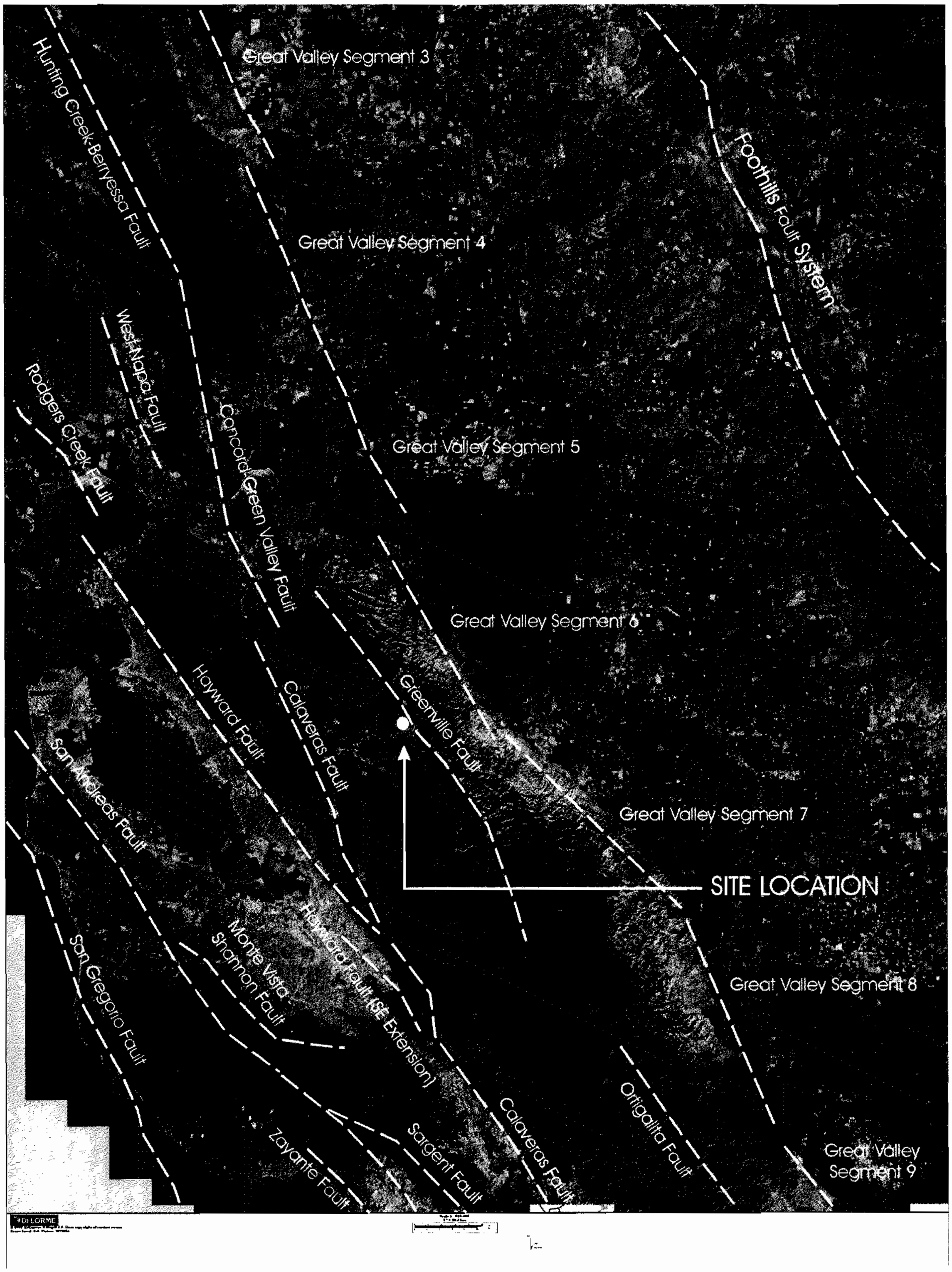
GEOLOGIC CROSS SECTIONS A-A' AND B-B'

JOB NO. R23265	SPEC NO. 1903	OCTOBER 2002	FIGURE 4-4



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Vasco Road Safety Improvements
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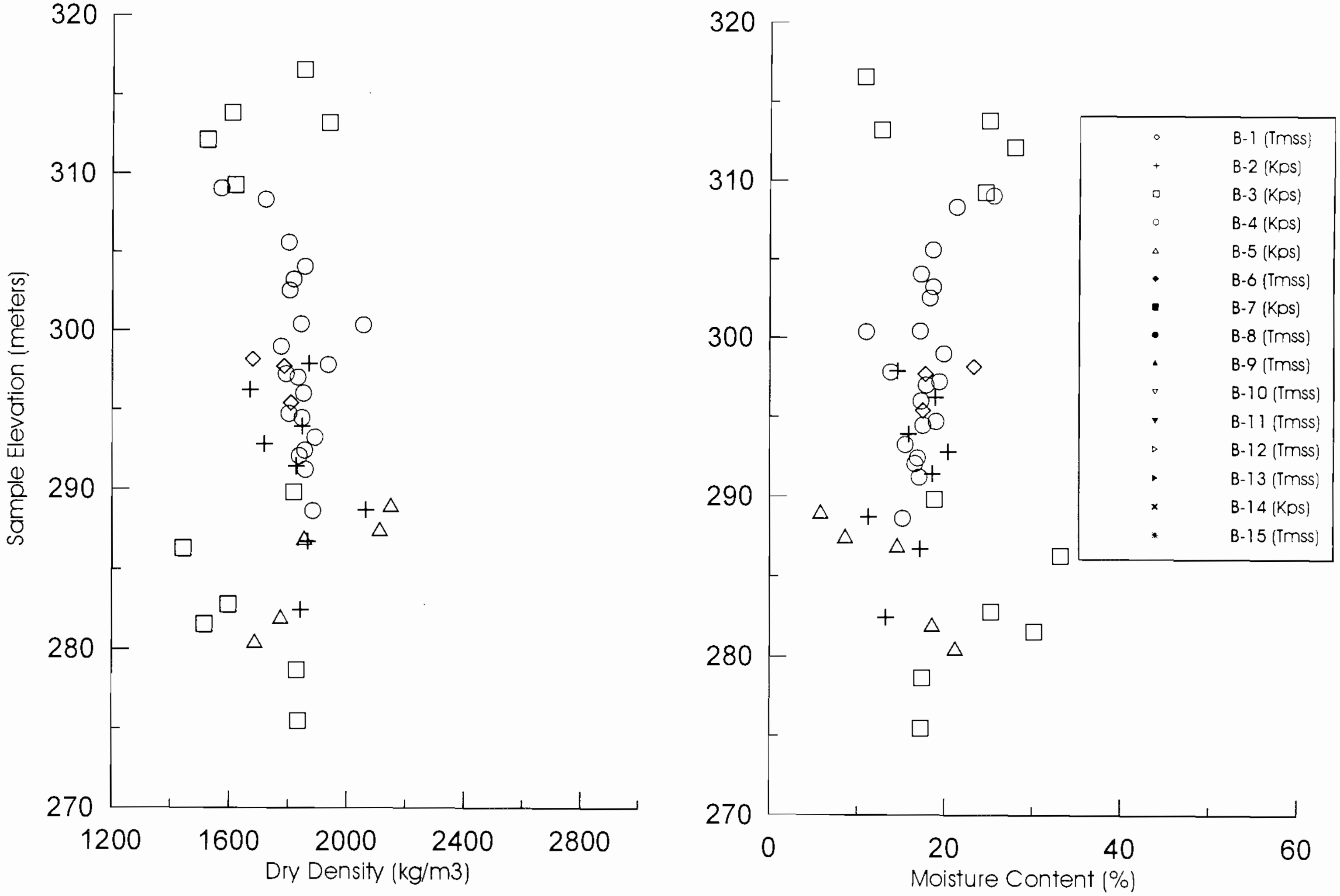
REGIONAL FAULTS

JOB NUMBER R23265	**SEPTEMBER 2002**	**FIGURE 4-5**



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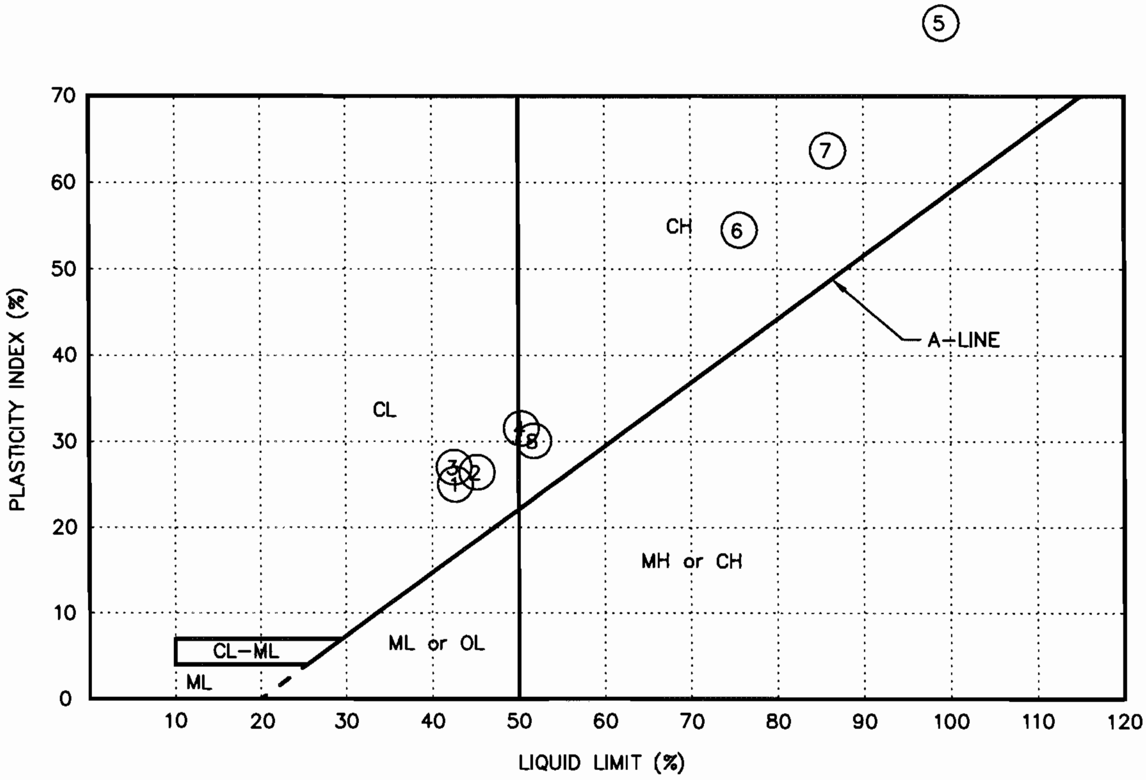
DRY DENSITY AND MOISTURE CONTENT VS. ELEVATION

CEG NO. 001860 | JUNE 2001 | FIGURE 6-1

...\CEG\001860\DRAFT\FIG6-1.dwg



NUMBER	BORING	DEPTH (m)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
①	B-2	5.3	42	18	24
②	B-3	4.2	45	19	26
③	B-3	6.6	42	16	26
④	B-3	10.7	50	19	31
⑤	B-3	14.2	99	20	79
⑥	B-3	17.7	75	21	54
⑦	B-3	18.9	86	23	63
⑧	B-3	21.8	51	21	30
⑨	B-3	25.0	56	18	38

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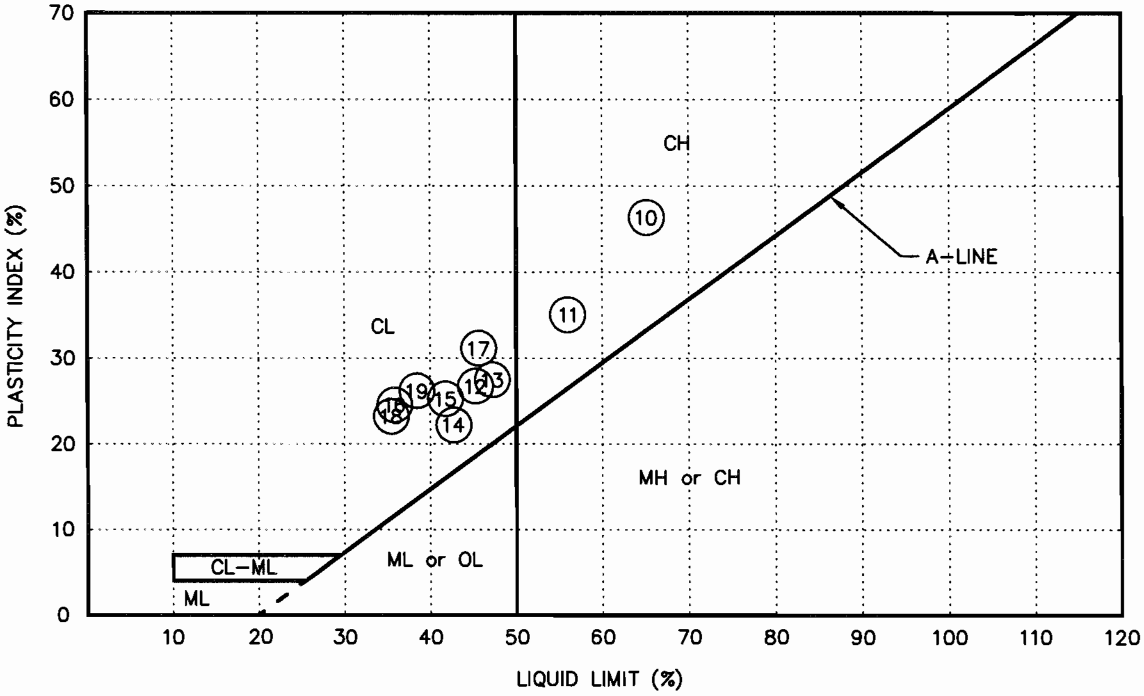
ATTERBERG LIMITS TEST RESULTS

JOB NO.: 001860 | DATE: JUNE 2001 | FIGURE 6-2 (1 OF 2)



NUMBER	BORING	DEPTH (m)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
⑩	B-4	3.7	65	18	47
⑪	B-4	5.3	56	21	35
⑫	B-4	9.1	45	18	27
⑬	B-4	11.9	47	20	27
⑭	B-4	13.4	42	20	22
⑮	B-4	17.1	41	16	25
⑯	B-4	19.7	36	12	24
⑰	B-4	20.3	46	15	31
⑱	B-4	21.5	35	12	23
⑲	B-4	24.2	39	13	26

...\CEG\001860\DRAFT\FIG6-2.dwg

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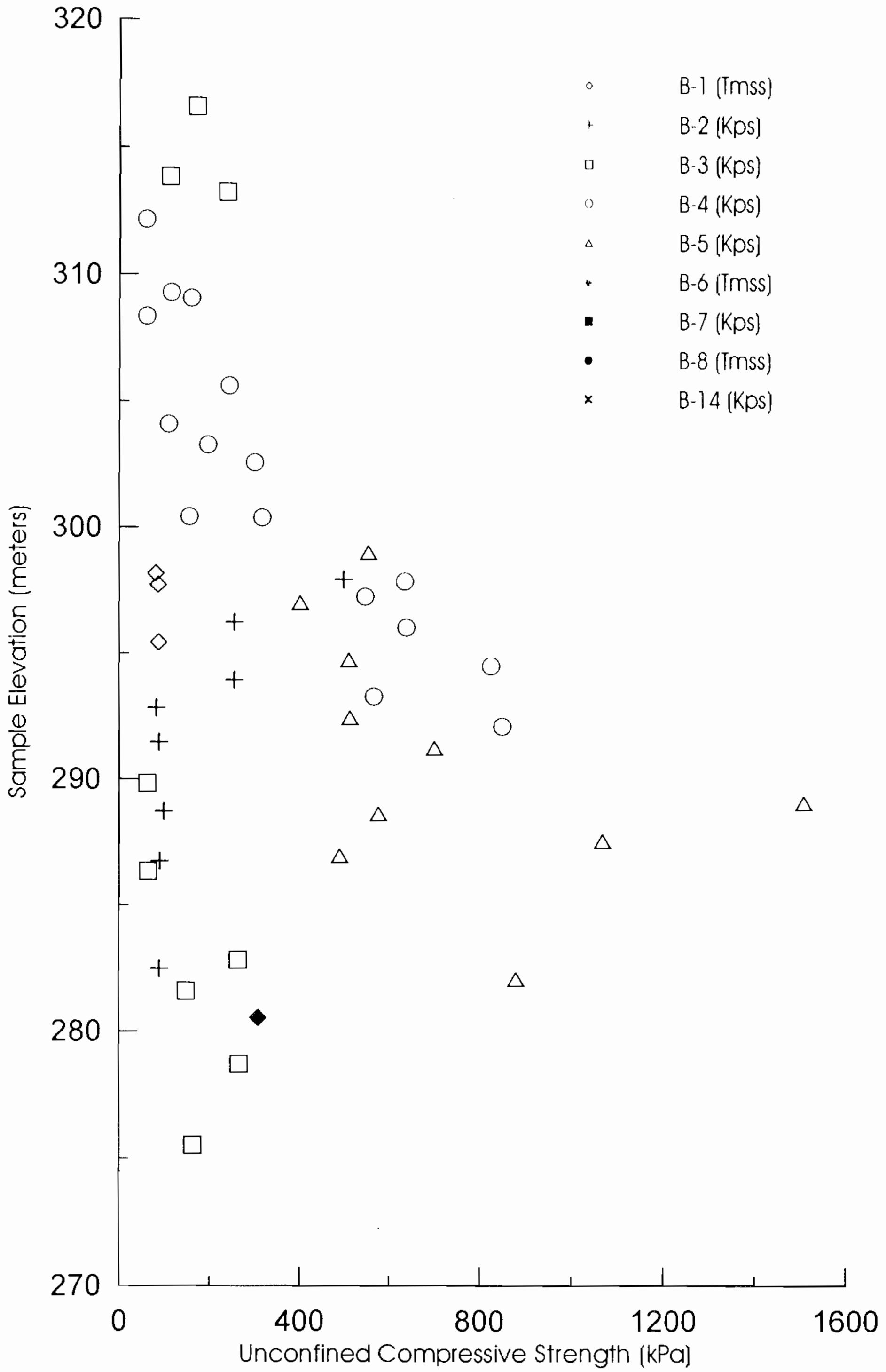
GEOTECHNICAL DESIGN REPORT
VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

ATTERBERG LIMITS TEST RESULTS

JOB NO.: 001860 | DATE: JUNE 2001 | FIGURE 6-2 (2 OF 2)



...\CEG\001860\DRAFT\FIG6-3.dwg

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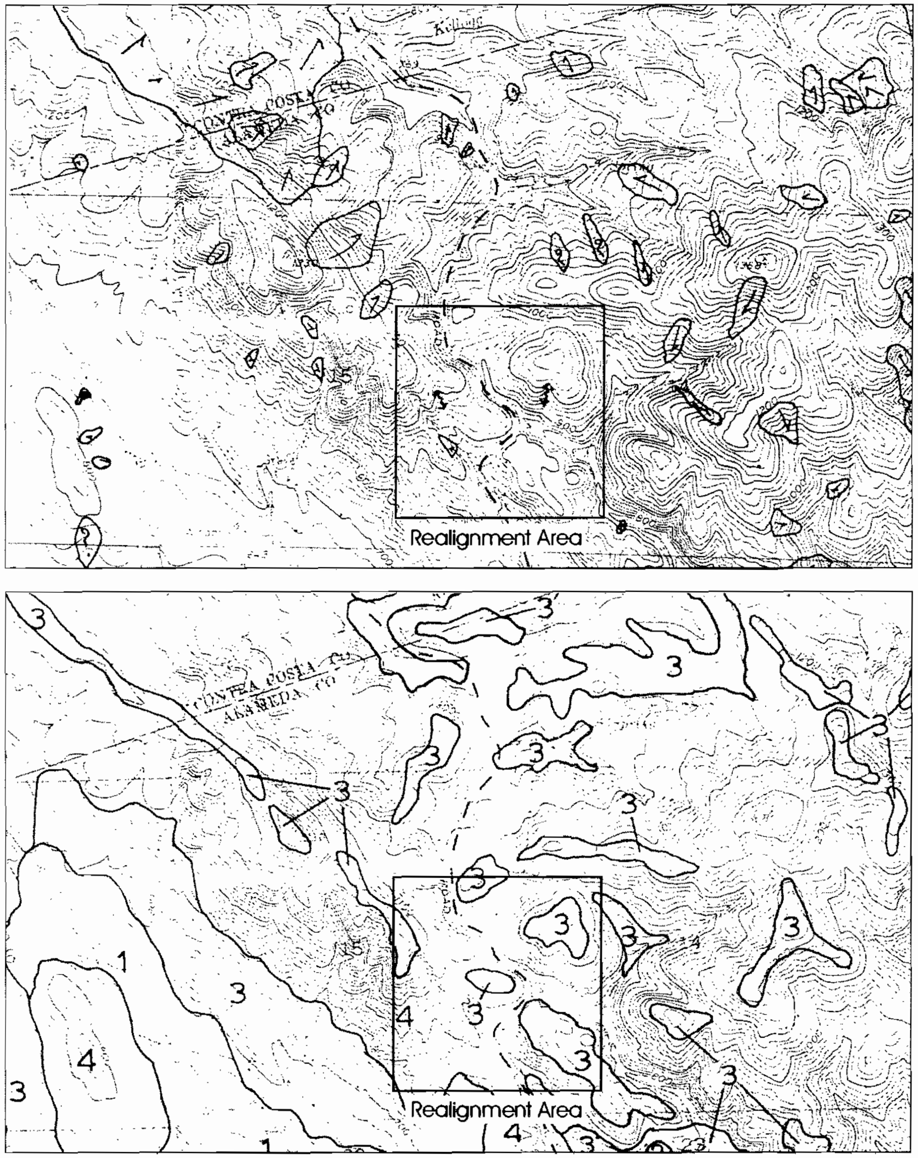
UNCONFINED COMPRESSIVE STRENGTH VS. ELEVATION

CEG NO. 001860	JUNE 2001	FIGURE 6-3



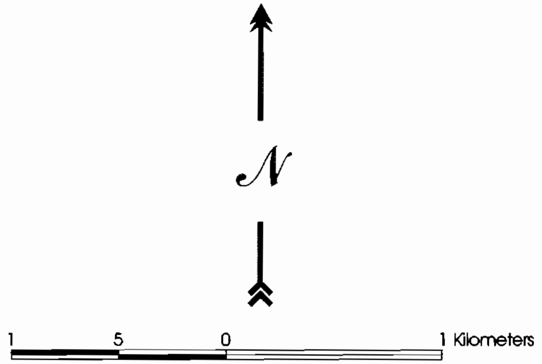
EXPLANATION

Landslides from California Department of Mines and Geology Open-File Report 92-05; Landslide Hazard Identification Map No. 27, Landslides and Related Features Map Plate 27 B.

Relative Slope Stability from California Department of Mines and Geology Open-File Report 92-05; Landslide Hazard Identification Map No. 27, Relative Landslide Susceptibility Map, Plate 27A

Area 3 - Generally susceptible to landslides. Slopes within this area are at or near their stability limits due to a combination of weaker materials and steeper slopes. Although most slopes within area 3 do not currently contain landslide deposits, the materials that underlie them can be expected fail, locally, when modified because they are close to their stability limits

Area 4 - Most susceptible area. This area is characterized by steep slopes and includes most landslides in upslope areas, whether apparently active at present or not, and slopes upon which there is substantial evidence of downslope creep of surface materials. Slopes within area 4 should be considered unstable and subject to failure even in the absence of the activities of man.



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Vasco Road Safety Improvements
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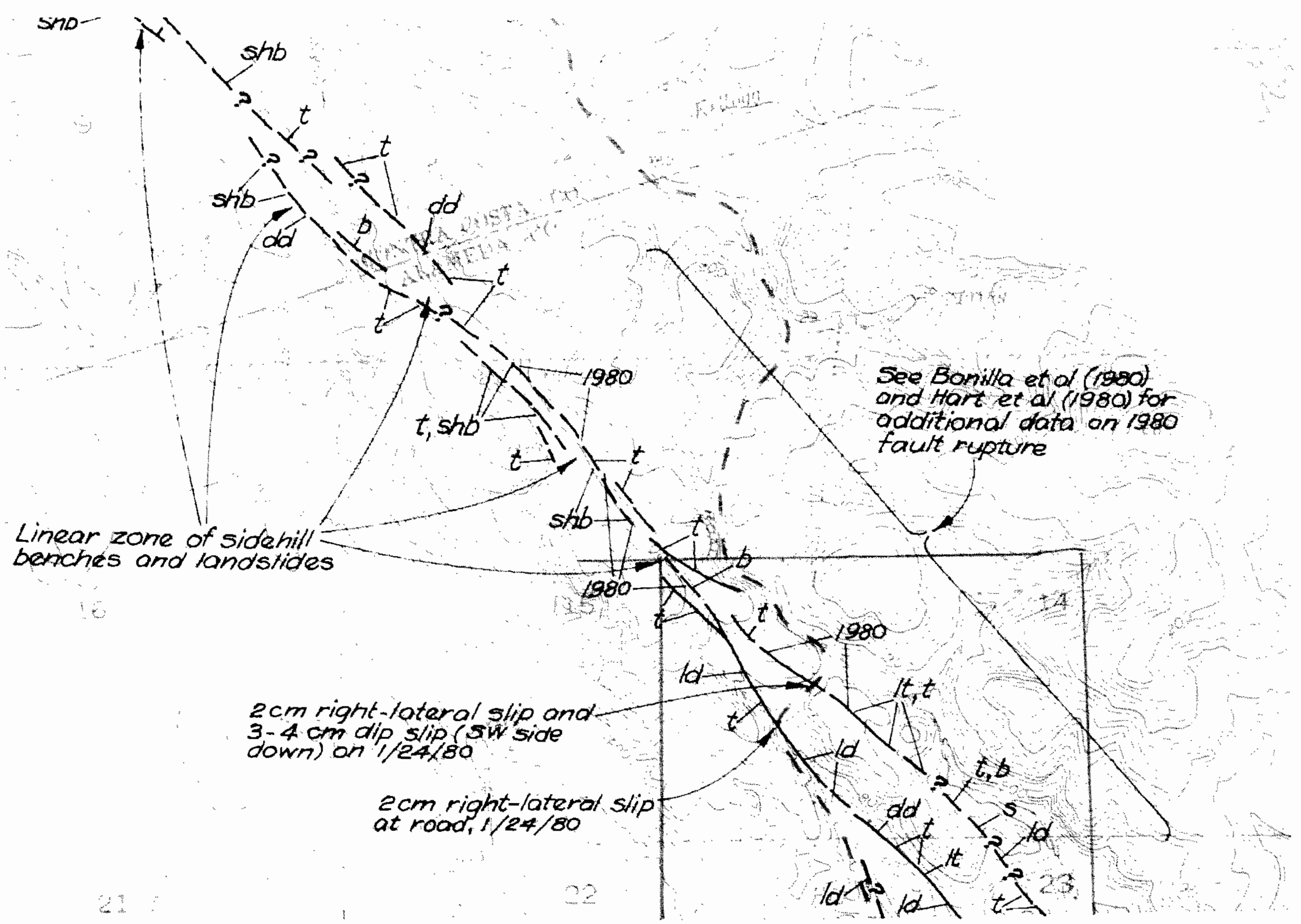
REGIONAL SLOPE STABILITY MAP

JOB NO. R23265	SPEC NO. 1903	OCTOBER 2002	FIGURE 7-1



EXPLANATION

b - Bench
bd - Beheaded drainage
cd - Closed depression
dd - Deflected or offset drainage
ld - Linear drainage
lt - Liner trough or trench
pa - Ponded Alluvium
s - Saddle
shb - Sidehill bench
t - Tonal lineament

N

Source: Bonilla, M.G., Lienkamper, J.J. and J.C. Tinsley, 1980, "Surface Faulting Near Livermore, California Associated With The January 1980 Earthquakes," U.S. Geological Survey Open File Report 80-523, Scale 1:12,000

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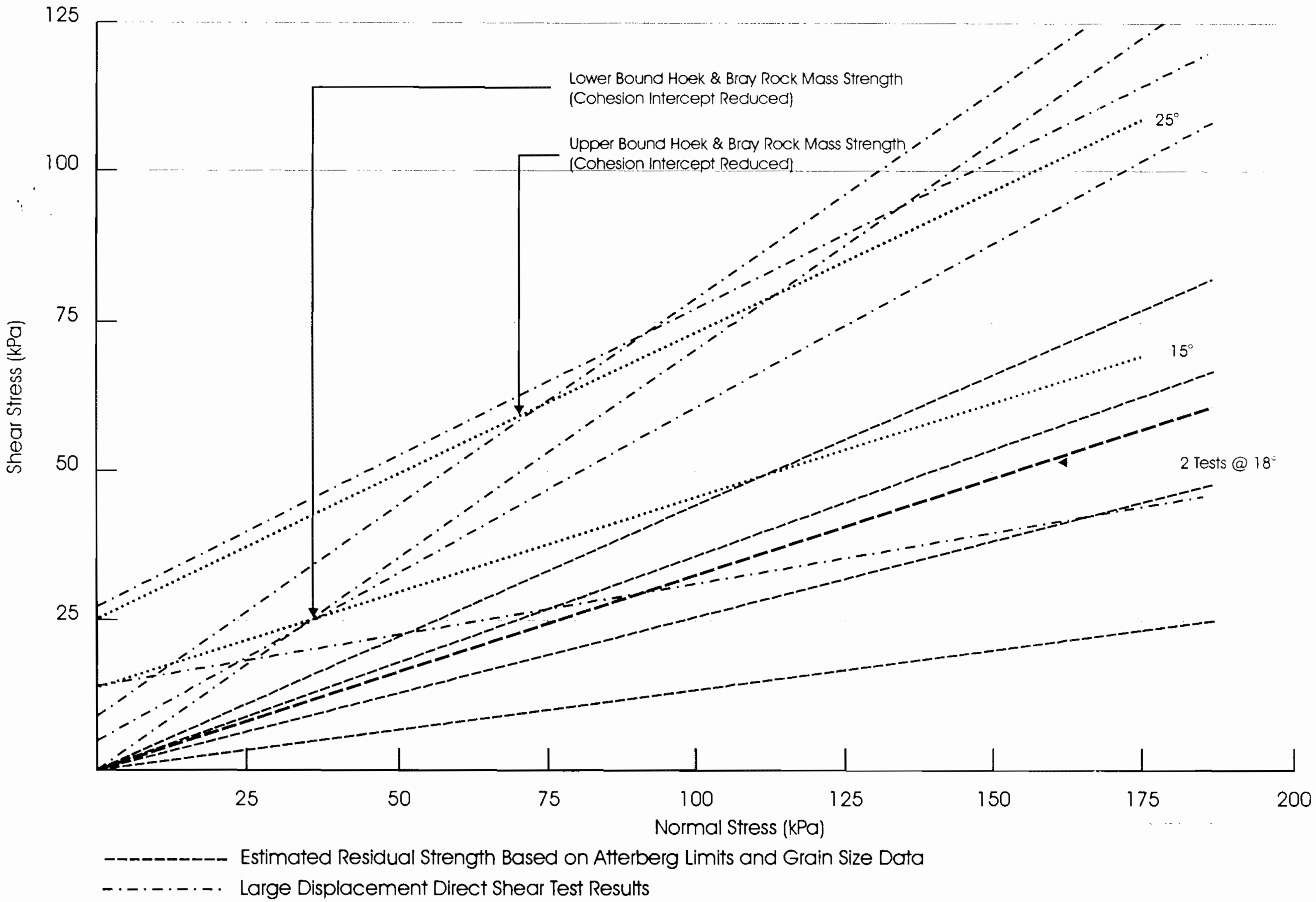
GEOMORPHIC FEATURES ATTRIBUTED TO THE GREENVILLE FAULT AND THE 1980 GREENVILLE EARTHQUAKE

JOB NO. R23265

October 2002

Figure 7-2



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VASCO ROAD SAFETY IMPROVEMENTS IN ALAMEDA COUNTY FROM MP 3.4 TO 4.3

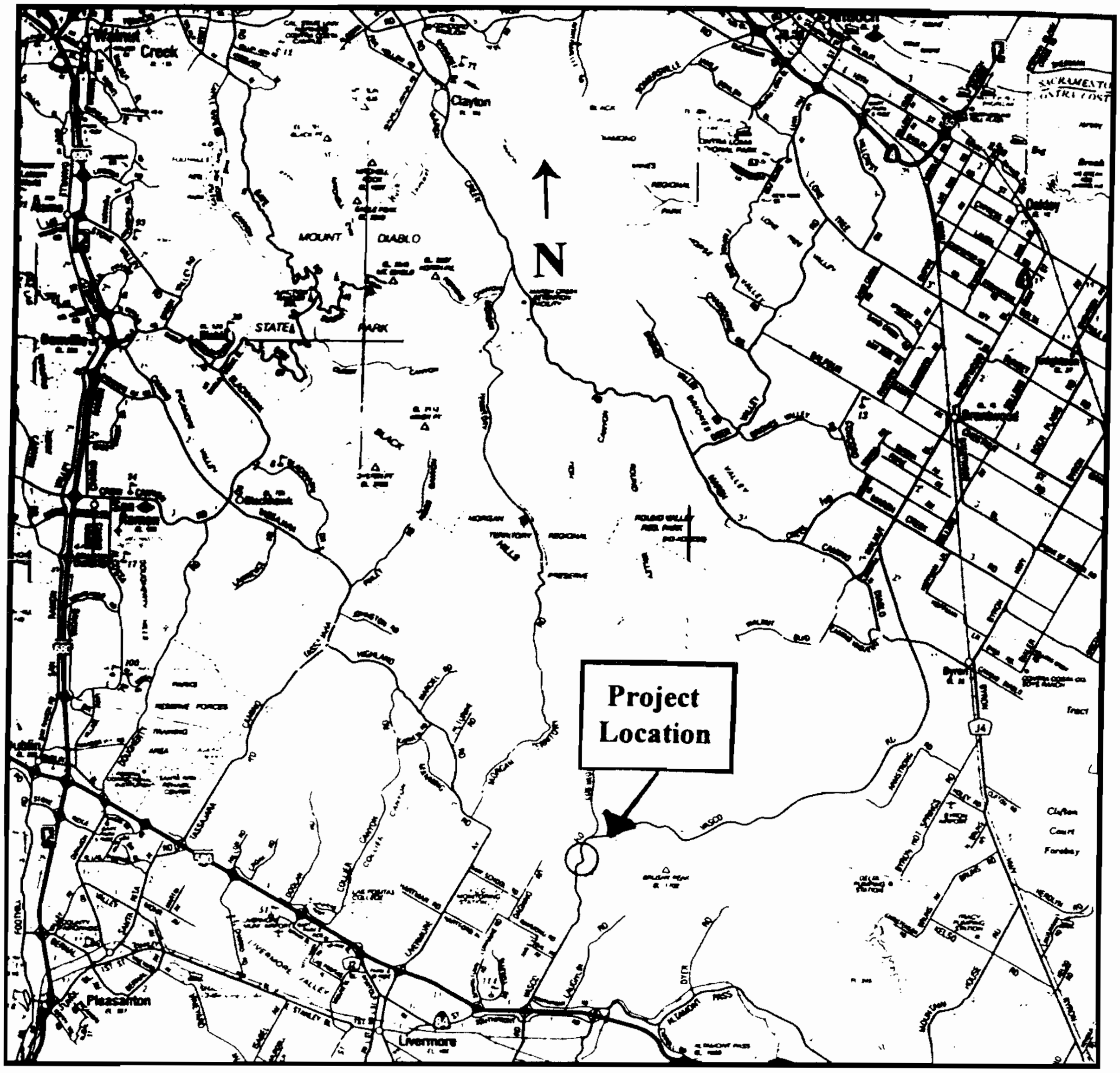
RANGE IN SHEAR STRENGTH PROPERTIES EVALUATED BY DIFFERENT METHODS

JOB NO.: 001860	DATE: JUNE 2001	FIGURE 8-1

...\CLG\001860\DRAFT\FIG6-2.dwg

Appendix A

PROJECT STUDY REPORT



VASCO ROAD SAFETY IMPROVEMENTS
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from MP 3.4 to MP 4.3

Approved:

Donald J LaBelle — 6-19-98

Donald La Belle, Public Works Director — Date

Approval Recommended by:

Ralph Johnson — 6-17-98

Ralph Johnson, Deputy Director — Date

Prepared by:

Teresa KQ Bowen

Teresa K.Q. Bowen, William R. Gray and Company

This Project Study Report has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests that recommendations and conclusions are based on the technical information and the engineering data contained herein this Project Study Report.

Tatcheung

Tat Cheung, P.E.
Project Manager

6-17-98

Date

I. INTRODUCTION

This project is located on Vasco Road in Alameda County starting at a point approximately 1.8 miles north of the Livermore City limit to the recently reconstructed Vasco Road approximately 1.6 miles south of the Contra Costa County line. For a Location Map, see Attachments A and B. It is proposed to reconstruct this portion of Vasco Road on a new improved alignment and grade, widen shoulders and add passing lanes to improve traffic operations and safety. This portion of Vasco Road will be designed based on current County standards for new roads and comfort speeds. Three alternatives with varying alignments and grades have been defined and studied. The cost of the alternatives range from $7.2 million to $10 million. This Project Study Report (PSR) summarizes the results of engineering studies and documents program level cost estimates. This PSR is intended to form the basis for a multi-agency consensus of the project concept and to seek funds to advance the state of readiness and construction of the proposed project. This project has been developed in cooperation with, and has the support of, Contra Costa County, the Cities of Livermore, Brentwood and Antioch, and the Contra Costa Transportation Authority.

II. BACKGROUND

Vasco Road is a north/south arterial between Tesla Road in Alameda County and Camino Diablo Road in Brentwood, Contra Costa County. Vasco Road is part of the Metropolitan Transportation System and is also defined as a route of regional significance by Contra Costa County. Vasco Road is a narrow and winding two-lane rural road along most of its length, except in developed areas in the City of Livermore, where it widens to four lanes.

In 1996, a 13 mile portion of Vasco Road in Contra Costa County was relocated and improved as a result of the construction of the Los Vaqueros Reservoir. The relocated segment from one-half mile south of the County line to Camino Diablo Road in Brentwood was constructed to current highway standards. The remaining three mile segment in Alameda County has tight curves, inadequate sight distance and narrow shoulders. Because of these poor roadway geometrics, transit does not serve this corridor. It is the general consensus that improvements on the Alameda County portion should be made to provide all users of Vasco Road with a safer facility.

Alameda County, in cooperation with Contra Costa County, the Cities of Livermore, Brentwood and Antioch, and the Contra Costa Transportation Authority initiated this PSR to define the scope and cost of the proposal in order to seek funds to advance the state of readiness and construction of the proposed project.

III. NEED AND PURPOSE

Vasco Road north of I-580 is a major commuter and truck route linking the Tri-Valley and Silicon Valley with eastern Contra Costa County. Vasco Road has become an alternative commute route to the congested I-680 and SR 4 corridors. Commute traffic on the Vasco Corridor is projected to increase with growth forecasted in Eastern Contra Costa County, the Tri-Valley, and Silicon Valley in Santa Clara County. Attachment G diagrams the distribution of trips on Vasco Road for northbound p.m. traffic projected for year 2000.

According to the studies conducted for the Vasco Road and Utility Relocation Project (prepared in conjunction with the Contra Costa Water District's Los Vaqueros project), the estimated free-flow travel time for Vasco Road from the intersection of Camino Diablo Road to I-580 interchange is 16-18 minutes. Traffic on Vasco Road is subject to substantial delays due to heavy peak hour traffic volumes, the steepness of roadway grade, short curve radii, and lack of passing lanes on Vasco Road. Travel during peak hours can take as long as 25-30 minutes, particularly when passenger vehicles are backed up behind trucks.

Several sources contribute to truck traffic on the Vasco Road Corridor. These sources include agricultural uses, commercial deliveries, landfill operations, and truck storage areas. In general, however, there are two major categories of truck travel in the project area: inter-regional truck travel (which includes exporting agricultural products) and trucks destined to and from the Vasco Road Landfill.

The existing and the projected Year 2010 traffic volumes and the historical accident data are shown on Attachment F. With increased traffic volumes in the future, Vasco Road is expected to have a Level of Service F in the Year 2010.

As noted above, a portion of Vasco Road in Contra Costa County was relocated as part of the Los Vaqueros Reservoir Project. This resulted in the improvement of a major arterial between eastern Contra Costa and Alameda Counties. The relocated 13 mile segment of the roadway was constructed to current highway standards resulting in a safer road with higher design speeds and better traffic conditions. With the improvement on the Contra Costa segment, the occurrences of accidents and injuries along the improved portion of Vasco Road have been substantially reduced.

The table below summarizes the accident rates for a period from 1994 to 1997. The average accident rates, except for fatal accidents, for Vasco Road between the Livermore

City limit and the Alameda/Contra Costa County line for a three-year period from 1994 to 1996 is higher than the State average rates for a similar facility.

Location:	Total Accidents	Type		Actual Average Rate per Million Vehicles Miles			Statewide Average Rate per Million Vehicles Miles[1]		
		Fatal	Injury	Fatal	F&I	Total	Fatal	F&I	Tota
Alameda County (1994, '95 & '96) MP 3.4 to 4.3	18	0	9	0.00	0.36	0.71	0.017	0.25	0.57
Contra Costa County (1994, '95) MP 0 to 11.10	77	3	30	0.027	0.30	0.70	0.017	0.25	0.57
Contra Costa County (May to December 1996[2], '97) MP 0 to 11.10	39	1	19	0.009	0.17	0.34	0.017	0.25	0.57

1. Assembly of Statistical Reports 1995, State of California, Business Transportation and Housing Agency, December 1997

2. Reconstructed segment of Vasco Road in Contra Costa County was completed and opened to traffic April 15, 1996. Data for Jan-April 1996 was not included due to ongoing construction activities.

Both the Gateway Policy adopted by the Alameda County Board of Supervisors and the Action Plan adopted by the Tri-Valley Transportation Council places constraints on widening Vasco Road beyond two through lanes. The Tri Valley Transportation Plan does acknowledge the need to realign and upgrade the Alameda segment of Vasco Road while retaining the two lane cross section. The Tri-Valley Transportation Plan further recommends that improvements be done in such a manner to not preclude future accommodation of public transit or other improvements as subsequently determined appropriate. Alameda County and Contra Costa County are taking steps in seeking funds for improving Vasco Road from the improved segment in Contra Costa County to the Livermore City limit.

Recognizing that both counties have other major unfunded transportation priorities and all of the needed funds for Vasco Road may not be available, phasing construction of the three-mile segment is proposed. Phase I of the project will cover 0.9 miles of the most winding and narrowest portion of Vasco Road contiguous to the new Vasco Road. To improve traffic safety and operation at this location, improvements would include realignment of the roadway, widening of shoulders and installing passing lanes without increasing its capacity. Phase 1 has independent utility from future and subsequent phases. The proposed project concept is consistent with the standards used in the Contra Costa County. Other phases covering the remainder of the three-mile segment may follow as funds become available.

IV. ALTERNATIVES

The typical roadway section for Vasco Road will include two 12-foot lanes with 8 foot shoulders, 2:1 side slopes and minimum 10 foot distance between the catch point and right of way fence line. This typical section applies to all three alternatives studied. For details on the proposed cross section, see Attachment C.

Three alternatives were defined and analyzed. Alternative 1 is characterized as Straight Alignment Basic Profile; Alternative 2: Straight Alignment High Profile and; Alternative 3, Reverse Curves Alignment. Features for each of these three alternatives are comparatively summarized in Attachment H. Detailed cost estimates for each alternative are shown on Attachments I, J and K. Each alternative is described as follows:

<u>Alternative 1: Straight Alignment Basic Profile</u> (Attachment D)

The alignment of this alternative for the most part is straight between conform points, connecting to the existing pavement with a R-1300' curve and 4% superelevation at each end. The design speed for this alternative is 55 mph. The maximum grade is 8%. The profile of this alternative does not fit the existing grade of the newly constructed Vasco Road. About 1000' of the new road may need to be reconstructed. However, this profile would meet existing grade at the south conform and would provide flexibility for the next phase of the project. Based on this profile grade, the maximum height of cut would be 100'. Consequently, this alternative would require the most earthwork, estimated at 550,000 CY of roadway excavation.

Right of way acquisition would involve only unimproved lands and no right of way relocation would be required. Existing property access would be maintained during construction of the project. Traffic through the south conform would be affected during construction so staged construction may be necessary. Utility relocation would include existing power poles and Sprint facilities. As wetlands would be impacted with this project, wetland restoration would be required. The construction and right of way cost of this alternative including 25% for preliminary and design engineering, 15% for construction engineering and 20% for contingencies is $9.6 million for a road improvement length of approximately 4,000'.

The advantages for this alternative are better alignment and grade. The disadvantages are higher cost due to more earthwork and the need to reconstruct more of the existing new road at the north conform.

Alternative 2: Straight Alignment High Profile (Attachment D)

The alignment and other design features and right of way and environmental impacts of this alternative are the same as Alternative 1, except this alignment has a higher profile. Consequently, the maximum height of cut is only 80' and the earthwork (estimated at 350,000 CY) is much less than Alternative 1. However, it would also require much longer distance (about 2,000') to conform at the south end and more right of way than Alternative 1. At the north end, it would require less construction of the new road (about 600'). The construction and right of way cost of this reconstruction alternative including 25% for preliminary and design engineering, 15% for construction engineering and 20% for contingencies is $10.0 million for a road improvement length of approximately 6,000'.

The advantages for this alternative are the straight alignment and lower cost per mile of construction. The disadvantages are higher profile with longer steep grade. Maintaining traffic during construction at the south conform is an issue due to the difference in grade between the existing and the proposed profile. The higher cost of Alternative 2 may make it more difficult to procure the needed funding for construction.

Alternative 3: Reverse Curves Alignment (Attachment E)

The alignment of this alternative for the most part is winding with double reverse curves (R=1200') between conform points. Superelevations of 4% are required almost throughout the entire length of the project. The design speed is 55 mph. The maximum grade is 8%. The profile of this alternative is the same as Alternative 1. About 1000' of new road may need to be reconstructed. The maximum height of cut is 85'. This alternative would require the least earthwork of the three alternatives studied. About 310,000 CY of roadway excavation would be needed. Right of way acquisition would be slightly less than Alternatives 1 and 2. Utility relocation, wetland impacts and other aspects of design involvements are the same as required for Alternative 1. The construction and right of way cost of this alternative including 25% for preliminary and design engineering, 15% for construction engineering and 20% for contingencies is $7.2 million for a road improvement length of approximately 4,000'.

The primary advantage for this alternative is lower cost. The primary disadvantages are the double reverse curves with short tangents.

V. SYSTEM PLANNING

The proposed project is consistent with the Alameda and Contra Costa Counties General Plans. The need to improve the Alameda portion of Vasco Road is acknowledged in the Tri -Valley Transportation Plan/Action Plan for Routes of Regional Significance. This project has the support of the Cities of Livermore, Brentwood and Antioch and the Contra Costa Transportation Authority.

VI. ENVIRONMENTAL ISSUES AND CLEARANCE PROCESS

An Initial Study was conducted by reviewing entries in the California Natural Diversity Database (NDDB), consulting with the Northwest Information Center, reviewing the Vasco Road and Utility Relocation Project Environmental Impact Report and by conducting a site visit on December 3, 1997. The initial findings and recommendations are summarized in a December 19, 1997 report included as Attachment L. Additional studies are required in order to determine the appropriate level of environmental clearance and whether the proposed project is subject to NEPA. Additional biological surveys are needed to determine the extent of impacts to special studies species and their habitats known to occur within the project area. A Project Site reconnaissance for historic and prehistoric cultural resources will need to be conducted. Given the proximity of the site to an earthquake fault, soil studies may be needed to determine characteristics along the project alignment.

The proposed project may be subject to the requirements of EPA's project level conformity rules and MTC Resolution 2270. It appears the project may be categorized as a "small project" since this project would not significantly change traffic capacity, traffic volumes or speed, and that there are no significant air quality impacts to nearby receptors.

The proposed project is likely to require the following permits: US Army Corps of Engineers Permit (US Fish and Wildlife Service Section 7 consultation may be required), Regional Water Quality Control Board Section 401 Water Quality Certification/Waiver, California Department of Fish and Game Streambed Alteration Agreement.

Federal environmental review is triggered if the project is located on federally owned or controlled lands or if the project is funded with federal funds. Alameda County would be the lead agency for CEQA.

VII. FUNDING AND PROGRAMMING

The proposed Phase 1 project is currently unfunded. Contra Costa County, through the Contra Costa Transportation Authority, has initiated steps to program partial funding for Phase 1 of the project. Proposed Track 1 Investments outlined in the Preliminary Draft 1998 Regional Transportation Plan (RTP) for Contra Costa County includes $5.8m for Vasco Road Improvements in Alameda County. (See Attachment M.) Contra Costa County proposes to program these funds contingent on an Alameda County match of $5.8m. At the present, Vasco Road is not included in the Alameda County project list proposed for the 1998 RTP. Potential funding for Phase 1 and subsequent phases of the project could include a combination of Federal, State, and local funds, including traffic impact mitigation fees.

VIII. RECOMMENDATION

It is recommended that this PSR be approved so that the project concept can be established. It is further recommended that the following steps be taken:

- **Develop a near and long term funding strategy for Phase 1 and subsequent phases in coordination with Contra Costa County and others.**
- **Advance the project's state of readiness by:**
    - **conducting an environmental assessment,**
    - **selecting a preferred alternative,**
    - **preparing the environmental document and**
    - **initiating preliminary and final PS&E.**

IX. PROJECT TEAM

Tat Cheung, Alameda County Public Works Agency	(510) 670-5486
Ralph Johnson, Alameda County Public Works Agency	(510) 670-5562
Joanne Parker, Alameda County Planning Department	(510) 670-6511
Dennis Fay, Alameda County CMA	(510) 836-2560
Bob McCleary, Contra Costa Transportation Authority	(925) 256-4724
Maurice Shiu, Contra Costa County	(925) 313-2251
Joe Yee, Contra Costa County	(925) 313-2258
Dan Smith, City of Livermore	(925) 373-5240
Lynne Filson, City of Brentwood	(925) 516-5322
Ed Franzen, City of Antioch	(925) 779-3051
Bill Gray/Terry Bowen, William R. Gray and Company	(925) 947-1966

X ATTACHMENTS

Attachment A:	Regional Location Map
Attachment B:	Location Map
Attachment C:	Typical Section
Attachment D:	Straight Alignment Alternatives Plan and Profiles (Basic and High)
Attachment E:	Reverse Curve Alignment Alternative Plan and Profile
Attachment F:	Existing and Projected Traffic Volumes and Accident Data
Attachment G:	Origins and Destinations on Vasco Road
Attachment H:	Summary of Alternatives
Attachments I-K:	Cost Estimates

Attachment L:	Environmental Reconnaissance
Attachment M:	Preliminary Draft 1998 Contra Costa Regional Transportation Plan

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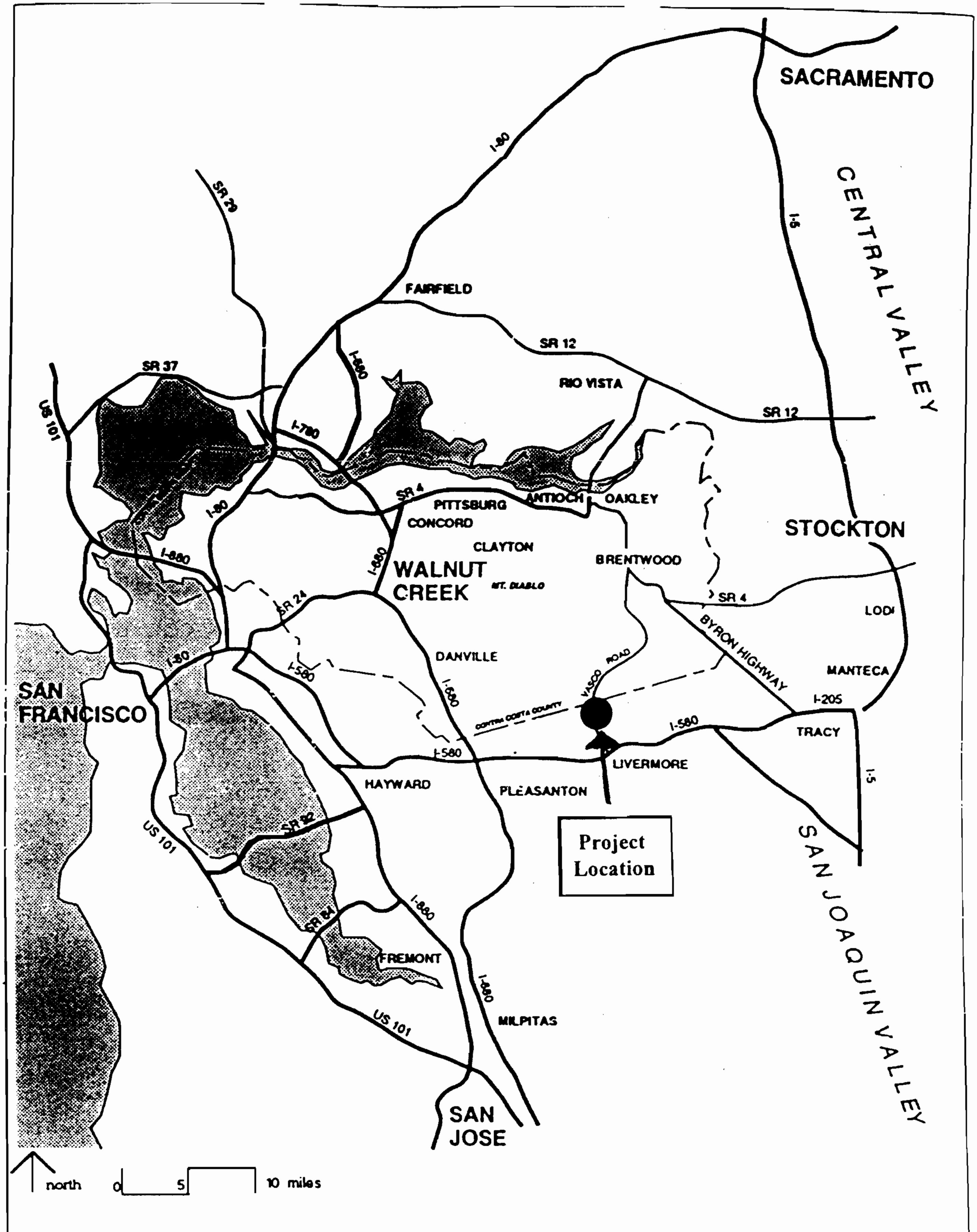
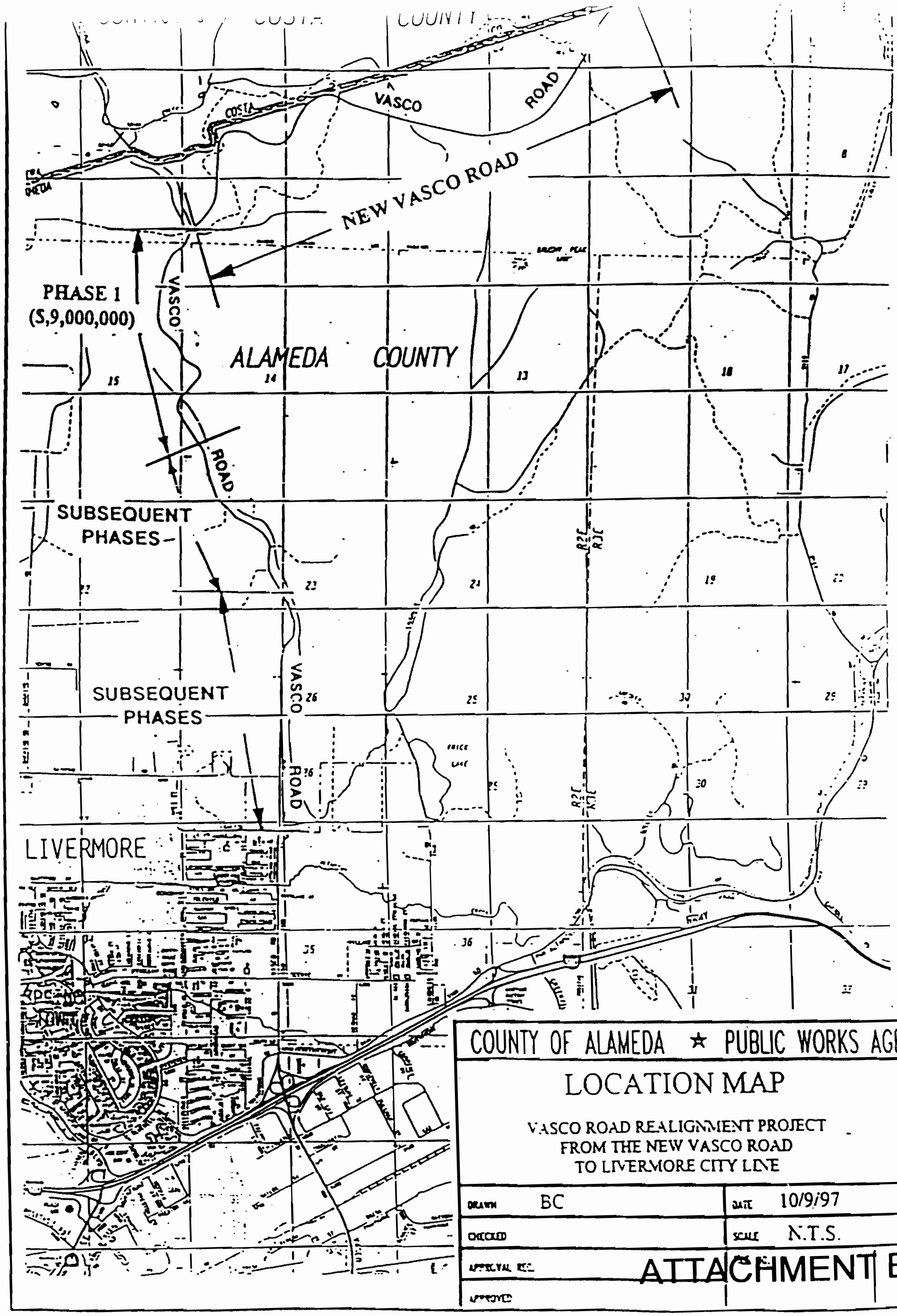


REGIONAL LOCATION

ATTACHMENT A

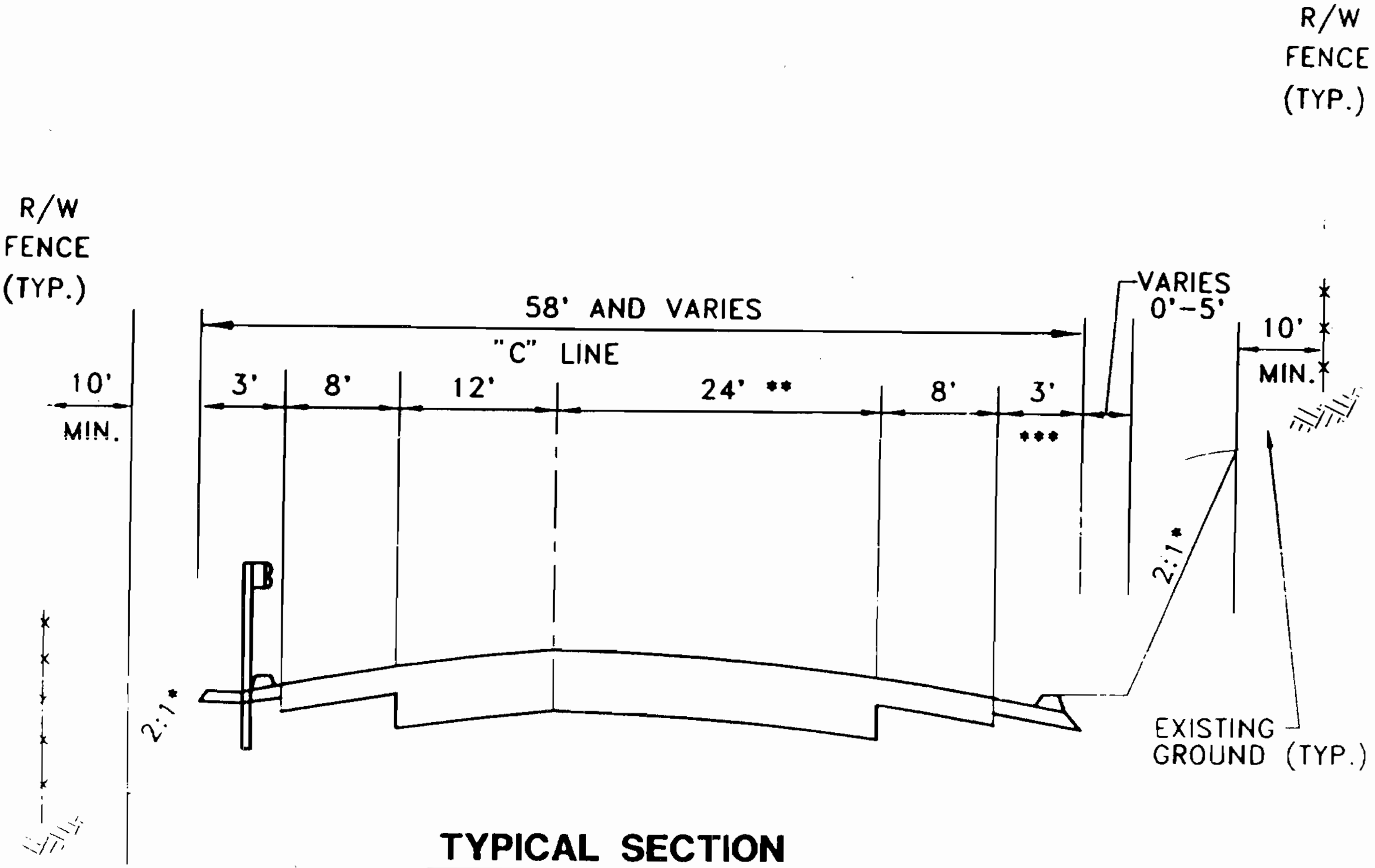


COUNTY OF ALAMEDA ★ PUBLIC WORKS AGENCY

LOCATION MAP

VASCO ROAD REALIGNMENT PROJECT
FROM THE NEW VASCO ROAD
TO LIVERMORE CITY LINE

DRAWN	BC	DATE	10/9/97
CHECKED		SCALE	N.T.S.
APPROVAL REC.		ATTACHMENT B	
APPROVED			



TYPICAL SECTION

NTS

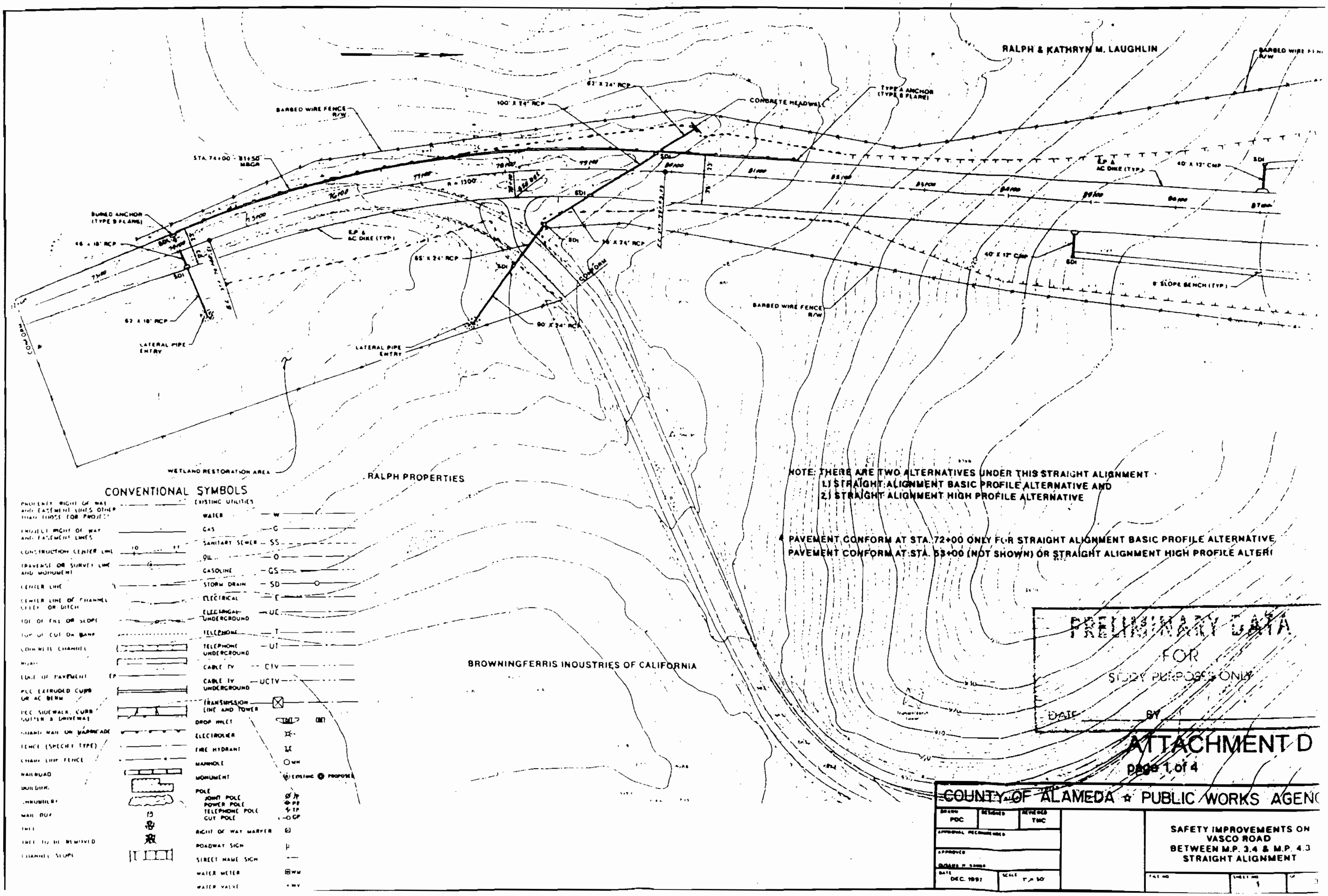
ATTACHMENT C

- * SLOPE BENCH IS NOT SHOWN.
- ** INCLUDES A 12' PASSING LANE, WHICH MAY BE ON EITHER/BOTH SIDES.
- *** WIDTH AS NEEDED FOR DRAINAGE.

COUNTY OF ALAMEDA ★ PUBLIC WORKS AGENCY

VASCO ROAD REALIGNMENT
(FROM PM 3.4 ± TO PM 4.3 ±)
TYPICAL SECTION

DRAWN	PDC	DATE	NOV. 1997	
CHECKED	TMC	SCALE	NTS	
APPROVAL REC.		FILE NO.		SHEET NO. 1 OF 1
APPROVED				



NOTE: THERE ARE TWO ALTERNATIVES UNDER THIS STRAIGHT ALIGNMENT
1.) STRAIGHT ALIGNMENT BASIC PROFILE ALTERNATIVE AND
2.) STRAIGHT ALIGNMENT HIGH PROFILE ALTERNATIVE

PAVEMENT CONFORM AT STA. 72+00 ONLY FOR STRAIGHT ALIGNMENT BASIC PROFILE ALTERNATIVE
PAVEMENT CONFORM AT STA. 53+00 (NOT SHOWN) OR STRAIGHT ALIGNMENT HIGH PROFILE ALTERI

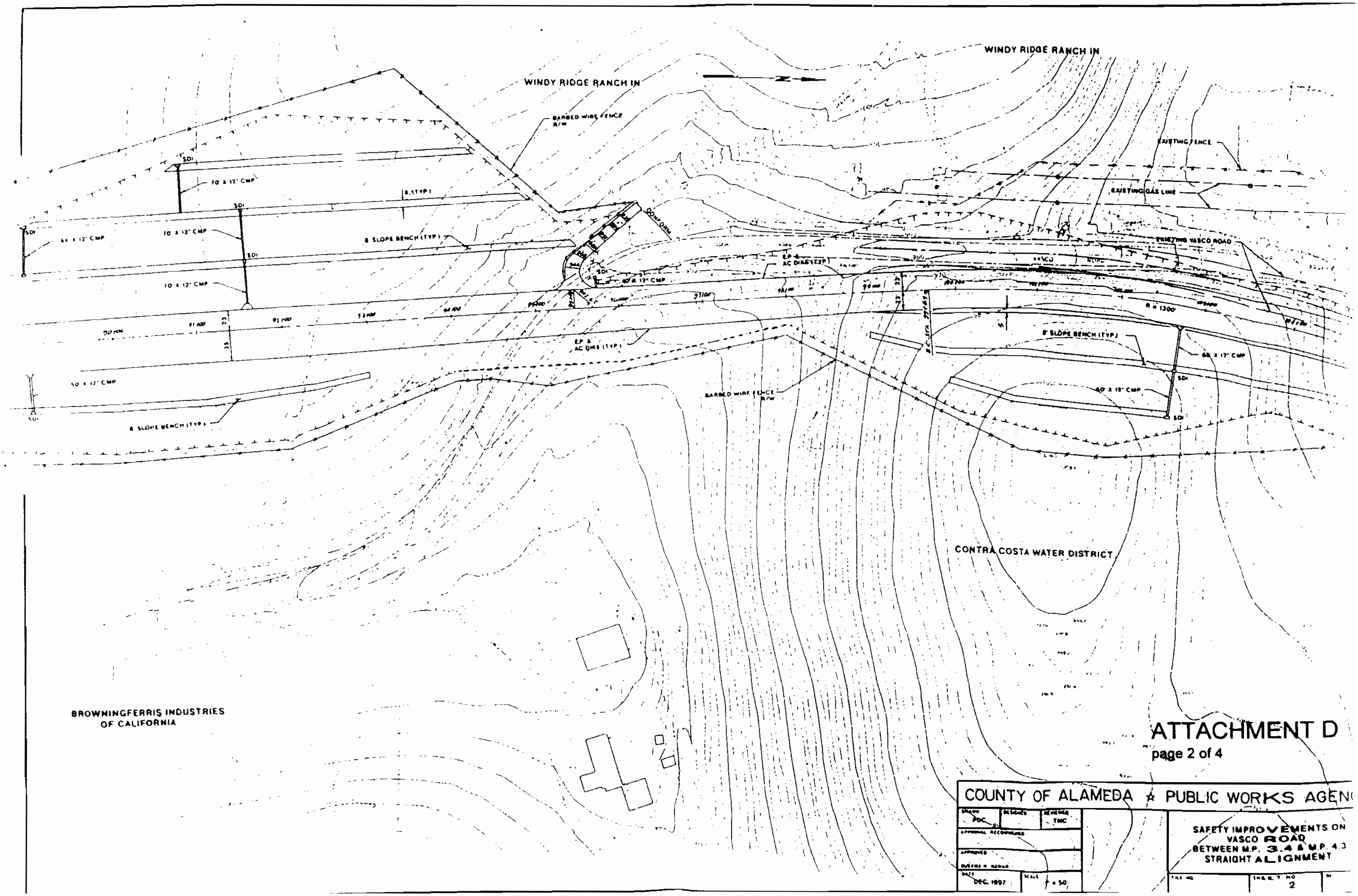
ATTACHMENT D
page 1 of 4

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENC

SAFETY IMPROVEMENTS ON
VASCO ROAD
BETWEEN M.P. 3.4 & M.P. 4.3
STRAIGHT ALIGNMENT

ATTACHMENT D

page 2 of 4

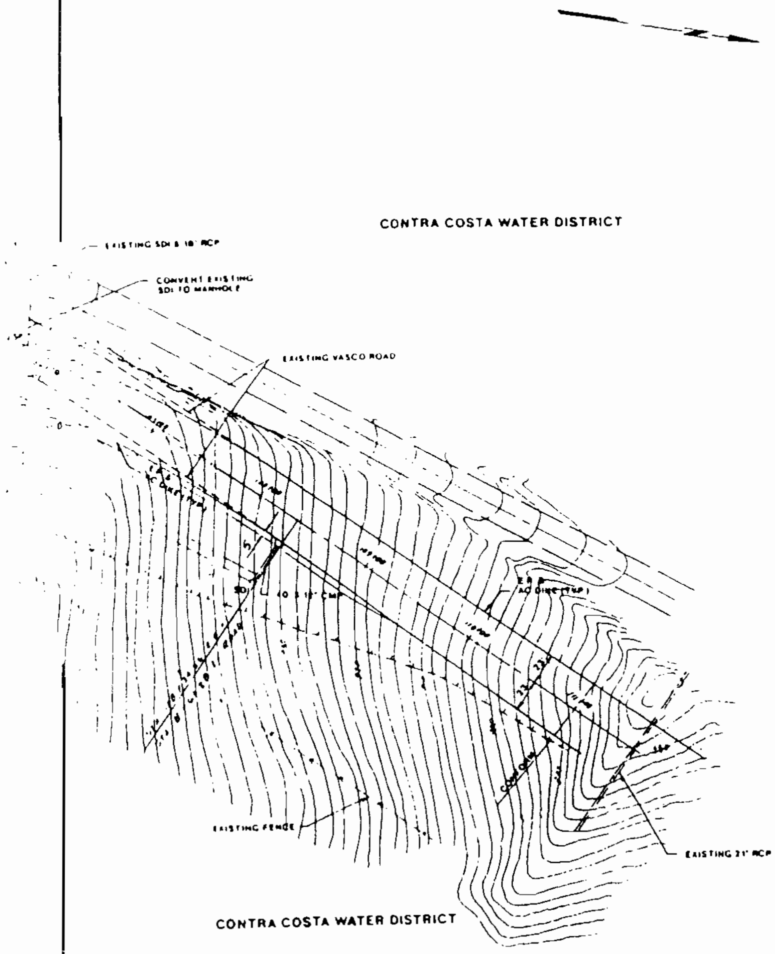


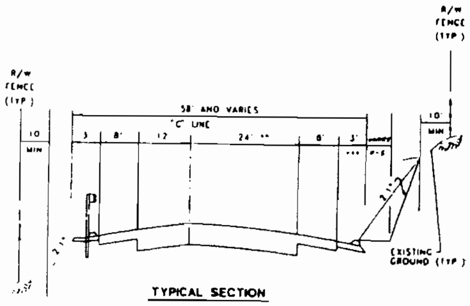
COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENC

DRAWN PDC
DESIGNED
REVIEWED TMC
APPROVAL RECOMMENDED
APPROVED
DATE DEC. 1997
SCALE 1" = 50'

SAFETY IMPROVEMENTS ON
VASCO ROAD
BETWEEN M.P. 3.4 & M.P. 4.3
STRAIGHT ALIGNMENT

FILE NO.
SHEET NO. 2





TYPICAL SECTION

NTS

* SLOPE BENCH IS NOT SHOWN

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*** WIDTH AS NEEDED FOR DRAINAGE.

ATTACHMENT D

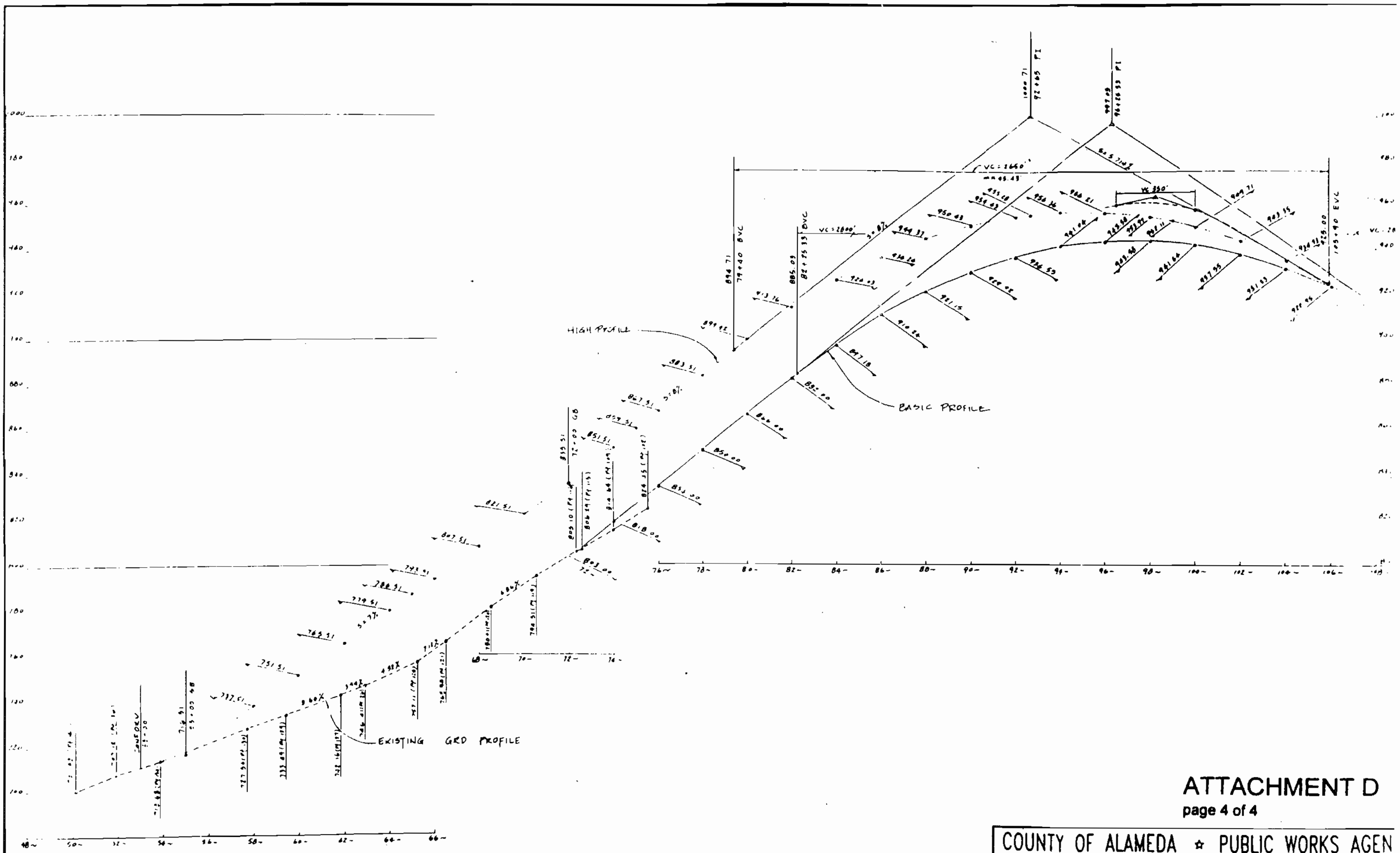
page 3 of 4

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGEN

DRAWN PDC
DESIGNED
REVISED TMC
APPROVAL RECOMMENDED
APPROVED
[illegible]
DATE DEC 1987
SCALE 1" = 50

SAFETY IMPROVEMENTS ON
VASCO ROAD
BETWEEN M.P. 3.4 & M.P. 4 3
STRAIGHT ALIGNMENT

FILE NO
SHEET NO



ATTACHMENT D

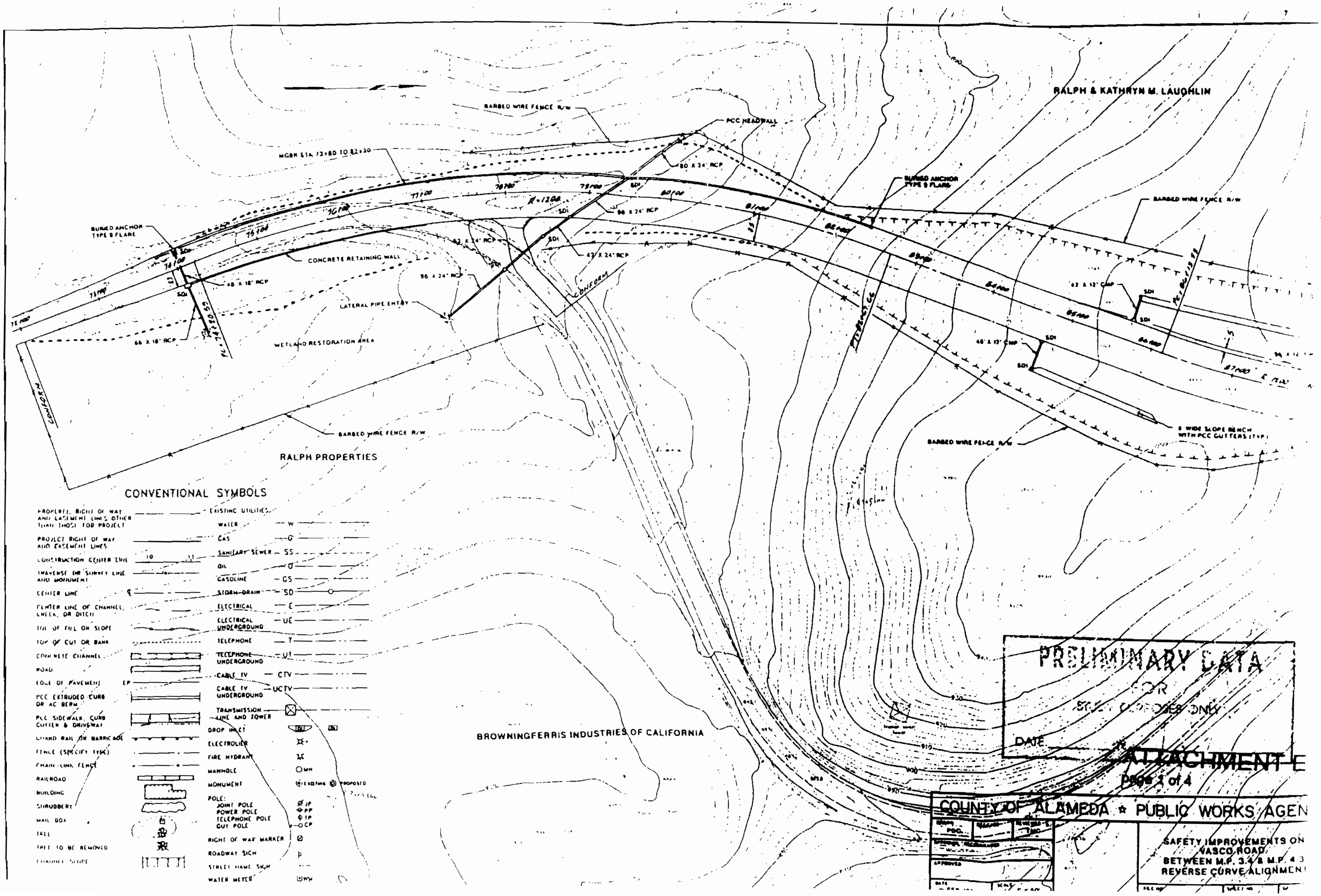
page 4 of 4

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGEN

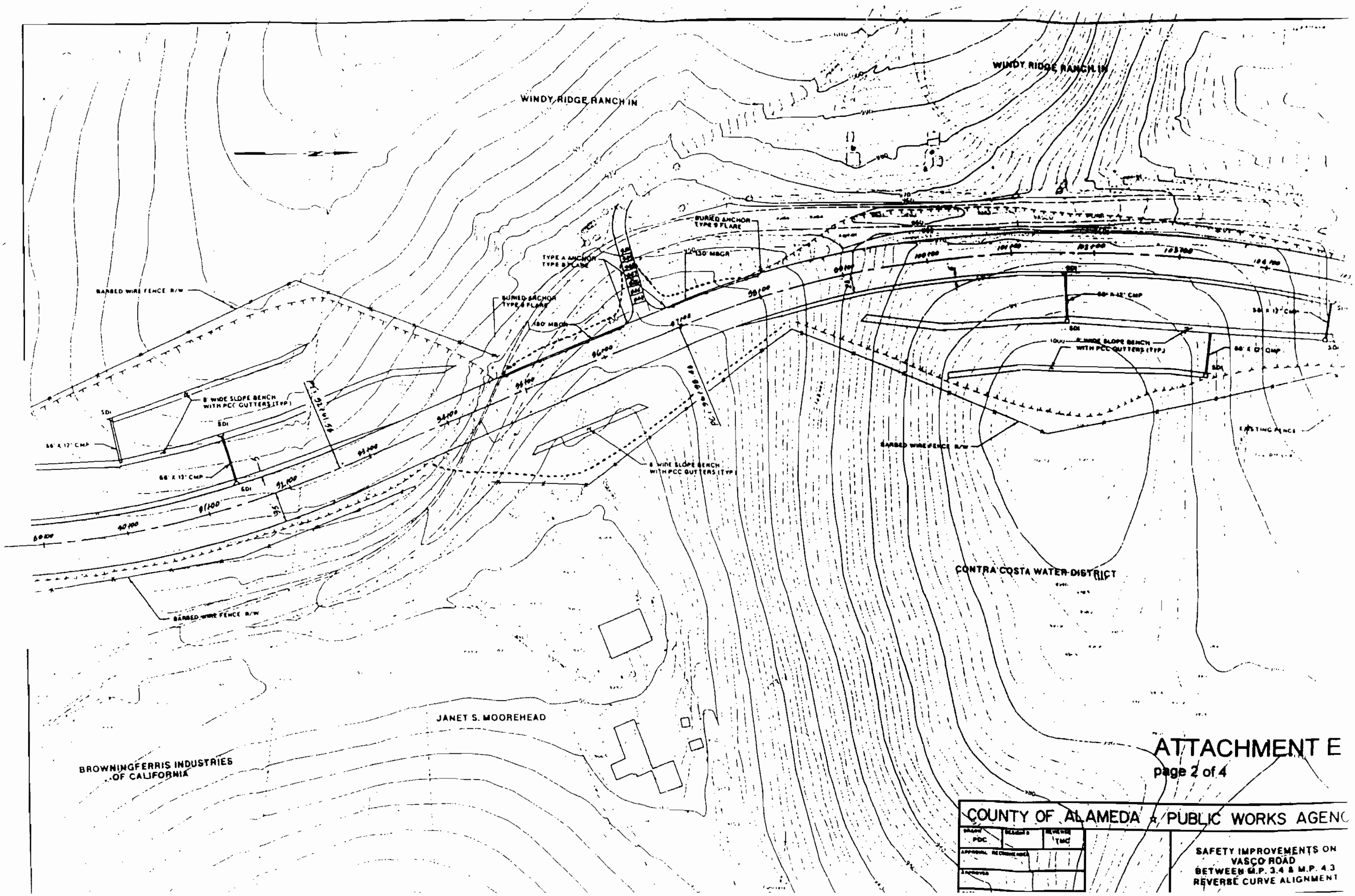
VASCO ROAD
PROFILES
STRAIGHT ALIGNMENT

1/7/98

H 1"=200'
V 1"=20'



ATTACHMENT E
Page 1 of 4



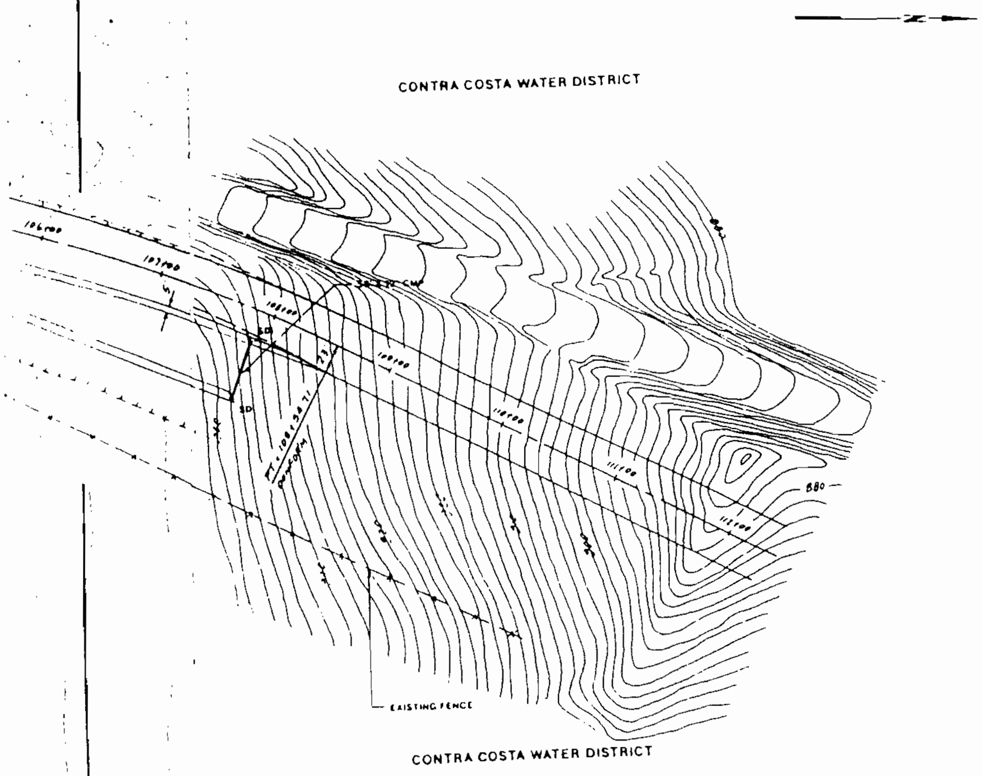
ATTACHMENT E

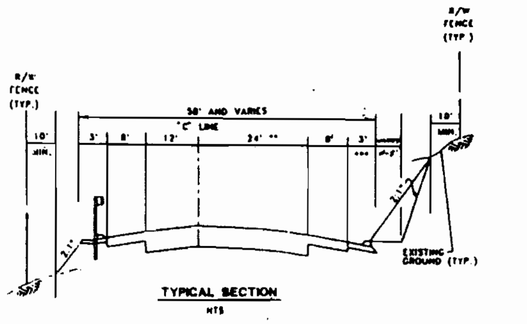
page 2 of 4

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENC

DRAWN	DESIGNED	REVIEWED
PDC		TMC
APPROVAL RECOMMENDED		
APPROVED		

SAFETY IMPROVEMENTS ON
VASCO ROAD
BETWEEN M.P. 3.4 & M.P. 4.3
REVERSE CURVE ALIGNMENT





TYPICAL SECTION

NTS

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*** WIDTH AS NEEDED FOR DRAINAGE.

ATTACHMENT E

page 3 of 4

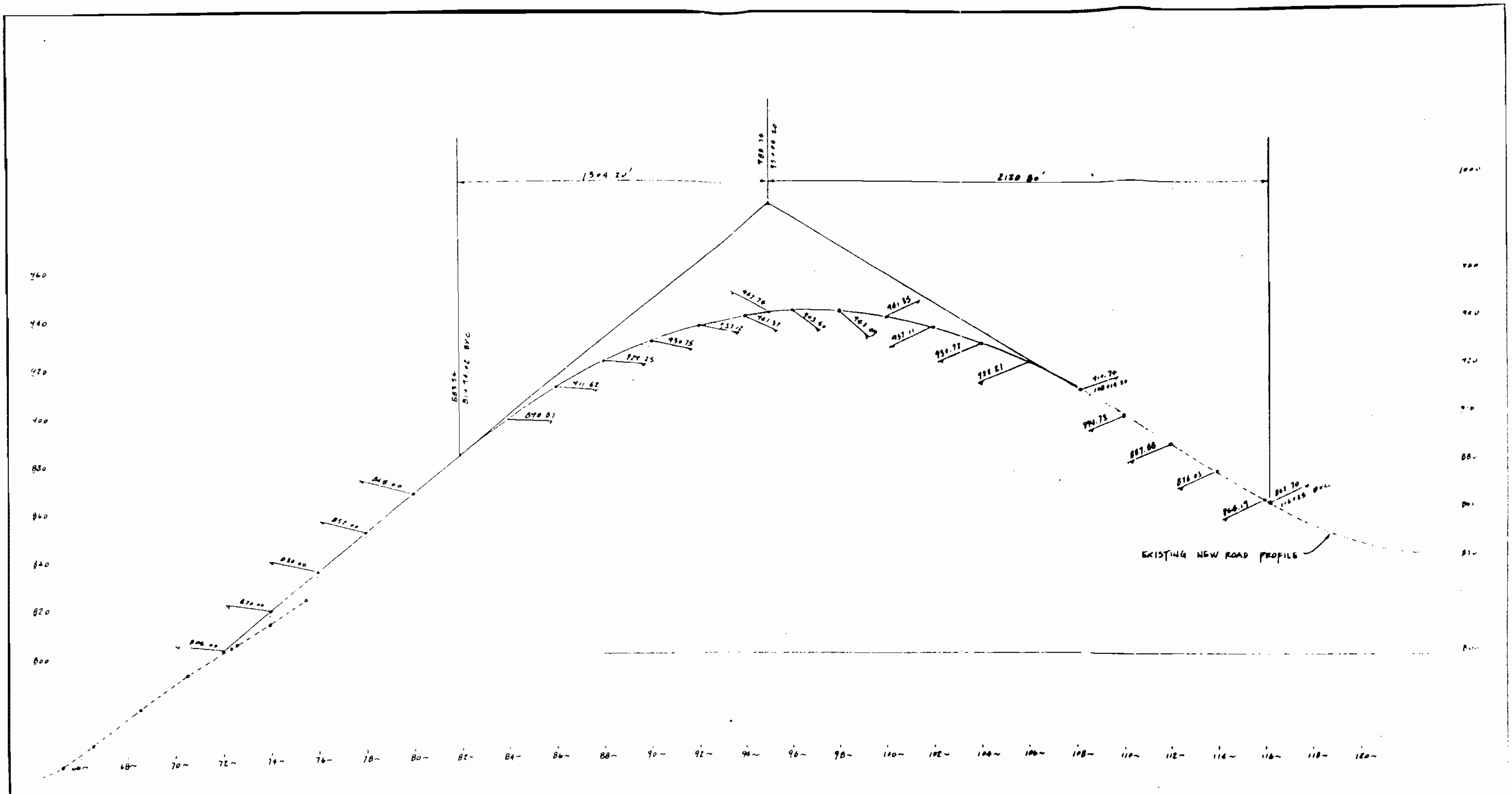
COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGEN

DRAWN PDC	DESIGNED	REVIEWED TMC

APPROVAL RECOMMENDED

APPROVED

SAFETY IMPROVEMENTS ON
VASCO ROAD
BETWEEN M.P. 3.4 & M.P. 4.3
REVERSE CURVE ALIGNMENT



ATTACHMENT E

page 4 of 4

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

VASCO ROAD
PROFILE
REVERSING CURVE ALIGNMENT

Vasco Road

Traffic Data

Traffic Volumes:

1) Existing Traffic Volumes

Time Period	Northbound (veh)	Southbound (veh)
Morning Peak Hour	293	1,508
Evening Peak Hour	1,666	343
Average Daily Traffic (ADT)	10,252	8,568

Source: Alameda County Public Works - Traffic Counts (1996)

2) Year 2010 Projected Traffic Volumes

Time Period	Northbound (veh)	Southbound (veh)
Morning Peak Hour	539	1,666
Evening Peak Hour	1,681	311

Source: Tri-Valley Transportation Plan prepared by Barton-Aschman Associates (6/95)

Accident Data:

1) State average rates for a similar roadway:

	Accidents	Fatal & Injury Acc.	Fatal Acc.
Principle Arterial (Rural)	0.57	0.25	0.017

Note: All rates shown are expressed in annual accidents per million vehicle miles

Source: State of California 1995 Assembly of Statistical Reports.(most recent report)

2) Average annual accident rates for Vasco Road:
Between the Livermore City line and the Alameda\Contra Costa County Line
(1994, 1995, and 1996)

	Accidents	Fatal & Injury Acc.	Fatal Acc.
Vasco Road	0.71	0.36	0.0

Note: All rates shown are expressed in annual accidents per million vehicle miles

Source: State of California SWITERS reports.

ATTACHMENT F

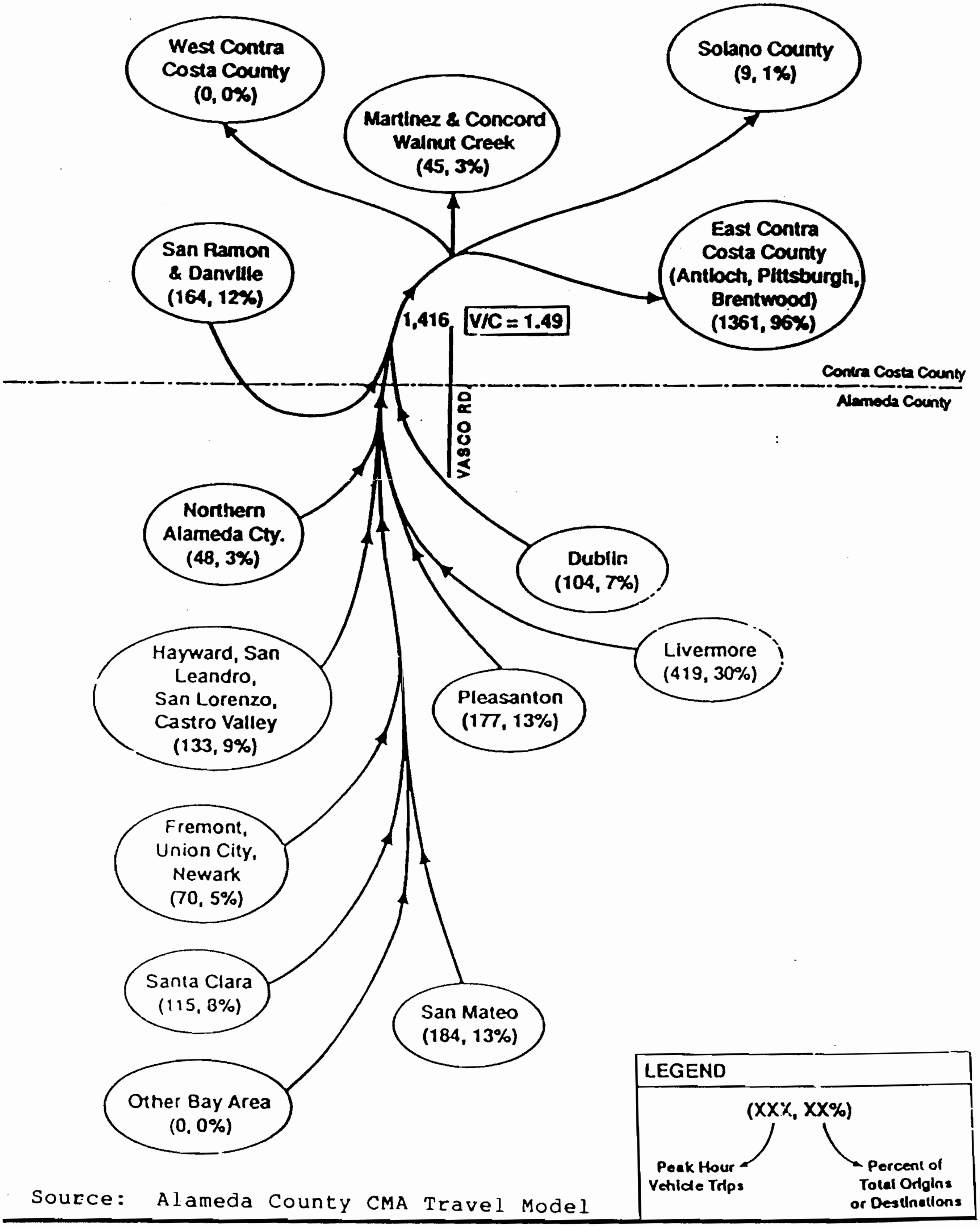
Year 2010 and 2026 Forecasts

Location	AM Peak Hour		PM Peak Hour	
	LOS	Volume (two direction)	LOS	Volume (two direction)
Vasco Road s/o Camino Diablo	F	2,065	F	2,274
	F	2,290	F	2,557
Vasco Road n/o I-580 (Alameda)	F	2,040	F	2,236
	F	2,252	F	2,486

Legend:

Year 2010
Year 2026

Source: DKS Associates 1996
Cowell Ranch DEIR (10/96) "without project" scenario



Source: Alameda County CMA Travel Model

Analysis of Origins/Destinations on Vasco Road for the Year 2000 PM Peak Hour

ATTACHMENT

PROJECT STUDY FOR SAFETY IMPROVEMENT ON VASCO ROAD BETWEEN MP 3.4 AND 4.3

FACTORS	ALT. 1 STRAIGHT ALIGNMENT BASIC PROFILE	ALT. 2 STRAIGHT ALIGNMENT HIGH PROFILE	ALT. 3 REVERSE CURVES ALIGNMENT	COMMENTS
DESIGN SPEED	55 m.p.h.	55 m.p.h.	55 m.p.h.	
CONSTRUCTION COST	$ 9.6 Million	$ 10 Million	$ 7.2 Million	Critical factor
ALIGNMENT	Straight between conform	Straight between conform	Double reverse curves	Safety/comfort
SUPERELEVATION	4% @ curve each end	4% @ curve each end	Almost throughout	Safety/comfort
ROAD IMPROVEMENT LENGTH	4,000'	6,000'	4,000'	Cost-effectiveness
R/W ACQUISITION	610,000 SF	900,000 SF	550,000 SF	
EARTHWORK	550,000 CY	350,000 CY	310,000 CY	Major cost item
MAX. HEIGHT OF CUT	100'	80'	85'	
PROPERTY ACCESS	Maintained	Maintained	Maintained;Improves 1 access	
TRAFFIC DURING CONSTRUCTION	Affected @ S. Conform	More affected @ S. Conform	Affected @ S. Conform	
WETLAND/CREEK IMPACT	Wetland	Wetland	Wetland	Wetland restoration
UTILITIES AFFECTED	Poles, sprint	Poles, sprint (More)	Poles, sprint	
SOUTH CONFORM FLEXIBILITY	Flexible	Much longer (2000') conform	Flexible	
RECONSTRUCT EXIST. NEW ROAD	1,000'	600'	1000'	

ATTACHMENT H

Realignment and Safety Improvements on Vasco Road between Mile Post 3.4 and Mile Post 4.3
Straight Alignment Basic Profile Alternative
Preliminary Estimates

Length of Project : 4,000 Feet

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL ($)
1. Clearing annd Grubbing	**100%**	**LS**	**$ 50,000**	**$ 50,000**
2. Traffic Control	**100%**	**LS**	**$ 70,000**	**$ 70,000**
3. Roadway Excacation	**550000**	**CY**	**$ 6**	**$ 3,300,000**
4. Asphalt Concrete, Type B	**7600**	**Ton**	**$ 50**	**$ 380,000**
5. Aggregate Base, Class 2	**8000**	**Ton**	**$ 20**	**$ 160,000**
6. Aggregate Subbase, Class 3	**23000**	**Ton**	**$ 14**	**$ 322,000**
7. AC Dike	**8000**	**LF**	**$ 4**	**$ 32,000**
8. Minor Concrete (Retaining Walls)	**250**	**CY**	**$ 400**	**$ 100,000**
9. Storm Drain Inlet	**19**	**Each**	**$ 2,000**	**$ 38,000**
10. 24" RCP, Class III	**400**	**LF**	**$ 150**	**$ 60,000**
11. 18" RCP, Class III	**120**	**LF**	**$ 120**	**$ 14,400**
12. 12" RCP, Class III	10	LF	$ 120	$ 1,200
13. 12" CMP	700	LF	$ 100	$ 70,000
14. Lateral Pipe Entry	2	Each	$ 2,000	$ 4,000
15. 3" Slotted Plastic Pipe	7000	LF	$ 20	$ 140,000
16. 6" Unslotted Plastic Pipe	3200	LF	$ 25	$ 80,000
17. Subdrain Cleanout	44	Each	$ 400	$ 17,600
18. PCC Gutter (3" Thick)	4000	LF	$ 20	$ 80,000
19. Minor Concrete (Headwall)	4	CY	$ 500	$ 2,000
20. Metal Beam Guardrail	800	LF	$ 40	$ 32,000
21. Anchor Assembly	2	Each	$ 1,000	$ 2,000
22. Barbed Wire Fencing	7000	LF	$ 12	$ 84,000
23. Kit Fox Fencing	8000	LF	$ 24	$ 192,000
24. Survey Monuments	10	Each	$ 500	$ 5,000
25. Signing & Striping	100%	LS	$ 25,000	$ 25,000
26. Landscaping & Hydoseeding	100%	LS	$ 80,000	$ 80,000
27. Wetland Restoration	100%	LS	$ 100,000	$ 100,000
28. Slope Protection	1000	Ton	$ 100	$ 100,000
29. Environmental Mitigation	100%	LS	$ 100,000	$ 100,000
30. Cleaning Site & Misc. Things	100%	LS	$ 50,000	$ 50,000
Subtotal (Construction)				$ 5,691,200
Right of Way Acquisition	610000	SF	$ 1	$ 610,000
Preliminary Engineering and Design (25%)				$ 1,400,000
Construction Engineering (15%)				$ 850,000
Subtotal (Engineering)				$ 2,250,000
Contingencies (20% of Construction)				$ 1,130,000
Total				**$ 9,600,000**

ATTACHMENT I

Realignment and Safety Improvements on Vasco Road between Mile Post 3.0 and Mile Post 4.3.
Straight Alignment High Profile Alternative
Preliminary Estimates

Length of Project : 6,000 Feet

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL ($)
1. Clearing annd Grubbing	100%	LS	$ 70,000	$ 70,000
2. Traffic Control	100%	LS	$ 100,000	$ 100,000
3. Roadway Excacation	350000	CY	$ 6	$ 2,100,000
4. Asphalt Concrete, Type B	12200	Ton	$ 50	$ 610,000
5. Aggregate Base, Class 2	12800	Ton	$ 20	$ 256,000
6. Aggregate Subbase, Class 3	37000	Ton	$ 14	$ 518,000
7. AC Dike	12500	LF	$ 4	$ 50,000
8. Minor Concrete (Retaining Walls)	250	CY	$ 400	$ 100,000
9. Storm Drain Inlet	23	Each	$ 2,000	$ 46,000
10. 24" RCP, Class III	400	LF	$ 150	$ 60,000
11. 18" RCP, Class III	420	LF	$ 120	$ 50,400
12. 12" RCP, Class III	10	LF	$ 120	$ 1,200
13. 12" CMP	700	LF	$ 100	$ 70,000
14. Lateral Pipe Entry	4	Each	$ 2,000	$ 8,000
15. 3" Slotted Plastic Pipe	10000	LF	$ 20	$ 200,000
16. 6" Unslotted Plastic Pipe	3200	LF	$ 25	$ 80,000
17. Subdrain Cleanout	54	Each	$ 400	$ 21,600
18. PCC Gutter (3" Thick)	4000	LF	$ 20	$ 30,000
19. Minor Concrete (Headwall)	4	CY	$ 500	$ 2,000
20. Metal Beam Guardrail	1600	LF	$ 40	$ 64,000
21. Anchor Assembly	4	Each	$ 1,000	$ 4,000
22. Barbed Wire Fencing	11500	LF	$ 12	$ 138,000
23. Kit Fox Fencing	10500	LF	$ 24	$ 252,000
24. Survey Monuments	12	Each	$ 500	$ 6,000
25. Signing & Striping	100%	LS	$ 40,000	$ 40,000
26. Landscaping & Hydoseeding	100%	LS	$ 100,000	$ 100,000
27. Wetland Restoration	100%	LS	$ 120,000	$ 120,000
28. Slope Protection	1000	Ton	$ 100	$ 100,000
29. Environmental Mitigation	100%	LS	$ 110,000	$ 110,000
30. Cleaning Site & Misc. Things	100%	LS	$ 80,000	$ 80,000
Subtotal (Construction)				$ 5,437,200
Right of Way Acquisition	900000	SF	$ 1	$ 900,000
Preliminary Engineering and Design (25%)				$ 1,400,000
Construction Engineering (15%)				$ 850,000
Subtotal (Engineering)				$ 2,250,000
Contingencies (20% of Construction)				$ 1,100,000
Total				$ 9,700,000
			Call	**$ 10,000,000**

ATTACHMENT J

Realignment and Safety Improvements on Vasco Road between Mile Post 3.4 and Mile Post 4.3
Reverse Curves Alignment Alternative
Preliminary Estimates

Length of Project : 4,000 Feet

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL ($)
1. Clearing annd Grubbing	100%	LS	$ 50,000	$ 50,000
2. Traffic Control	100%	LS	$ 70,000	$ 70,000
3. Roadway Excacation	310000	CY	$ 6	$ 1,860,000
4. Asphalt Concrete, Type B	7600	Ton	$ 50	$ 380,000
5. Aggregate Base, Class 2	8000	Ton	$ 20	$ 160,000
6. Aggregate Subbase, Class 3	23000	Ton	$ 14	$ 322,000
7. AC Dike	8000	LF	$ 4	$ 32,000
8. Minor Concrete (Retaining Walls)	250	CY	$ 400	$ 100,000
9. Storm Drain Inlet	17	Each	$ 2,000	$ 34,000
10. 24" RCP, Class III	400	LF	$ 150	$ 60,000
11. 18" RCP, Class III	120	LF	$ 120	$ 14,400
12. 12" RCP, Class III	0	LF	$ 120	$ -
13. 12" CMP	560	LF	$ 100	$ 56,000
14. Lateral Pipe Entry	2	Each	$ 2,000	$ 4,000
15. 3" Slotted Plastic Pipe	7000	LF	$ 20	$ 140,000
16. 6" Unslotted Plastic Pipe	3200	LF	$ 25	$ 80,000
17. Subdrain Cleanout	44	Each	$ 400	$ 17,600
18. PCC Gutter (3" Thick)	3000	LF	$ 20	$ 60,000
19. Minor Concrete (Headwall)	4	CY	$ 500	$ 2,000
20. Metal Beam Guardrail	1300	LF	$ 40	$ 52,000
21. Anchor Assembly	6	Each	$ 1,000	$ 6,000
22. Barbed Wire Fencing	7000	LF	$ 12	$ 84,000
23. Kit Fox Fencing	8000	LF	$ 24	$ 192,000
24. Survey Monuments	10	Each	$ 500	$ 5,000
25. Signing & Striping	100%	LS	$ 25,000	$ 25,000
26. Landscaping & Hydoseeding	100%	LS	$ 70,000	$ 70,000
27. Wetland Restoration	100%	LS	$ 100,000	$ 100,000
28. Slope Protection	1000	Ton	$ 100	$ 100,000
29. Environmental Mitigation	100%	LS	$ 100,000	$ 100,000
30. Cleaning Site & Misc. Things	100%	LS	$ 50,000	$ 50,000
Subtotal (Construction)				$ 4,226,000
Right of Way Acquisition	550000	SF	$ 1	$ 550,000
Preliminary Engineering and Design (25%)				$ 1,050,000
Construction Engineering (15%)				$ 630,000
Subtotal (Engineering)				$ 1,680,000
Contingencies (20% of Construction)				$ 840,000
Total				$ 7,290,000

ATTACHMENT K

5

PRELIMINARY ENVIRONMENTAL ASSESSMENT
VASCO RD. REALIGNMENT PHASE I

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December 19, 1997

PROJECT LOCATION: The proposed project is located on Vasco Road that runs north from the City of Livermore into Contra Costa County in the eastern part of Alameda County. The project begins from MP 3.4 to MP 4.3 and includes about 500-foot segment of the newly constructed segment of the road in Contra Costa County.

PROECT DESCRIPTION: The project proposes to realign portions of the roadway easterly and westerly of the existing road in order to flattened the dangerous curves in the road. Several alternatives have been considered. The preferred alternative runs easterly of the existing road (at the southerly limits) and westerly (at the northerly limits) to intersect the new roadway in Contra Costa County. The project construction would involve severe cuts and excavation and fill to lower and raise the roadway gradient. In addition, an existing CMP that crosses underneath the road way will be replaced. The proposed project is a Phase 1 of a project that would extend south to intersect Interstate Highway 580.

PROJECT PURPOSE: The proposed project purpose is to upgrade the existing road to current standards and safety.

A. ENVIRONMENTAL SETTING:

The project is located on the easterly edge of the Inner Coast Ranges characterized by rolling hills and valleys with intermittent creeks that drain into northern parts of the Livermore Las Positas Valley.

Geology: The geology of the proposed project area is composed of complexly folded and faulted Tertiary marine and nonmarine formations, and cretaceous marine formations (AGS 1989). The upland areas are underlain by Panoche Formation, which consists of shale and interbedded sandstone, mudstone, claystone and siltstone. (Jones and Stokes Associates 1990). The highest points within the project immediate vicinity is 1300 feet. The valleys and the low land areas consist of alluvial fan and basin deposits. In most areas the hard rock is at depths of 25 feet of less.

Soil: The Soil in the project area is described as Altamont-Diablo-Fontana Association on the uplands and the Marcuse-Solano-Pescadero Association on the low land areas. Both types of Soil Association groups have moderate to high potential for expansion and erodability. (Jones and Stokes Associates 1990).

Grassland - The project area is dominated by annual grasslands (*Bromus mollis, B. rubens, B. diandrus, Avena barbata, A. fatua, Hordeum leporinum, Erodium cicutarium, E. botrys*), with sparsely distributed perennial grasslands of alkali ryegrass (*Leymus tritichoides*). Interspersed within the grasslands along the hilltops, are areas of rocky outcrops with shallow soils supporting patches of herbaceous plants such as locoweed (*Astragalus oxyphysus*). The

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grasslands provide livestock forage and foraging, protect the soil from erosion, and provide habitat for several wildlife species.

Riparian Corridor A well-defined unnamed intermittent creek that drains the hill slopes in the northwesterly segment of the proposed project alignment, crosses the roadway through a CMP and runs parallel to the southerly segment of the proposed project to drain into the Livermore Amador Valley. This creek corridor represents a remnant riparian habitat that is heavily degraded by cattle grazing, resulting in a loss of vertical structure and severely reduced herbaceous layer. This grazing activity has resulted in severe gullying. Near the culvert inlet and extending to the outlet (on the south side of the road) is a growing stand of mostly tree of heaven (*Ailanthus altissima) with* occasional willow trees (*Salix spp.*). Roadside landscaping of young coast live oak and fruit trees occur along the easterly edge of the road, near the southerly limits of the project. Five large matured oak trees *(Quercus agrifolia)* also occur along the creek at this segment of the project. Riparian areas provide critical habitat for a variety of wildlife species, protect against soil erosion, and filter out nutrients, sediment, and other pollutants.

Wildlife - A number of wildlife species potentially utilizes the project area. Among the more common animals found within the grassland community are: western fence lizards, gopher snakes, horned larks, western meadow larks, western screech owls, American kestrels, red-tailed hawks, deermice, desert cotton tails, California ground squirrels, striped skunks, red foxes, and coyotes (Jones and Stokes, 1989).

Riparian woodlands are an important wildlife resource. Although few upland species spend their entire life cycle in or next to a creek, most animals rely on the riparian areas in some way. Among the more common species that can be found utilizing riparian woodlands are: aquatic and terrestrial vertebrates species. These species include California slender salamander, western skink, common garter snake, ringneck snake, warble, northern flicker, downy woodpecker, flycatcher, great horned owl, red-tail hawk, American kestrel, bat, shrew, vole, mice, striped skunk, raccoon, red and grey fox, badger, and deer (Jones and Stokes, 1989).

Rare, threatened, and endangered species within or near project area -- There is several rare, threatened, and endangered species which can be found near the project area. Many are associated with special habitats. Several state or federal listed species have been observed within a five mile radius of the project site including: kit fox (*Vulpes macrotis mutica*), burrowing owl (*Athene cunicularia*), tricolored blackbird (*Agelaius tricolor*), Alameda whipsnake (*Masticophis lateralis euryxanthus*), California red-legged frog (*Rana aurora draytonnii*), California tiger salamander (*Ambystoma tigrinum*), Mt. Diablo manzanita (*Arctostaphylos auriculata*), brittlescale (*Atriplex parishii*), San Joaquin spearscale (*Atriplex patula* ssp. *spicata*), and Diablo helianthella (*Helianthelle castenea*) (Jones and Stokes, 1989).

Cultural Resources -Four separate Native American linguistic groups (Costanoans, the Bay

Miwok, the plains Miwok, and the Northern Valley Yokuts) are known to have utilized the project area, as they maintained mutual territorial boundaries in the project area. Archaeological sites, such as rock shelters and small encampments, including the Vasco Caves and petroglyphs have been found within two miles of the project area. Although records and literature review found no known historic or archaeological sites within the project alignment, it is highly likely that buried and or exposed archaeological sites may occur within the project area especially along midslope terraces, ridge tops, and stream terraces. These resources may be uncovered during project construction.

A. INITIAL STUDY

Initial investigations were conducted by reviewing entries in the California Natural Diversity Database (NDDB), consulting with the Northwest Information Center, reviewing the *Vasco Road and Utility Relocation Project Environmental Impact Report*, and by conducting a site visit on December 3, 1997.

B. ADDITIONAL STUDIES REQUIRED

1. Additional Biological site surveys would be needed to determine the extent of impacts to resources including special status species and their habitats known to occur within the project area. These species would include but not limited to rare, threatened, or endangered species such as San Joaquin pocket mouse (*Perognathus inornatus inornatus*), the American badger (*Taxidea taxus*), ferruginous hawk (*Buteo regalis*), and the northern harrier (*Circus cyaneus)*

2. Project Site reconnaissance for historic and prehistoric cultural resources will need to be conducted. The recommendation from this reconnaissance should be followed.

3. Soil studies may be needed to determine the characteristics, e.g., soil expansion along the project alignment. This is important because of the proximity of site to earth quake fault.

C. ADDITIONAL ENGINEERING INFO NEEDED

Exact project alignment including cut and fill zones would be required to determine extent of potential impacts to wetland resources. The preferred alignment Alternative 1 appears to require some filling of the creek at the inlet and downstream of the outlet along the southerly limits of the project. Slight modifications to this alignment will negate any impacts to this wetland.

D. RECOMMENDATIONS

The following recommendations are provided to minimize impacts to the creek corridor:

1. The recommended further studies should include the future phases (II & III) of the project in order to address regulatory agencies cumulative impacts concerns
2. The project is located along County designated Scenic route. The proposed project may be

in conflict with this designation and would therefore require changes to the County General and Specific plan if the realignment is considered significant.

3. The design of the proposed project and its subsequent phases should consider impacts to resources e.g., stock pond further south. Obtaining permits for filing a stock pond (that may be habitat for special status species) may pose a problem with regulatory agencies.
4. Realign the southerly segment of the project westerly, to avoid filling the wetland to the east of the roadway.
5. Install a retaining wall along the toe of the existing road at the southerly limits of the project to minimize encroachment onto the wetlands to the east.
6. Include in the project design and construction, enhancement of the wetlands along the southerly limits as a mitigation for the proposed fill at the inlet of the culvert and at other locations.

E. ENVIRONMENTAL PERMITS REQUIRED

1. **US Army Corps of Engineers Permit** (US Fish and Wildlife Service Section 7 Consultation may be required. This permit would take anywhere from one month to 12 months depending on project impacts and proposed mitigation plans.
2. **RWQCB Sec 401 Water Quality Certification/waiver**. This permit would also take three to 6 months to negotiate depending on project impacts.
3. **CA Dept. Of Fish and Game 1601 Streambed Alteration Agreement.** This Agreement would take about one month to negotiate if project impacts are minimal.

F. ALTERNATIVES TO CONSIDER

There are four alternative alignments being considered for the project. Each alignment has a slightly different set of impacts upon the environment. The main difference lies in the alignment of the road in relation to the unnamed creek at the southern terminus of the project. Alternative 1 (the preferred alternative) aligns the new road to the West of the existing road and would result in lesser impacts to resources than the other alternatives. This alignment is therefore, recommended (with minor modifications as stated under Section D 3,4 & 5 above). In addition, the area adjacent to the east side of the road near the southerly limits provides an excellent mitigation area for impacts elsewhere along the project alignment. Alternative 2 - 4 approach the southern terminus from the east side of the existing road, and will result in greater impacts to wetland habitats of higher quality (including removal of the large oak trees) than Alternative 1. Alternative 2 - 4 will also require finding another site to mitigate the impacts from the loss of the wetlands at the southerly limits of the project.

G. MITIGATION MEASURES

New wetlands will need to be created to replace filled wetlands associated with the project. Wetlands will be replaced at minimum, on a 1:1 ratio. The area adjacent to the creek near the southerly limits of the project provides excellent potential for the establishment or enhancement of the existing degraded riparian corridor. Trees removed as part of the project will require mitigation at a 3:1 ratio (three trees for everyone removed). Likely tree species include willow (*Salix* spp.), coast live oak (*Quercus agrifolia*), and tree of heaven (*Ailanthus altissima*). Removal of the matured oaks trees along the creek may result in a higher replacement ratio.

Any impacts to threatened or endangered species habitat will also require mitigation. Any mitigation for endangered species will be species specific. If several species from a similar habitat are affected, then mitigation will likely focus on creation and/or restoration of the impacted habitat. Alameda County will develop a protection plan to reduce any potential impacts to important resources during pre-and post construction.

The proposed project should consider installation of similar fence along the proposed realignment to conform with the existing Kit-fox/Tiger salamander protection fence located along the segment of the road in Contra Costa County.

REFERENCES

Compas, Lynn (1997), "Cultural resource record search for the realignment of a portion of Vasco Road"; Northwest Information Center; Rohnert Park, CA.

Jones and Stokes (1990), "Draft Environmental Impact Report Vasco Road and Utility Relocation Project SCH # 89032123," prepared for Contra Costa Water District, Concord, CA.

Dept. Of Fish and Game (1997), California Natural Diversity Database: Inventory Status Figures - Byron Hot Springs and Altamont 7.5 minute quadrangles.

AGS Inc. 1989. Draft preliminary geotechnical investigation: L Vasco Road relocation - Los Vasqueros project. Contra Costa and Alameda Counties, California, Sacramento, CA, prepared for: James Montgomery, Consulting Engineers, Inc., Walnut Creek, CA

PRELIMINARY DRAFT—For Review and Comment

23-Feb-98

TRACK I INVESTMENTS

1998 Regional Transportation Plan for Contra Costa County

Project costs and revenues shown in millions of escalated dollars

Project	Total Cost	Other Funds(1)	Track I Total
I-80 Corridor			
New express buses (capital only)	$25.0	$0.0	$25.0
I-80 HOV lanes, SR 4 to Carquinez Bridge	$39.4	$0.0	$39.4
AC Transit enhanced service, San Pablo Avenue	$3.4	$0.0	$3.4
I-80: interchange & parallel arterial projects (3)	$10.0	$0.0	$10.0
State Route 4 Corridor			
SR 4 West: widen to full freeway	$77.3	$6.0	$71.3
SR 4 East: 8 lanes to Somersville, 6 lanes beyond (4)	$131.9	$65.9	$65.9
SR 4 Bypass: widen to 4 lanes & new interchanges	$41.4	$5.9	$35.5
SR 4: interchange & parallel arterial projects (3)	$25.0	$0.0	$25.0
I-680 North Corridor			
I-680 Auxiliary Lanes, Diablo Rd to Bollinger	$72.9	$24.0	$48.9
SR 24 auxiliary lanes, Gateway Blvd to Brookwood	$10.3	$0.0	$10.3
I-680: interchange & parallel arterial projects (3)	$25.0	$0.0	$25.0
Other Projects			
Vasco Rd improvements in Alameda County (5)	$5.8	$0.0	$5.8
MTOS: Arterial improvements	$5.0	$0.0	$5.0
Total	**$472.4**	**$101.8**	**$370.5**
Available Track I Revenues			**$480.2**
Remaining Balance			**$109.7**

(1) "Other Funds" are from local sales tax revenues and impact fees

(2) "Track I Funds" are from STP, CMAQ, TIP and IIP

(3) A suggested proxy list of interchange and arterial projects for analyzing air quality conformity is:

- a) widen Ygnacio Valley/Kirker Pass from Cowell to Clearbrook
- b) improve the I-680-Alcosta interchange
- c) widen Alhambra Avenue from SR 4 to McAlvey
- d) widen Pacheco Blvd from Blum to Arthur

(4) SR 4 widening projects assume 50% of cost will be locally funded

(5) Contingent on Alameda County match of $5.8 M

Baseline Projects for the 1998 Regional Transportation Plan

Contra Costa County

Project	Status
I-680/SR 24 Interchange	Under Construction
I-680 Interchange/overcrossing improvements	Under Construction
Richmond Parkway: Phase 1B south & Phase 4	Under Construction
Oak Park Blvd overcrossing improvements	Locally Funded
Gateway Lamorinda Traffic Program	Locally Funded
SR 4: RR Ave I/C improvements, widen to Loveridge	Locally Funded
SR 24: auxiliary lane (initial stages of design only)	Locally Funded
SR 4 Bypass: I/C @ SR 4/160, 2 lanes to Balfour	Locally Funded
Bollinger Canyon Rd: extend, Alcosta to Dougherty	Locally Funded
Dougherty Rd: widen to 6 lanes, Red Willow to Alameda	Locally Funded
Windermere Pkwy: construct 4 lanes	Locally Funded
East Branch: construct 4 lanes, Bollinger to Camino Tassajara	Locally Funded
SR 242: mixed-flow lane	Locally Funded
I-680: HOV lanes, Benicia-Martinez Bridge to N. Main	STIP Funds
Benicia-Martinez Bridge: construct 2nd span	STIP Funds
Carquinez Bridge: replace west bridge, add HOV	STIP Funds
Amtrak Capitol Corridor: expand service	STIP Funds
SR 4 TOS	STIP Funds
SR 4: widen to 8 lanes (2 HOV), Bailey to RR	STIP Funds
Martinez Intermodal Facility	STIP Funds
SR 242: Concord ramps and auxiliary lane	STIP Funds

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Appendix B

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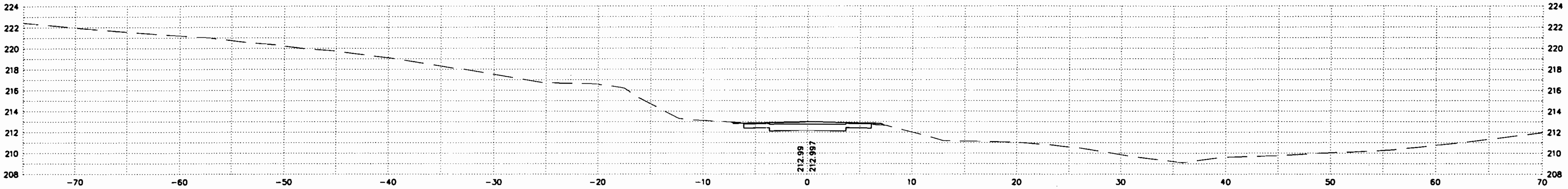

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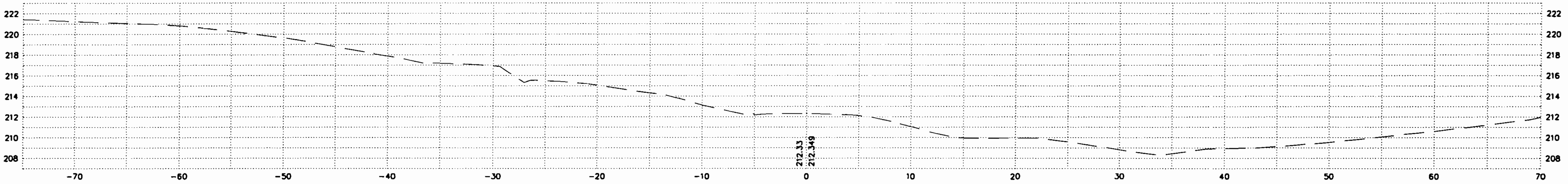

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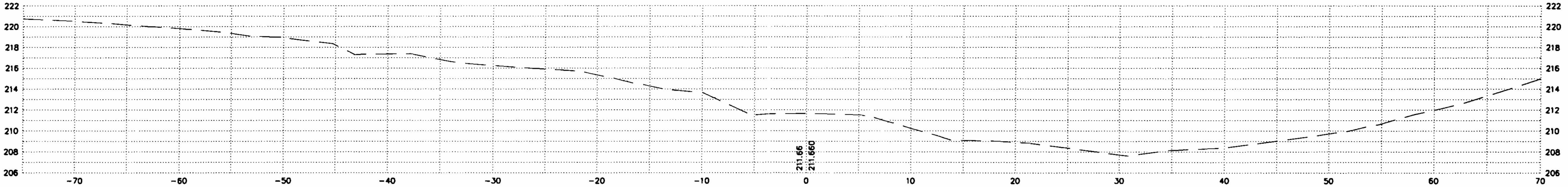

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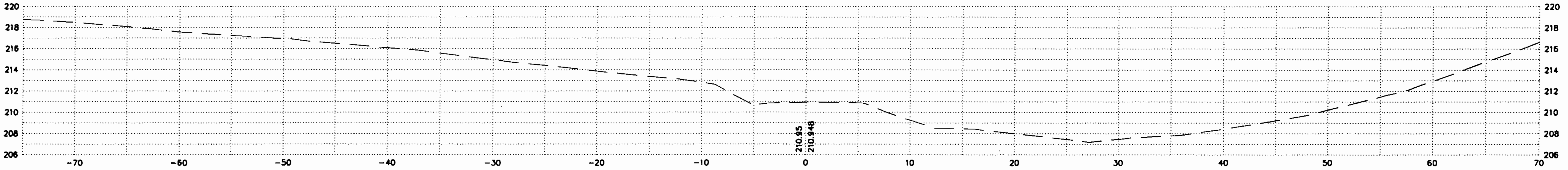

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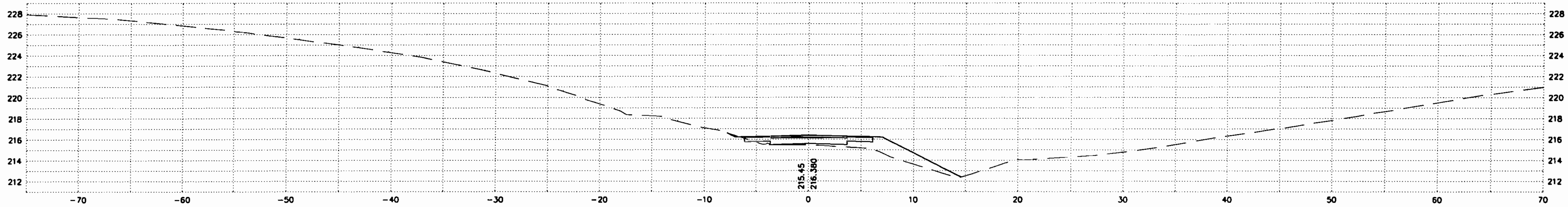

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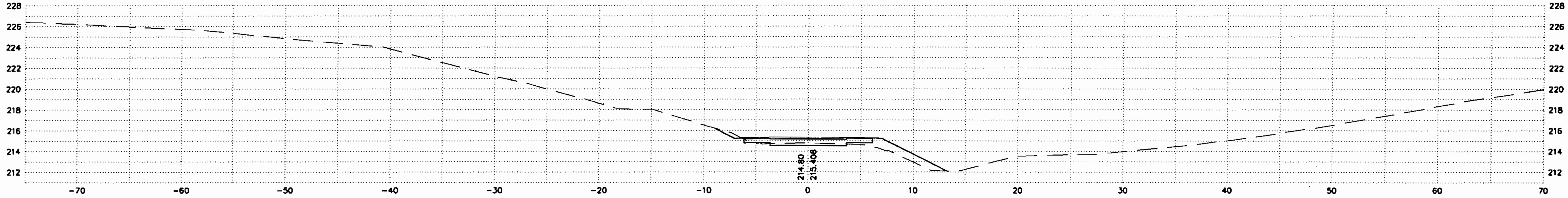

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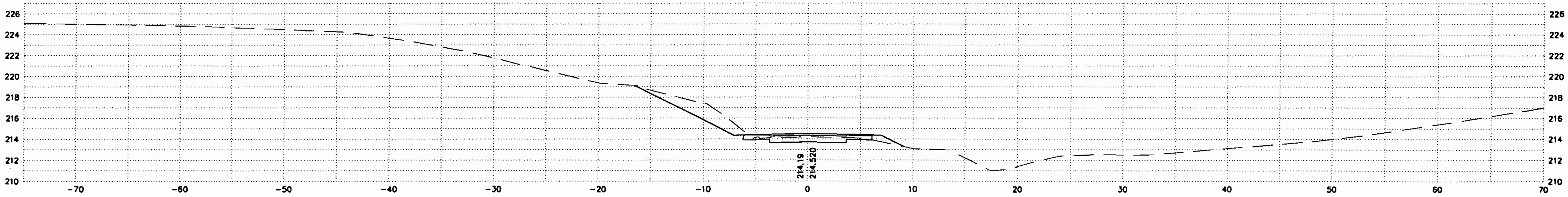

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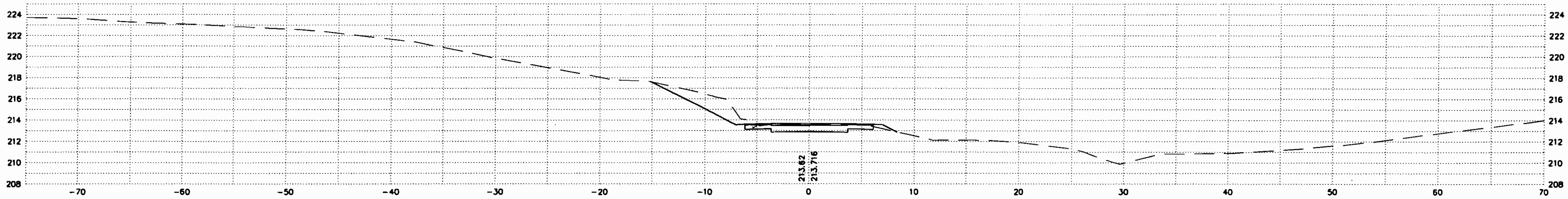

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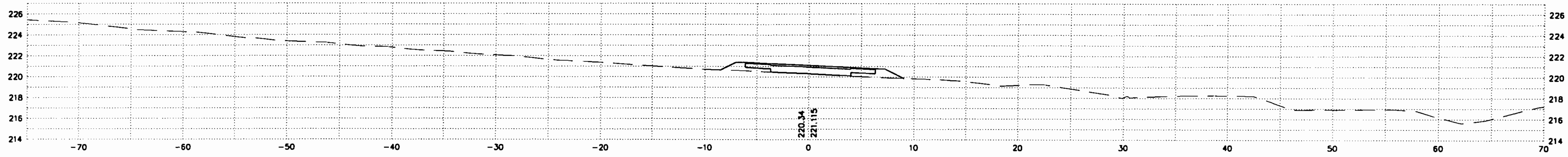

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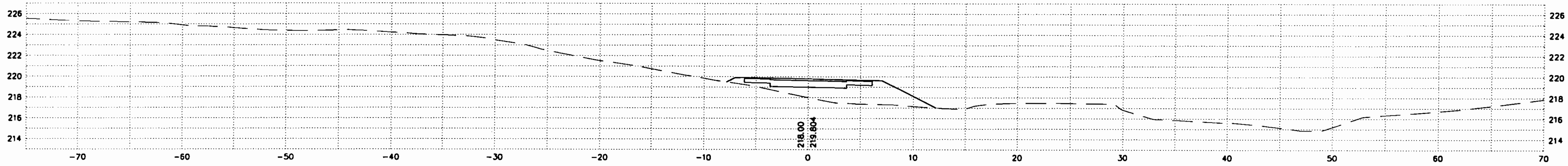

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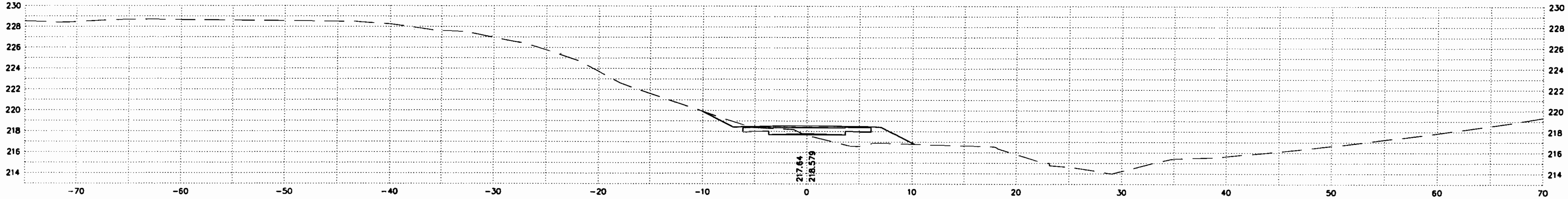

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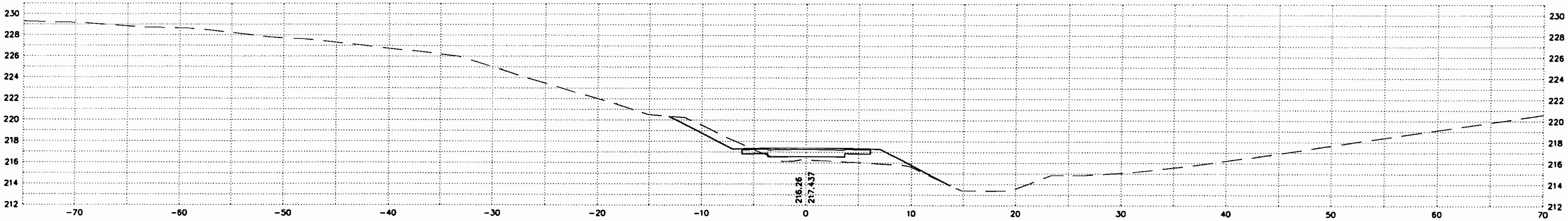

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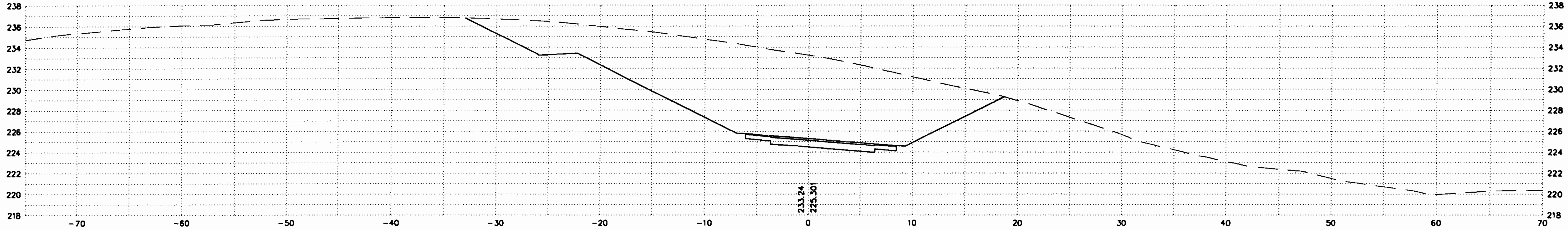

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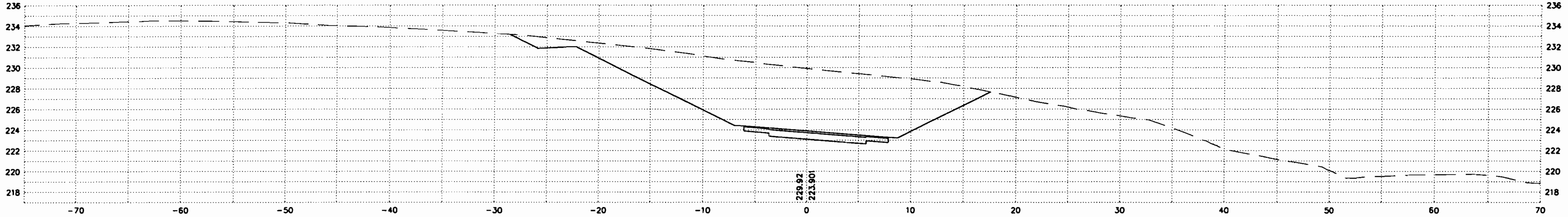

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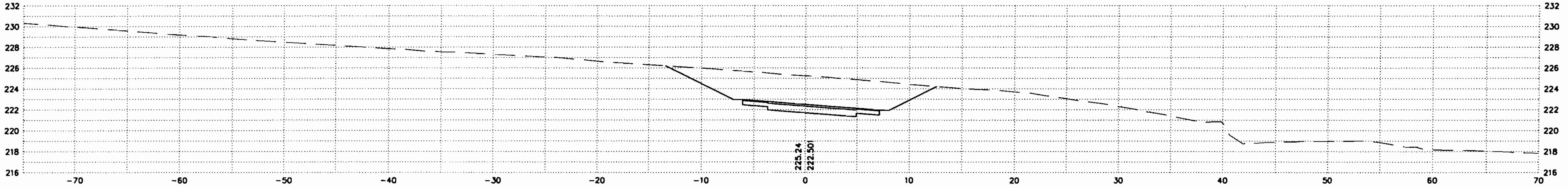

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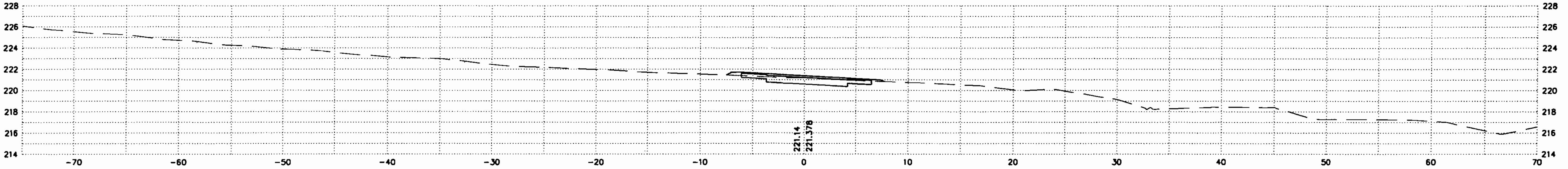

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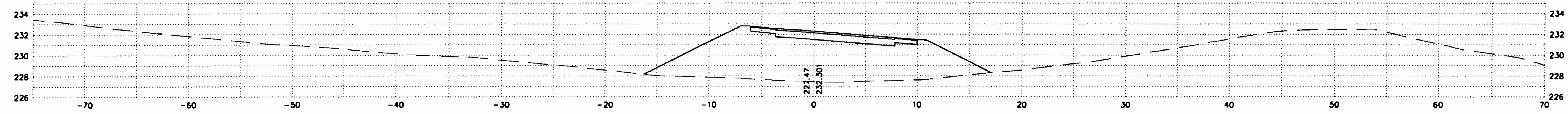

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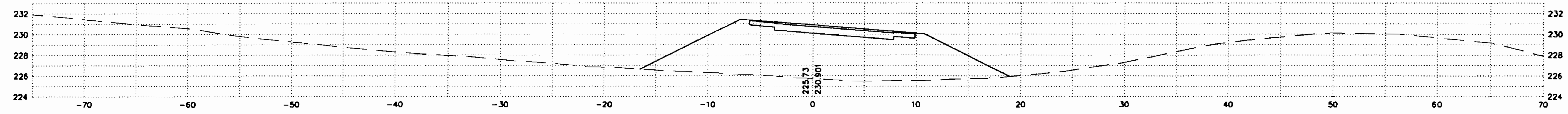

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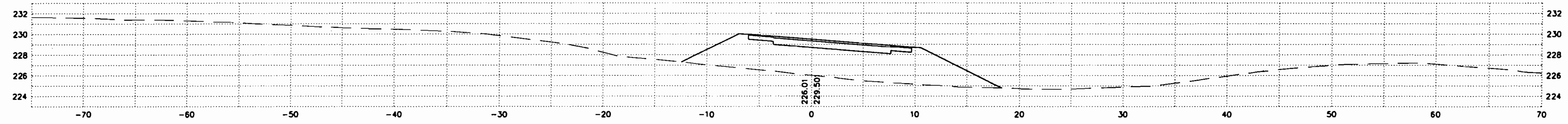

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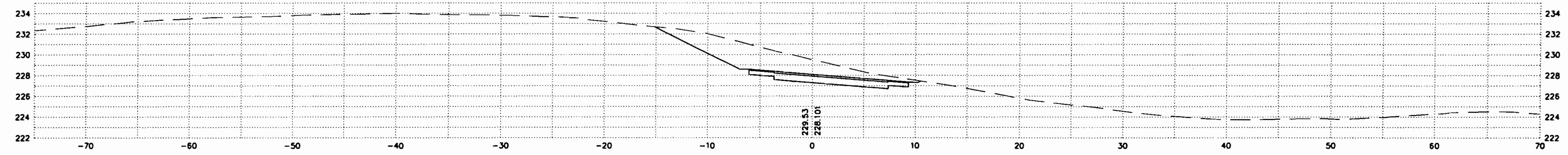

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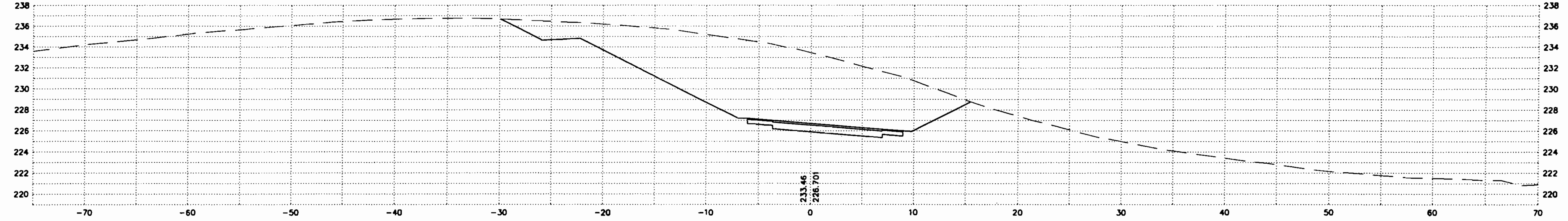

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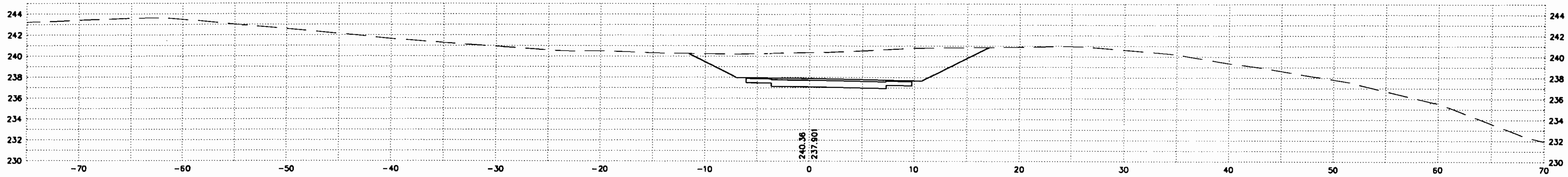

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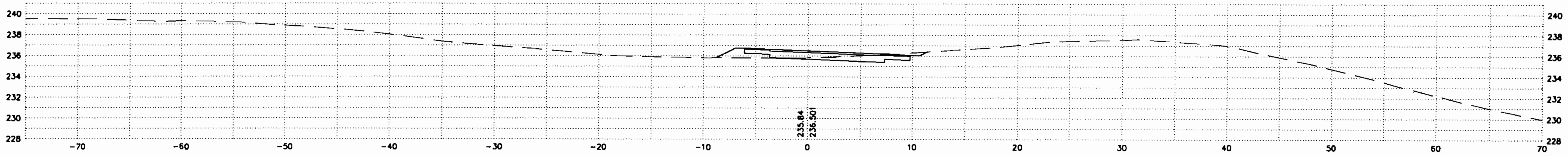

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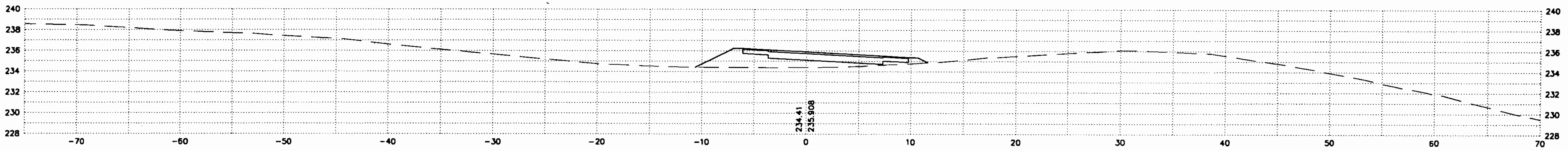

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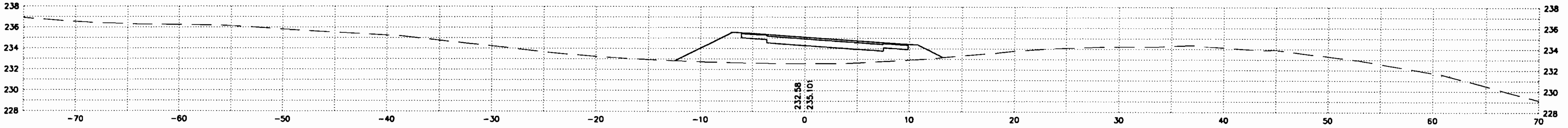

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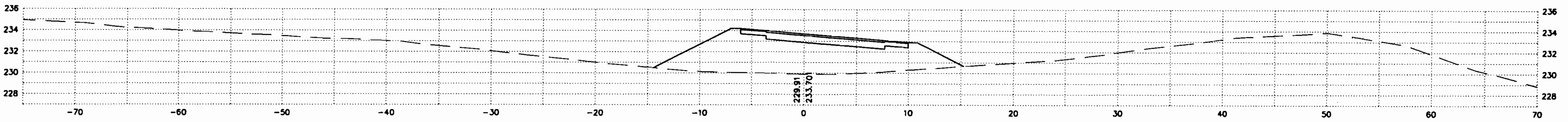

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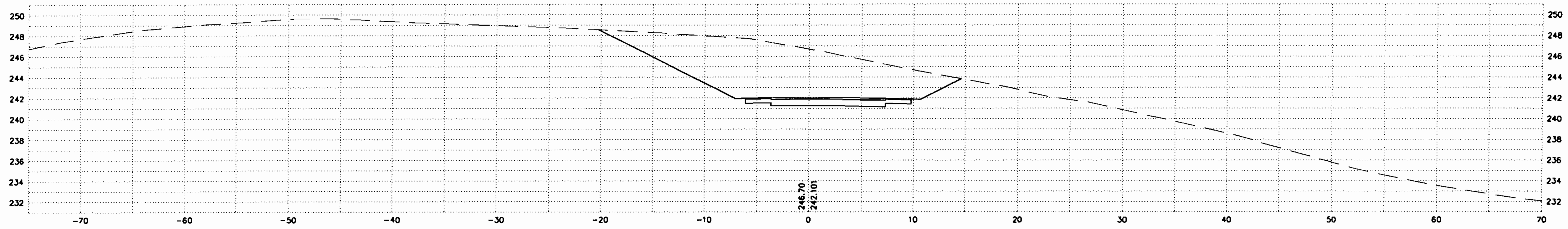

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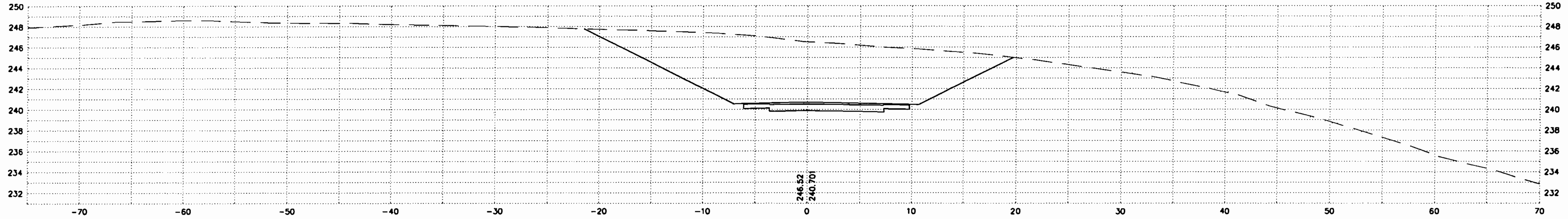

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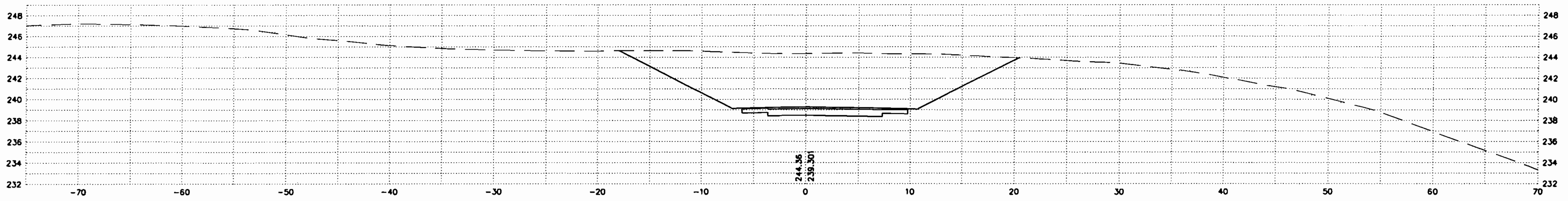

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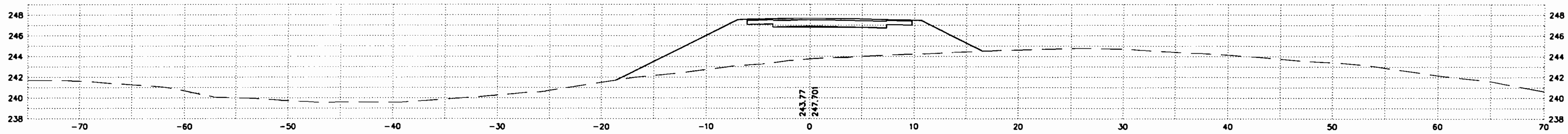

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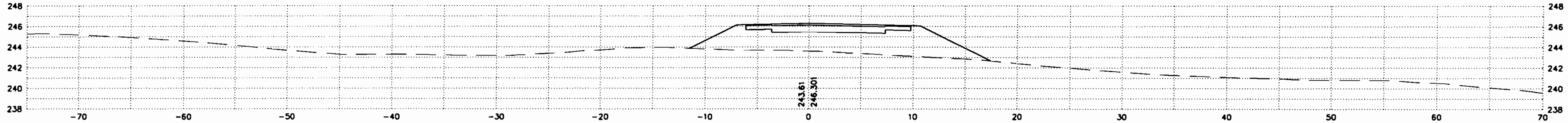

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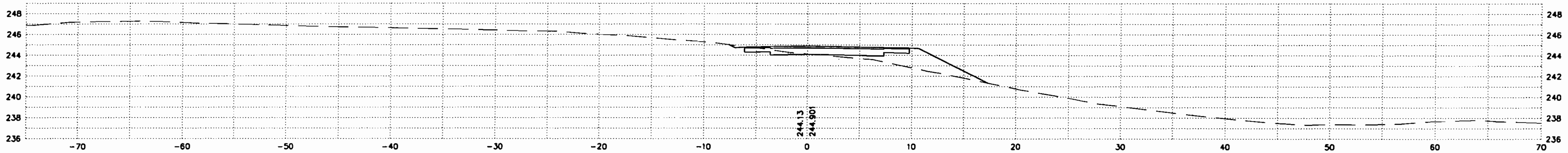

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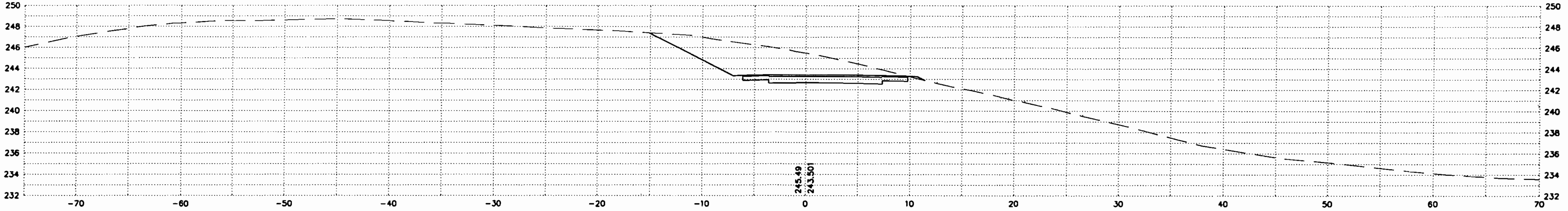

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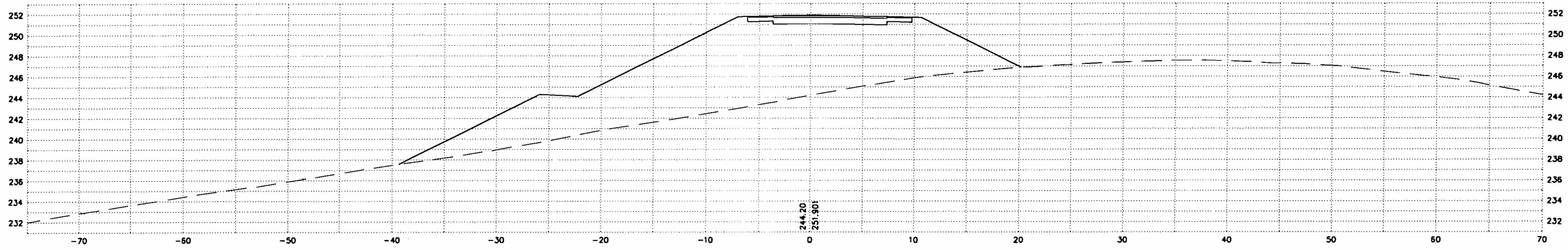

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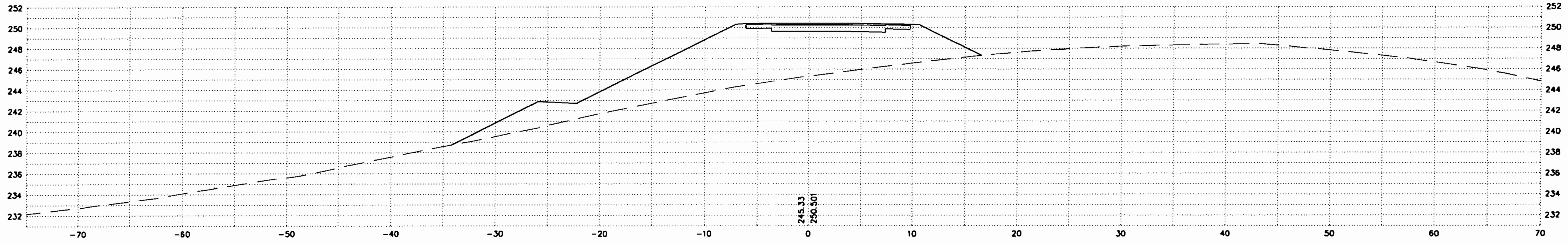

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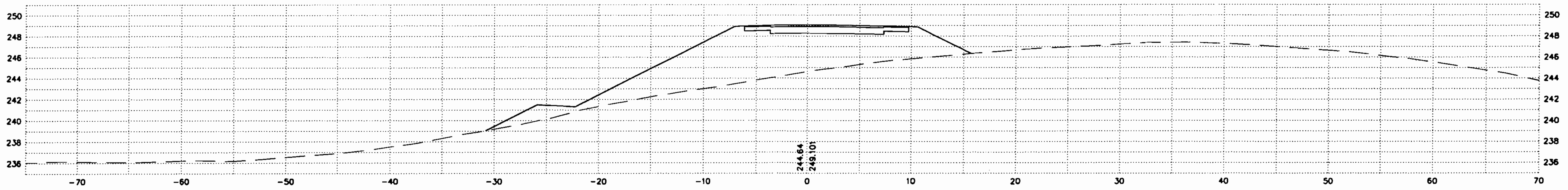

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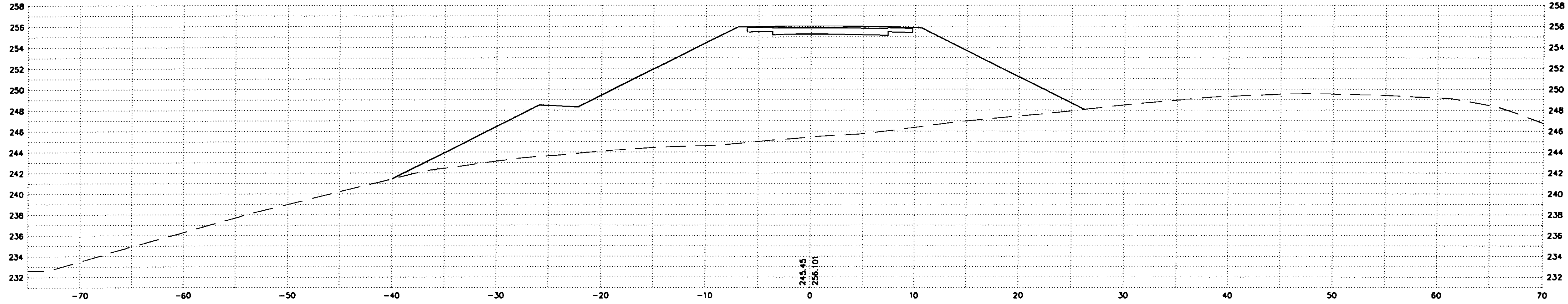

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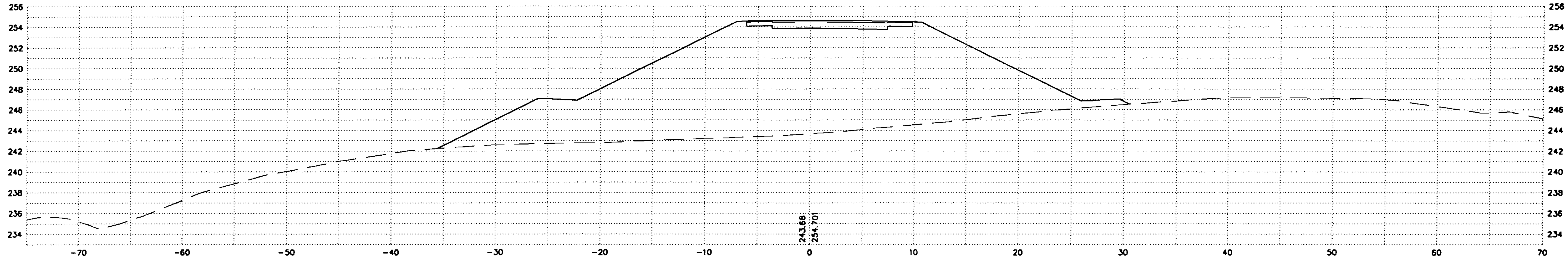

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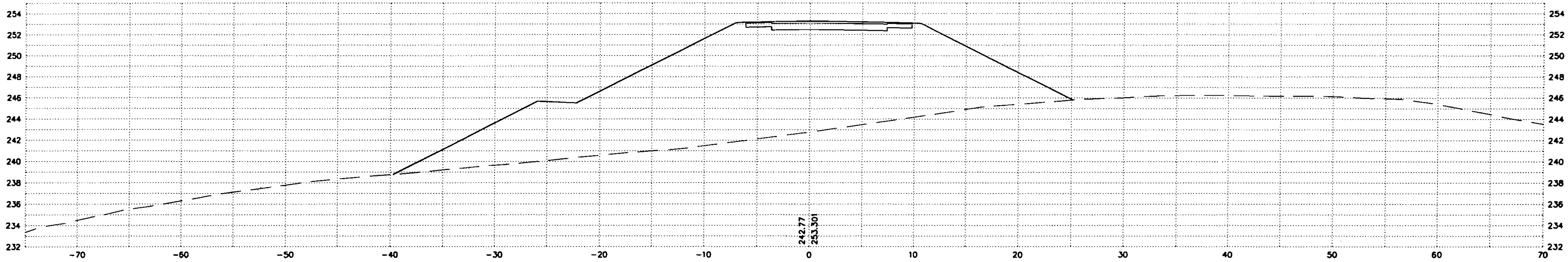

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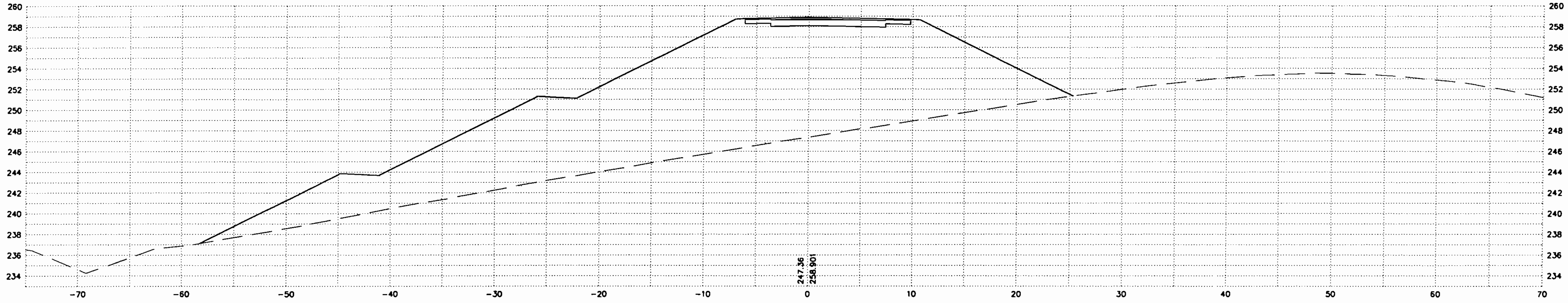

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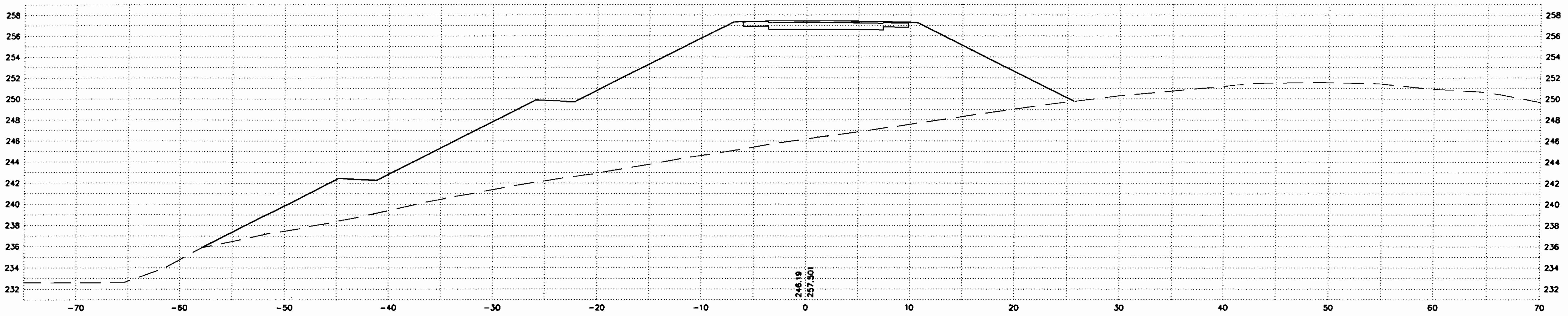

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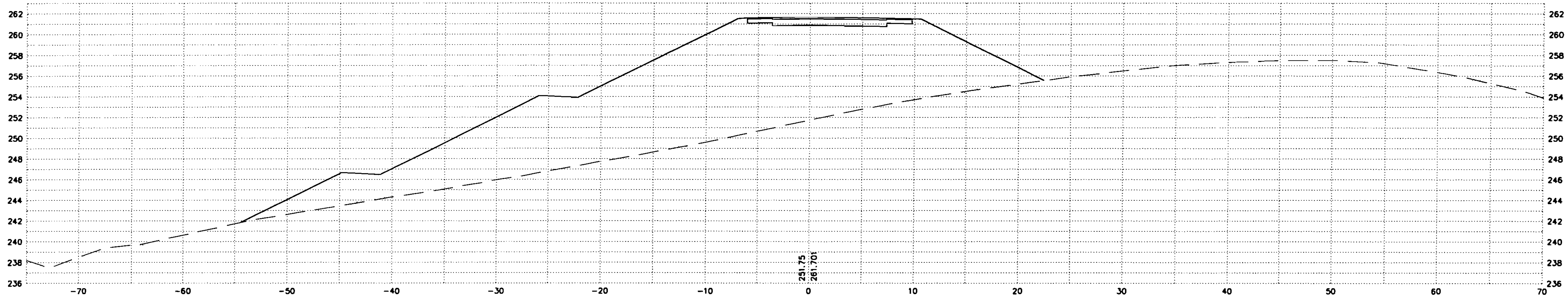
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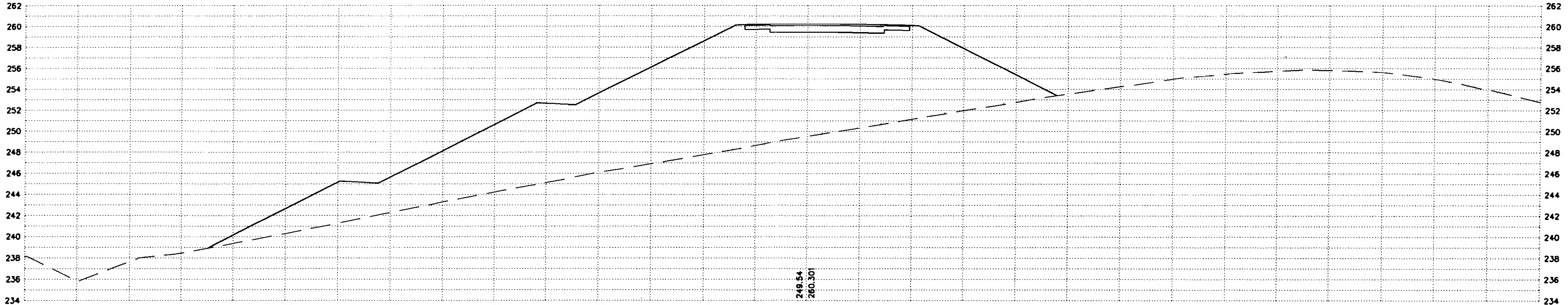
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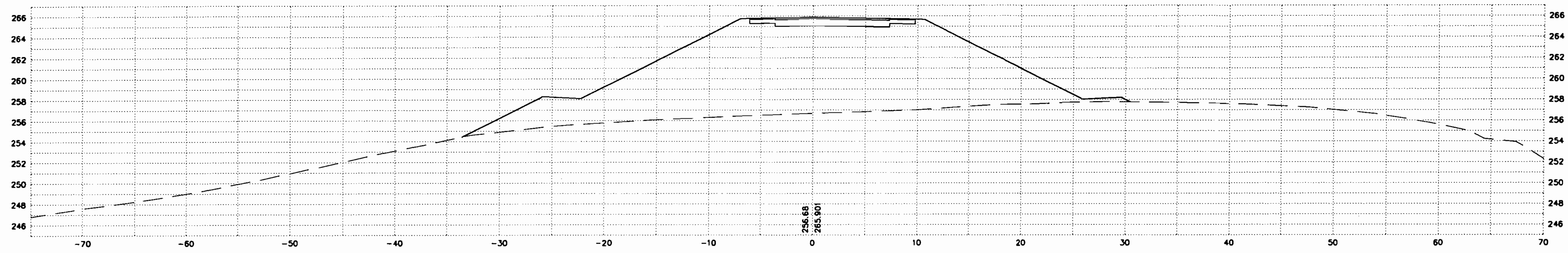

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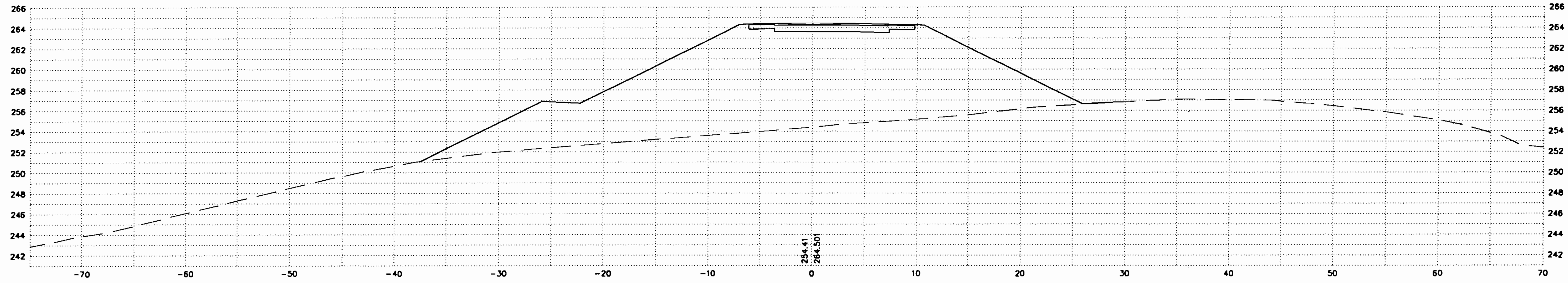

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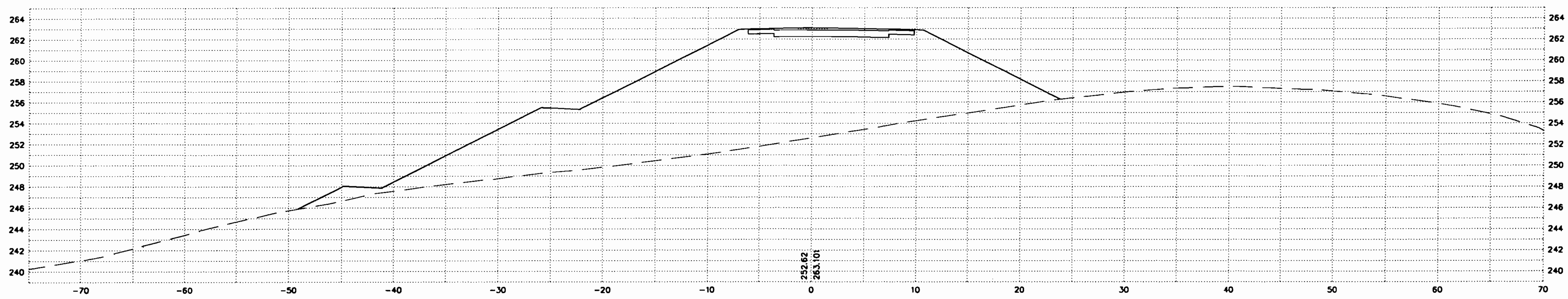

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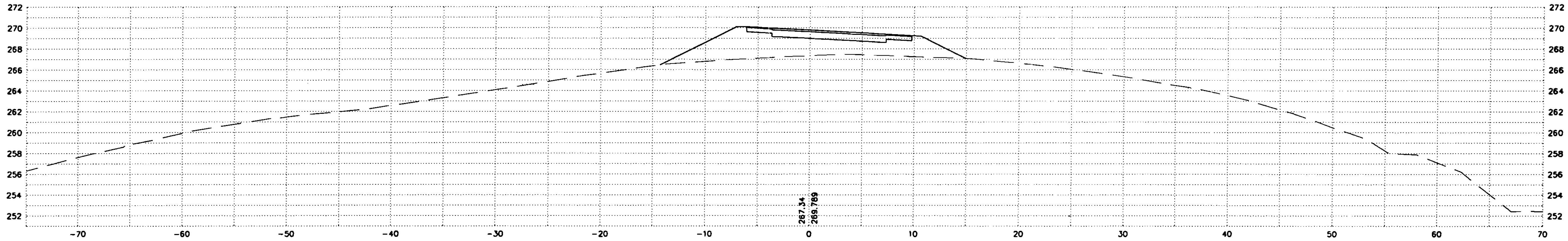

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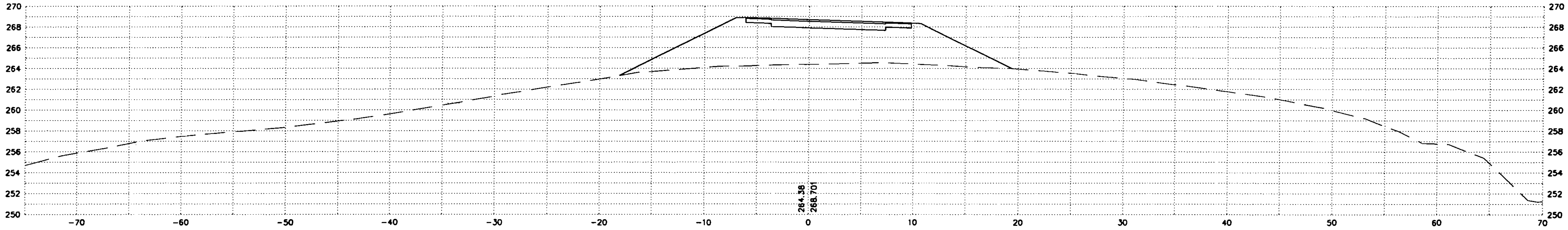

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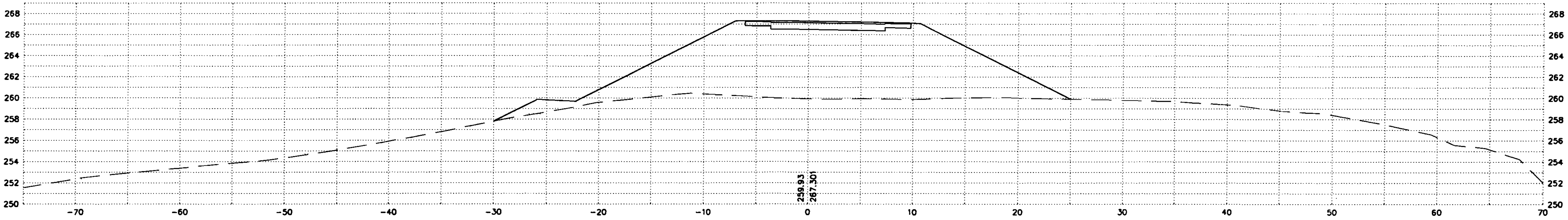

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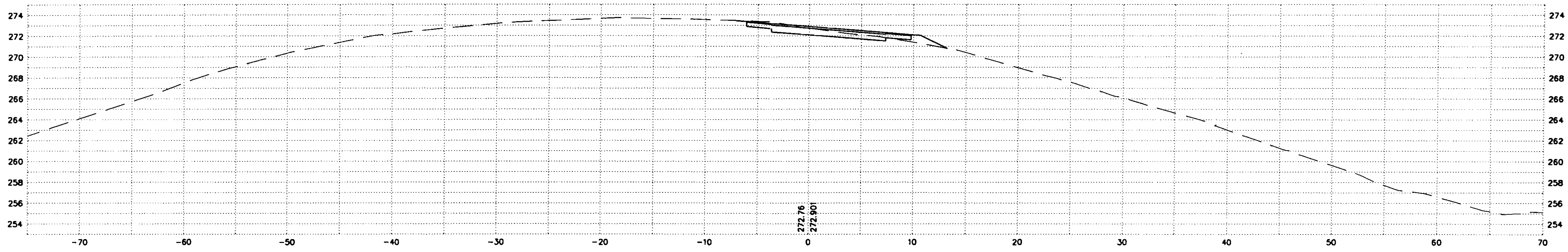

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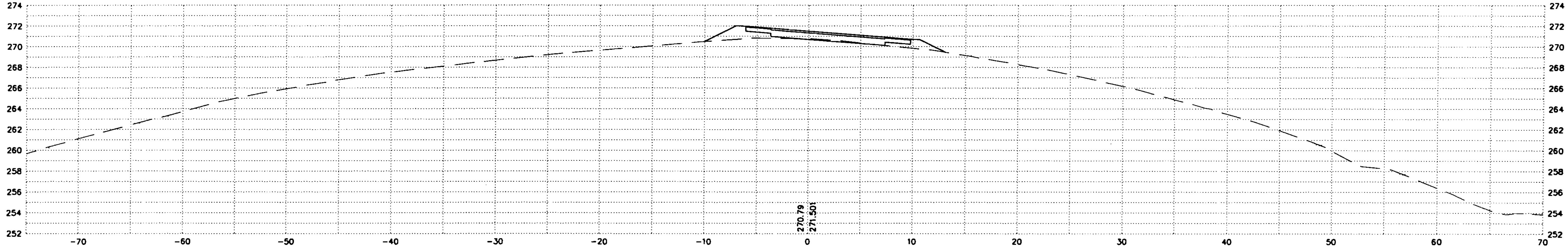

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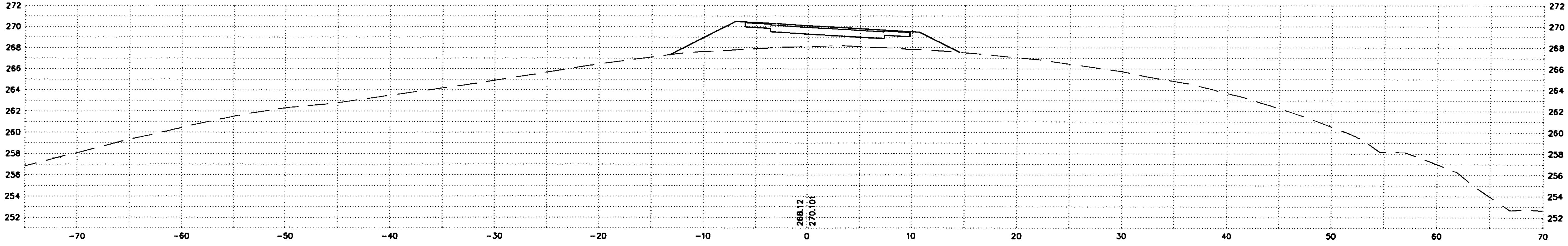

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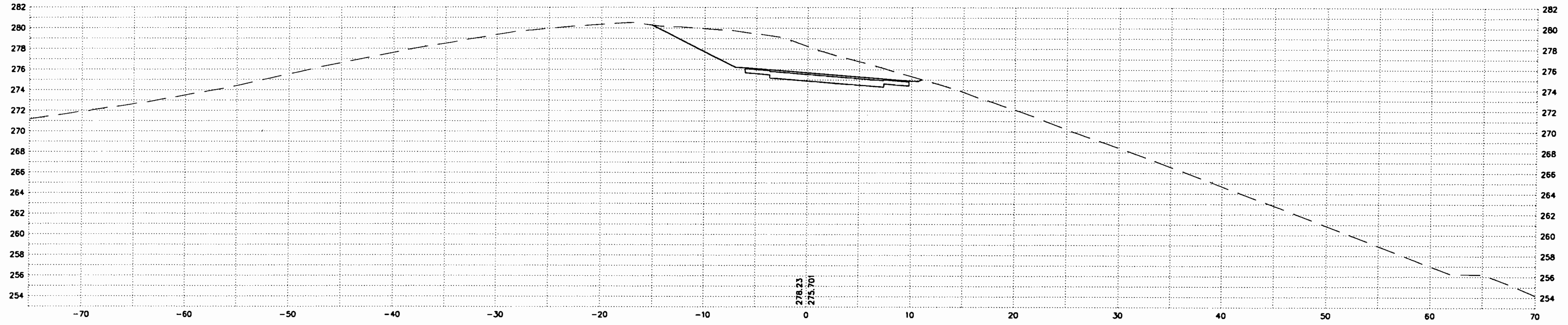

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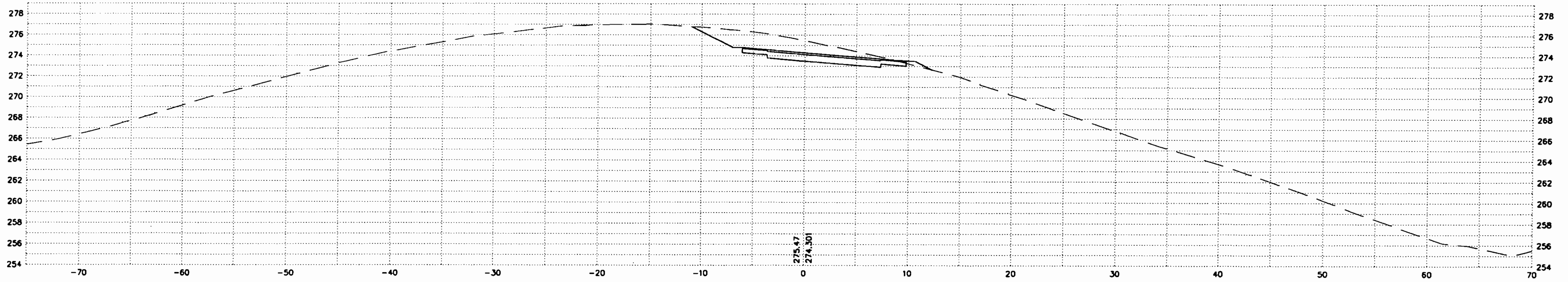
1+020



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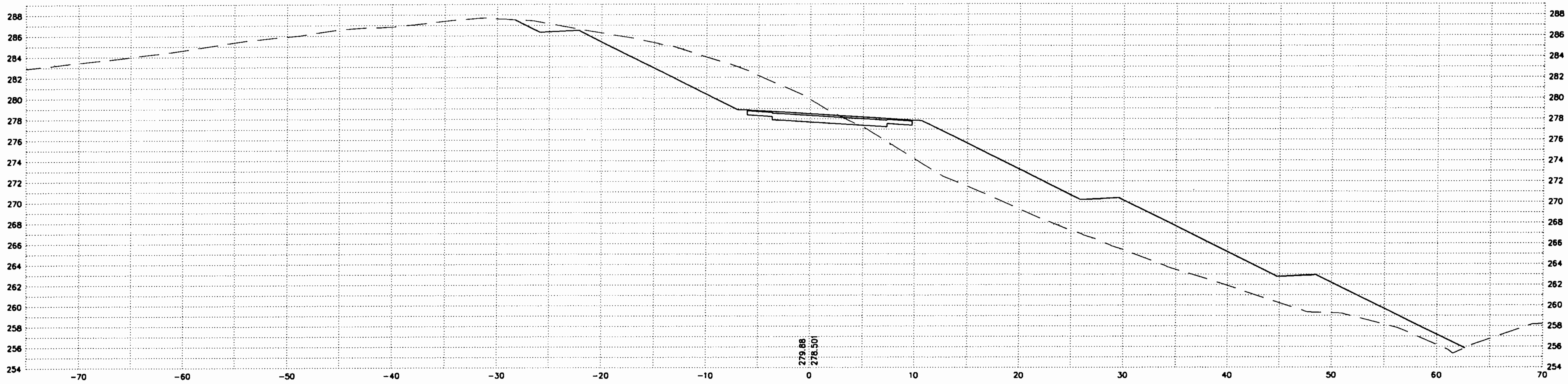
1+080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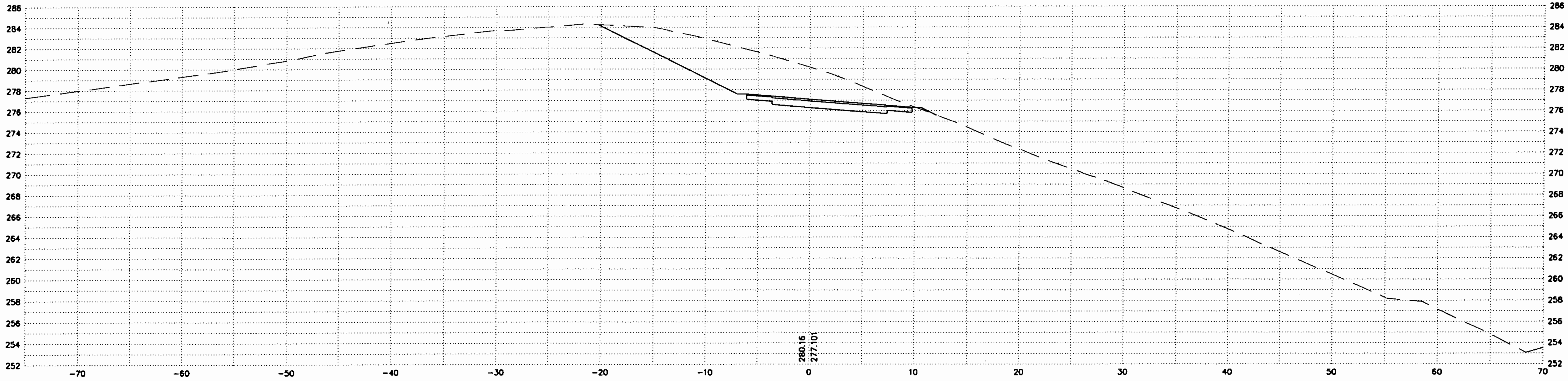
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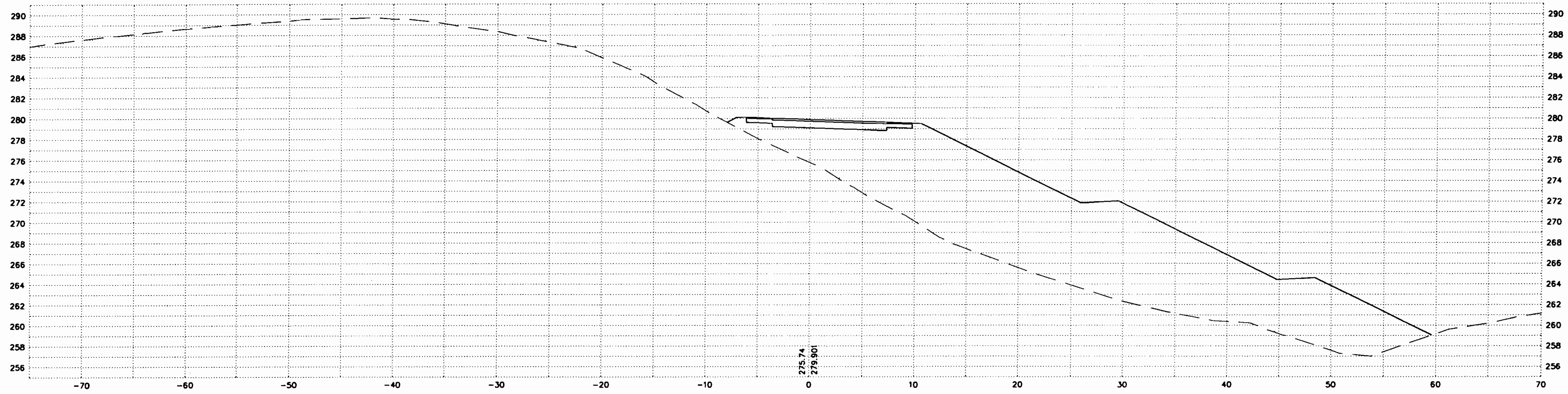
1+100



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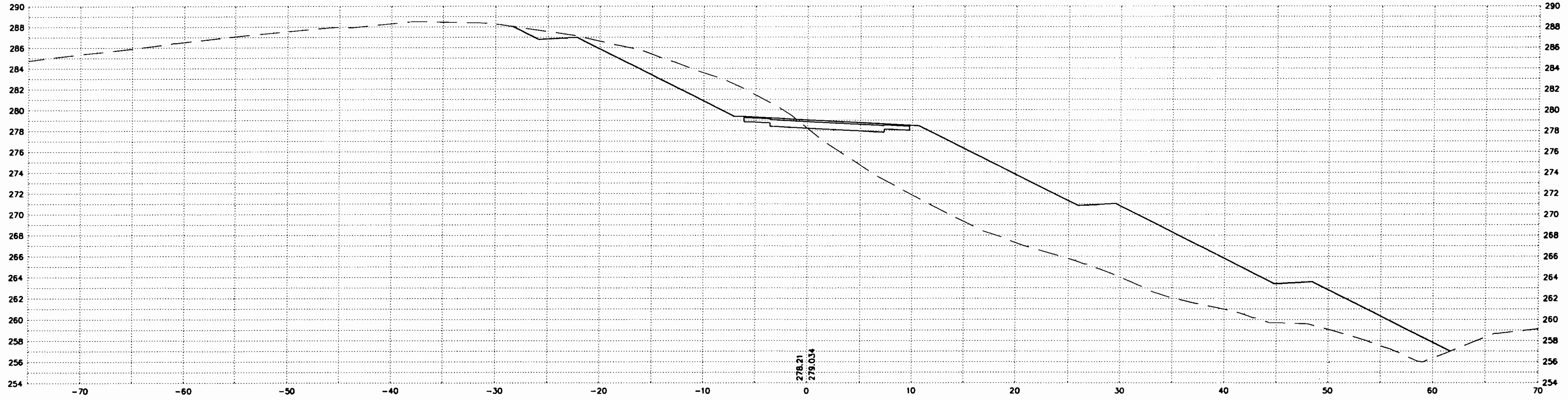

1+140


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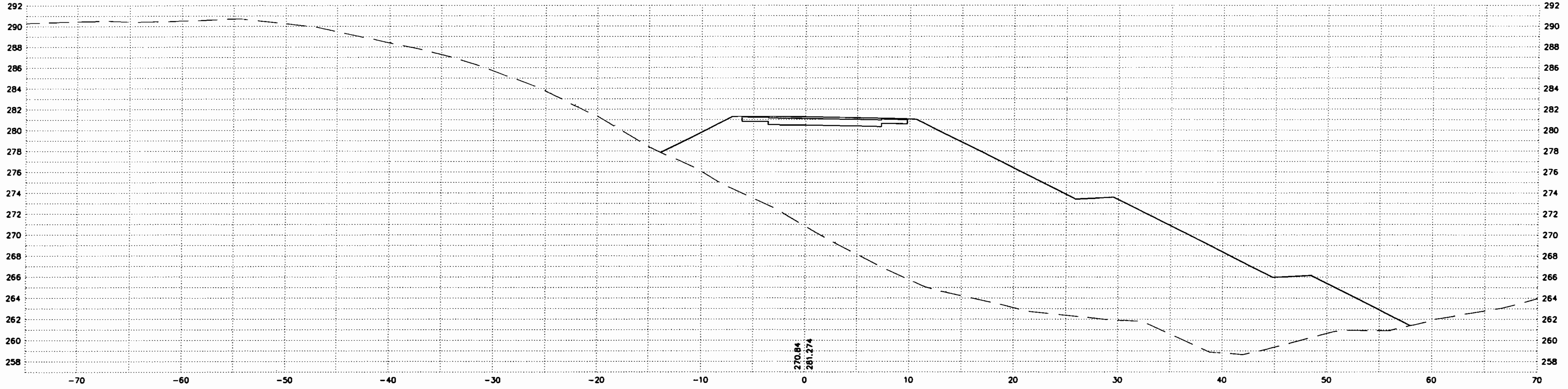
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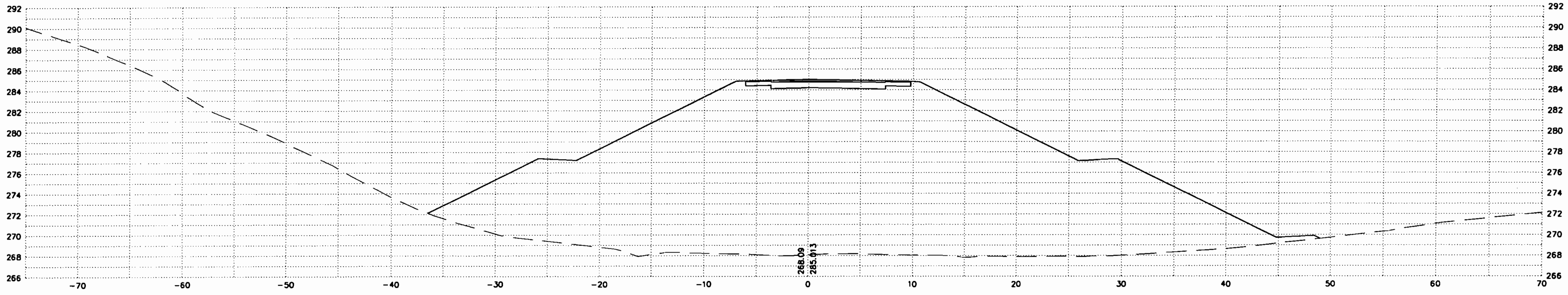
1+180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268.09
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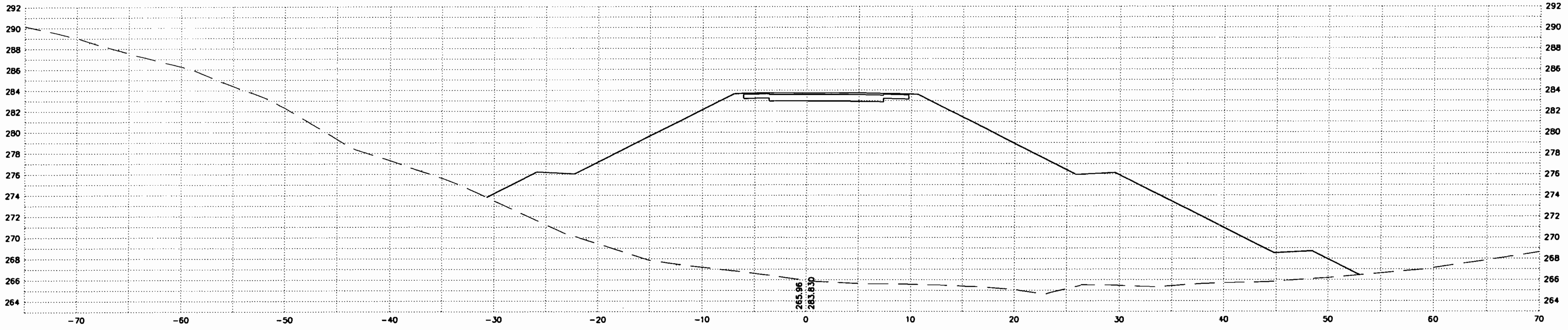
1+160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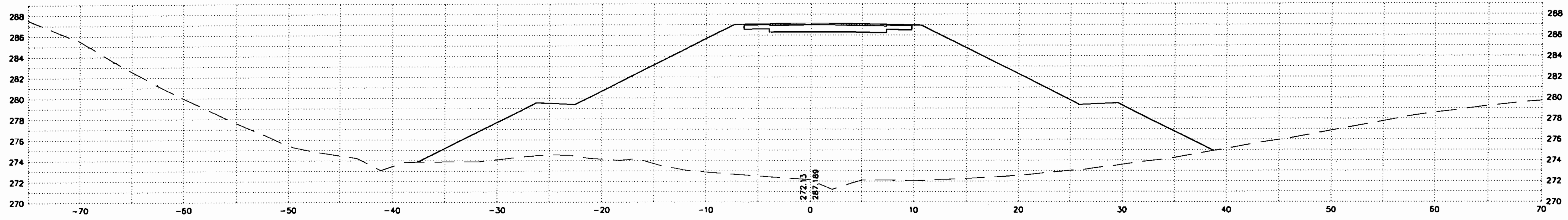

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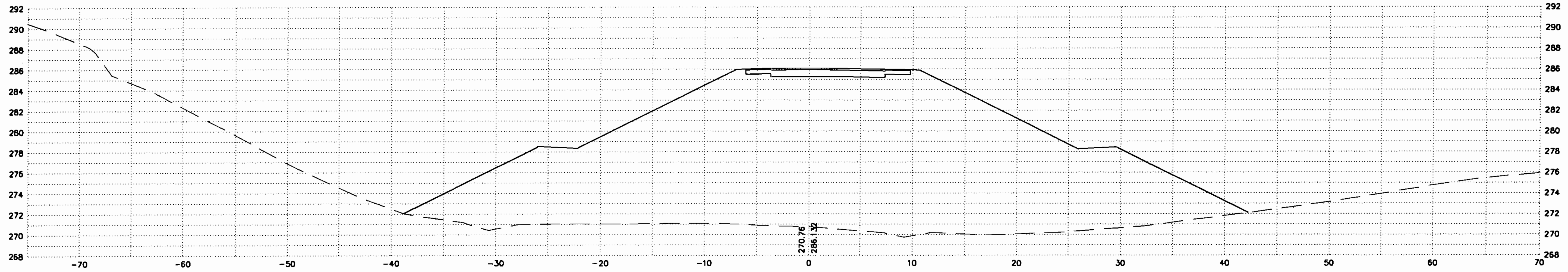

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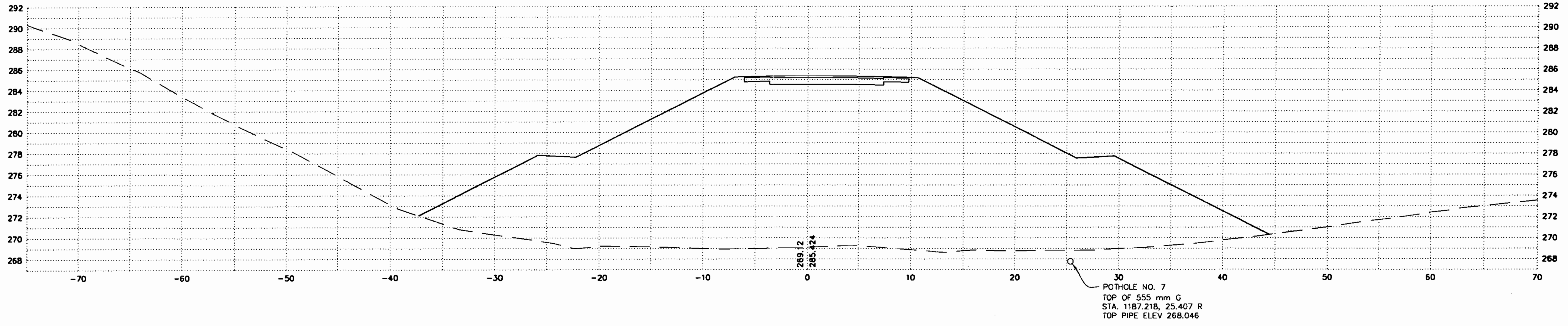
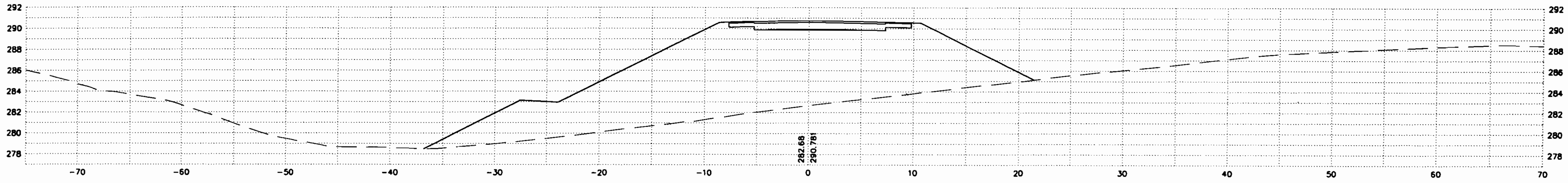


POTHOLE NO. 7
TOP OF 555 mm G
STA. 1187.218, 25.407 R
TOP PIPE ELEV 268.046

1+300



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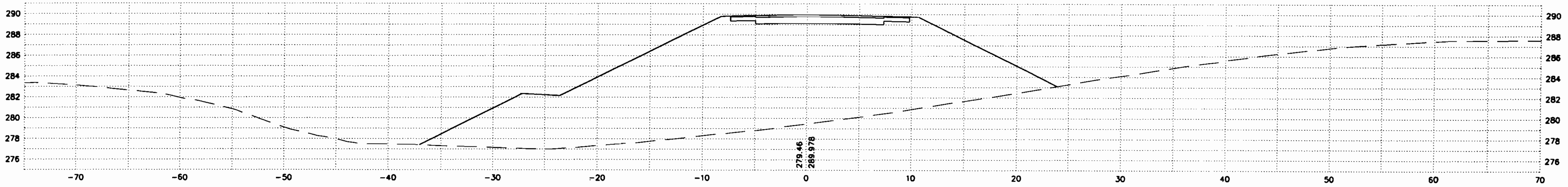

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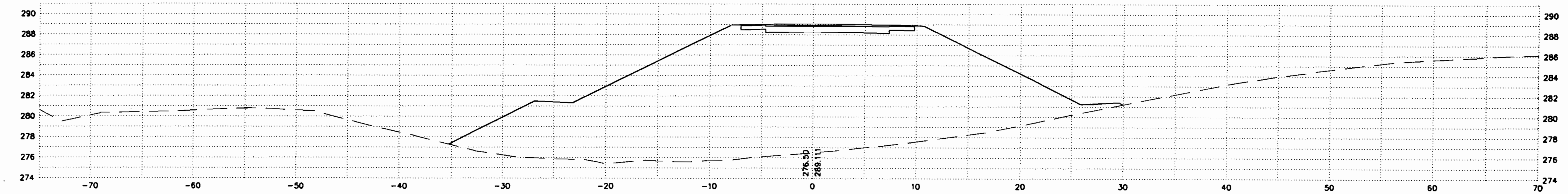

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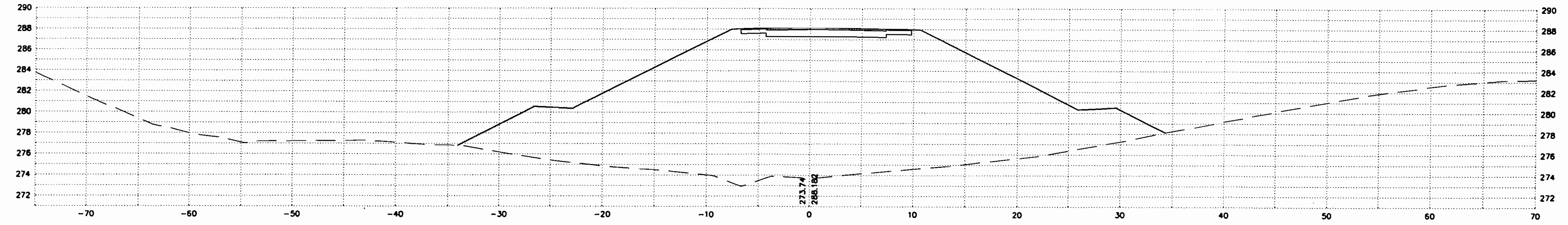

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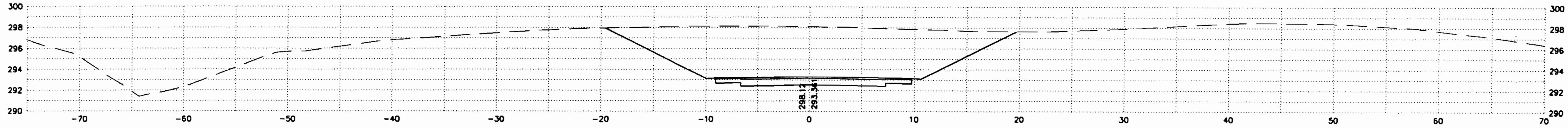

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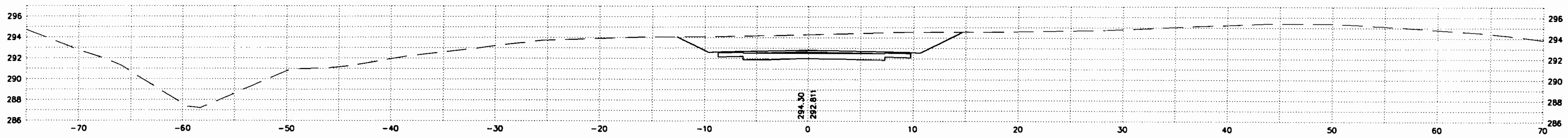

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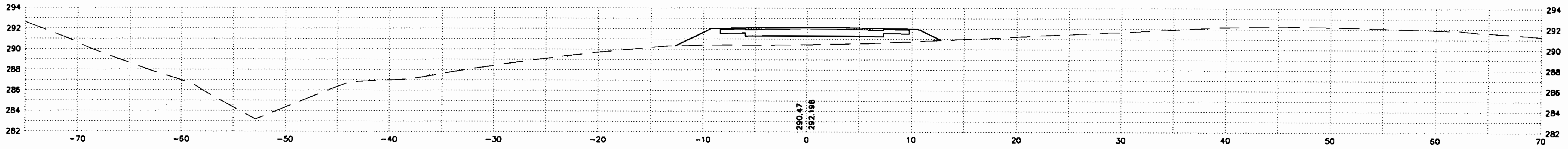

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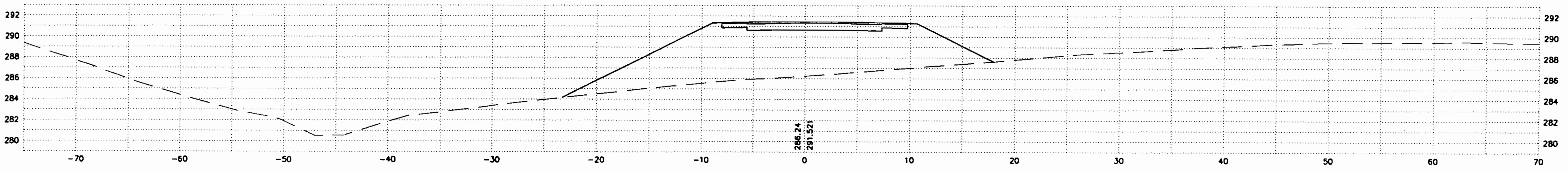

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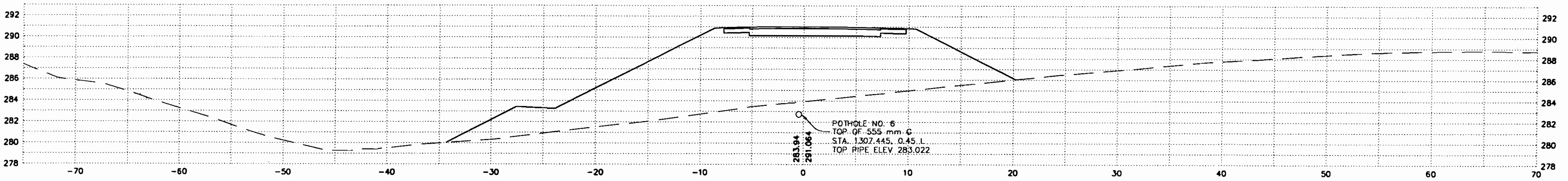

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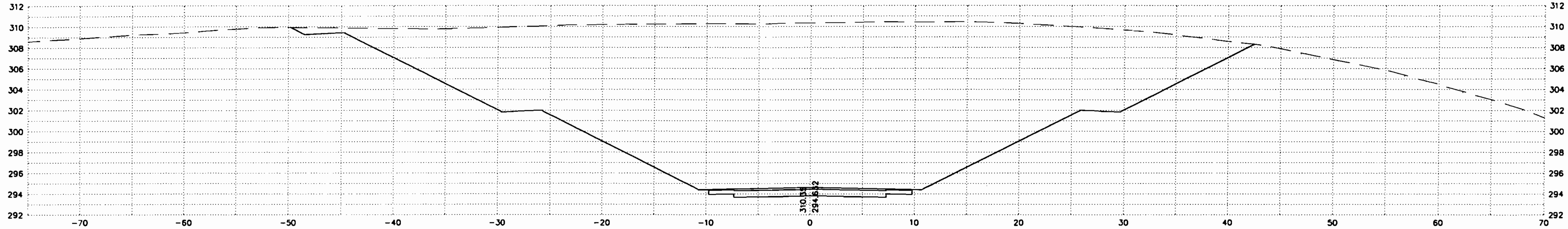

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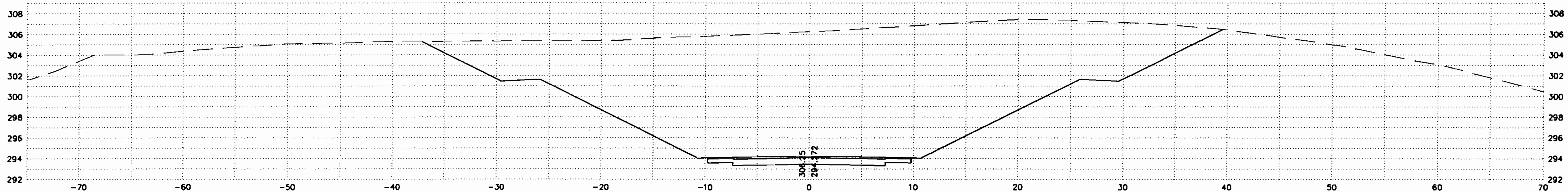

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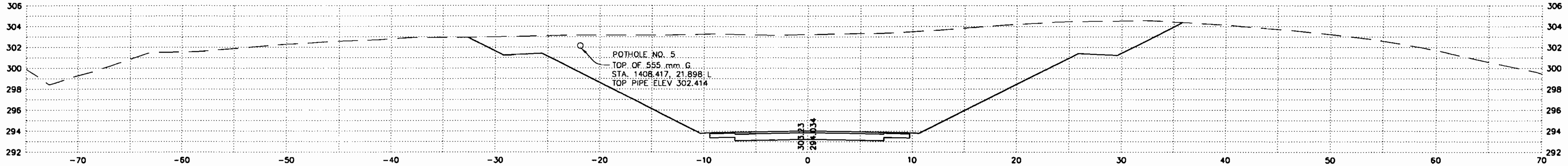

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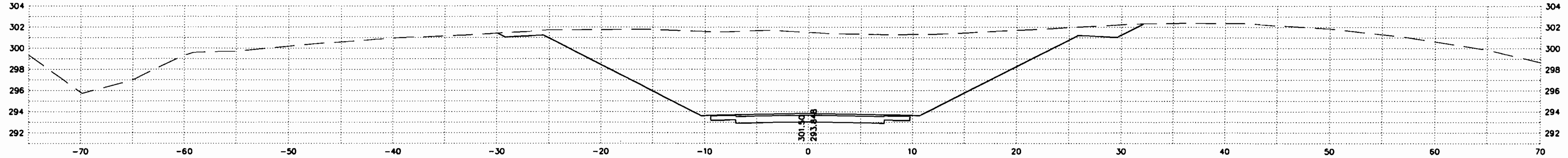

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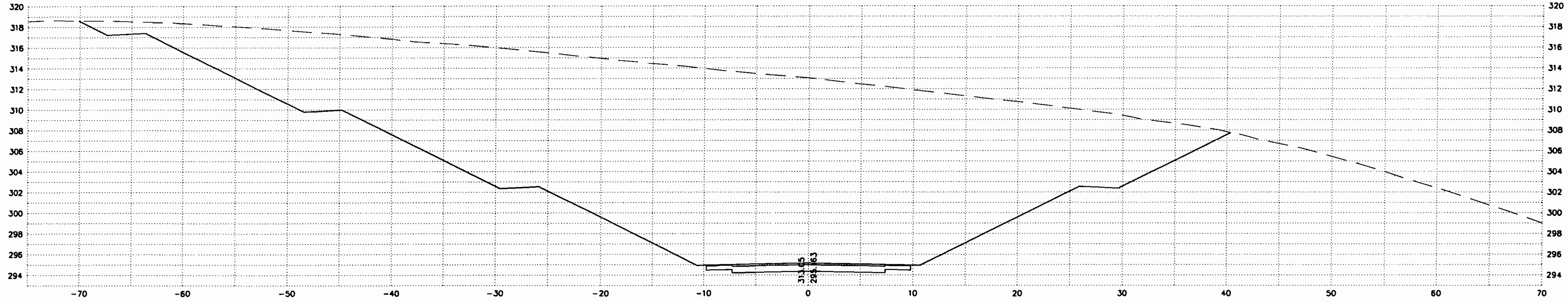
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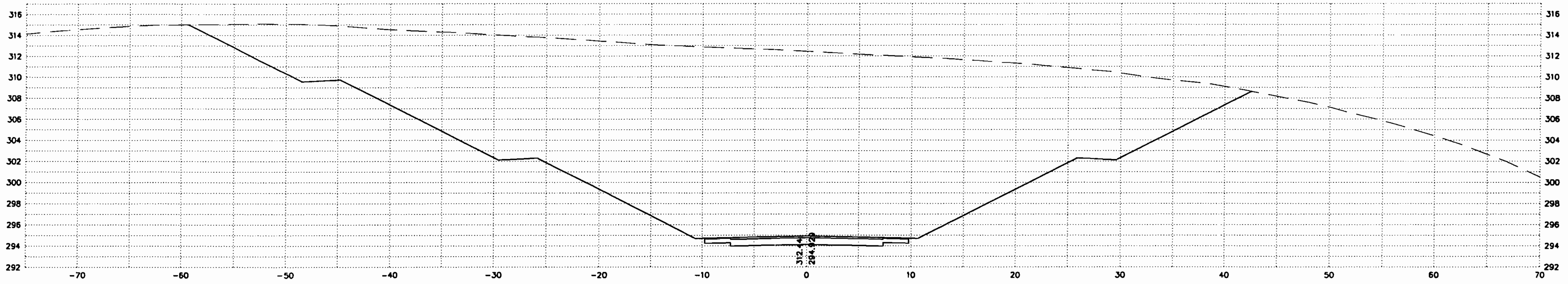
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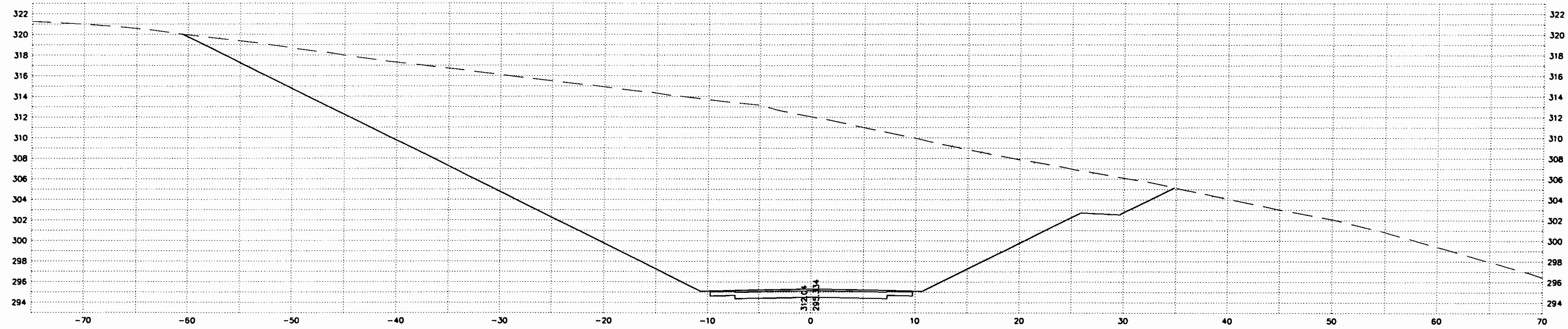
294.929

1+500



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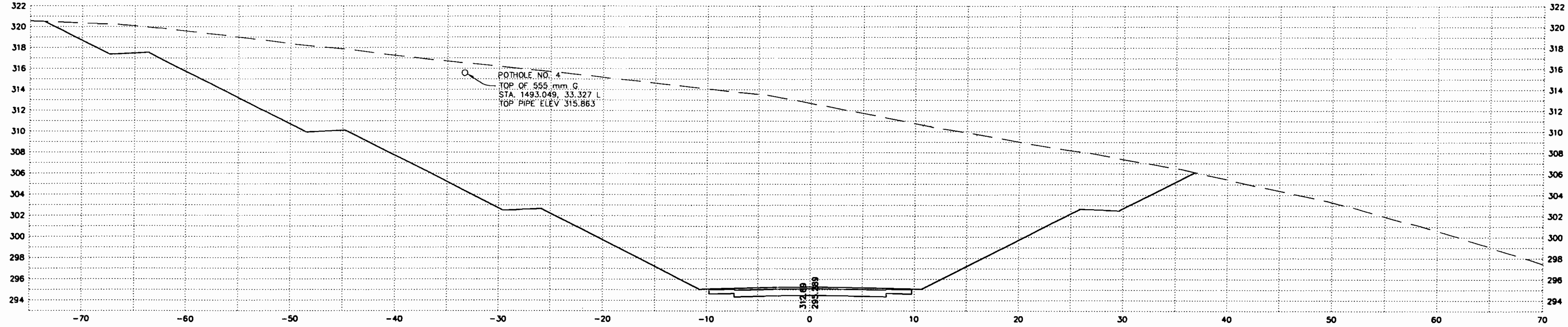
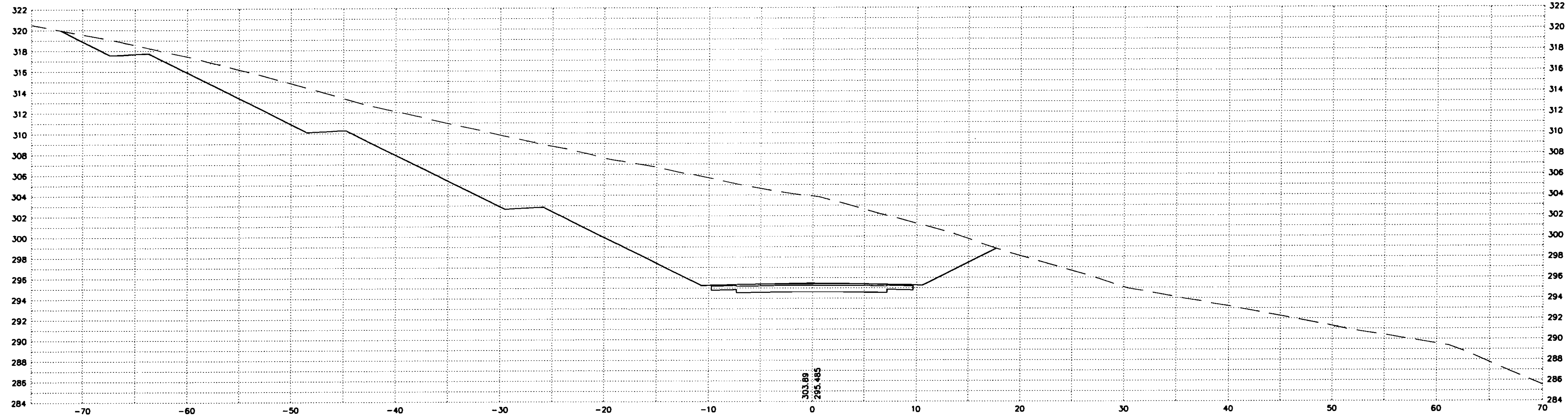


1+540



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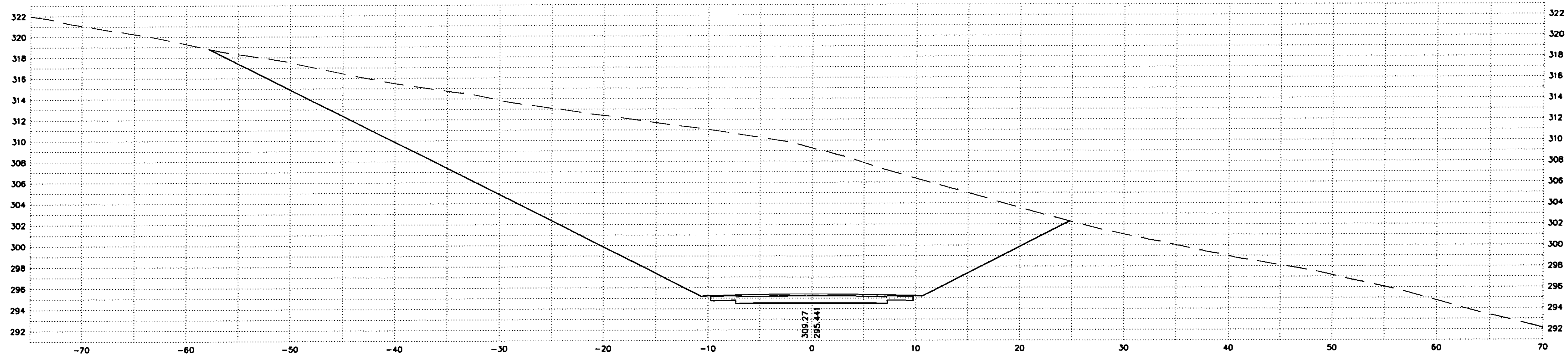
1+520



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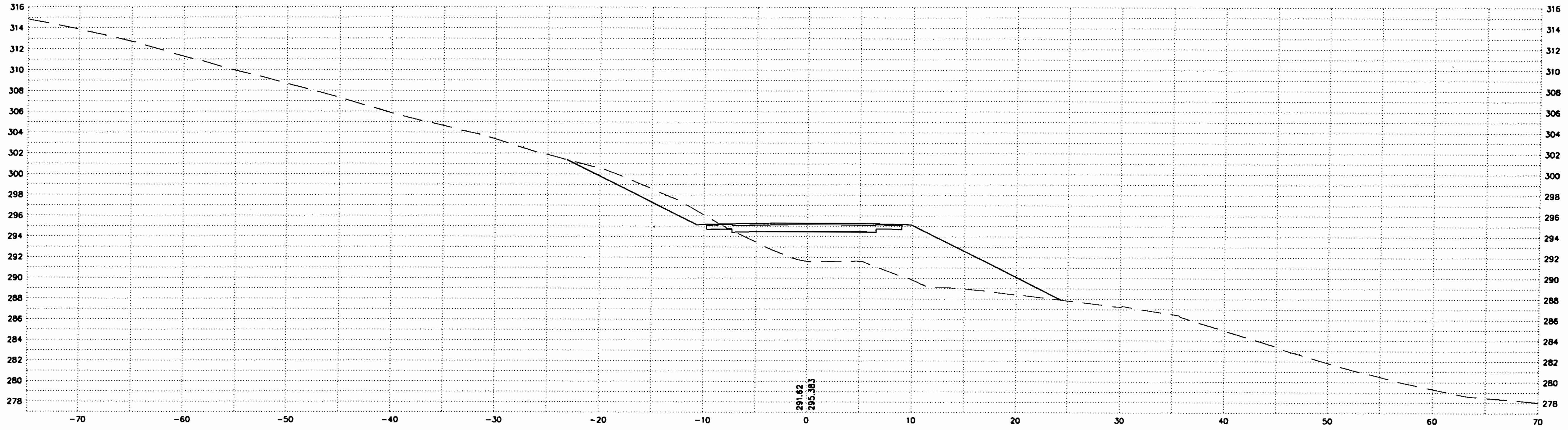

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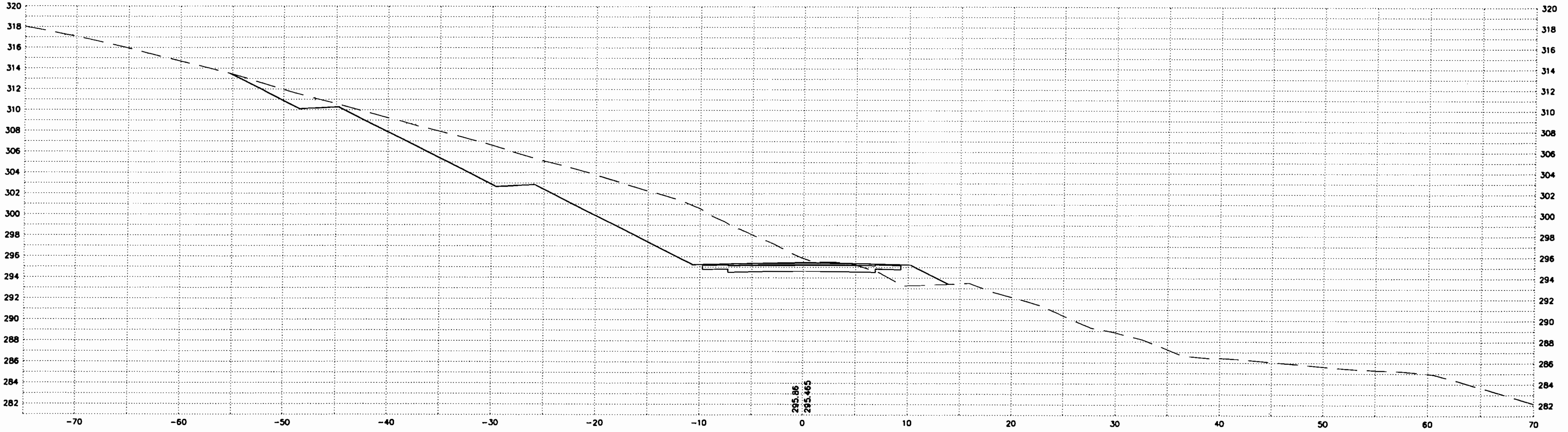

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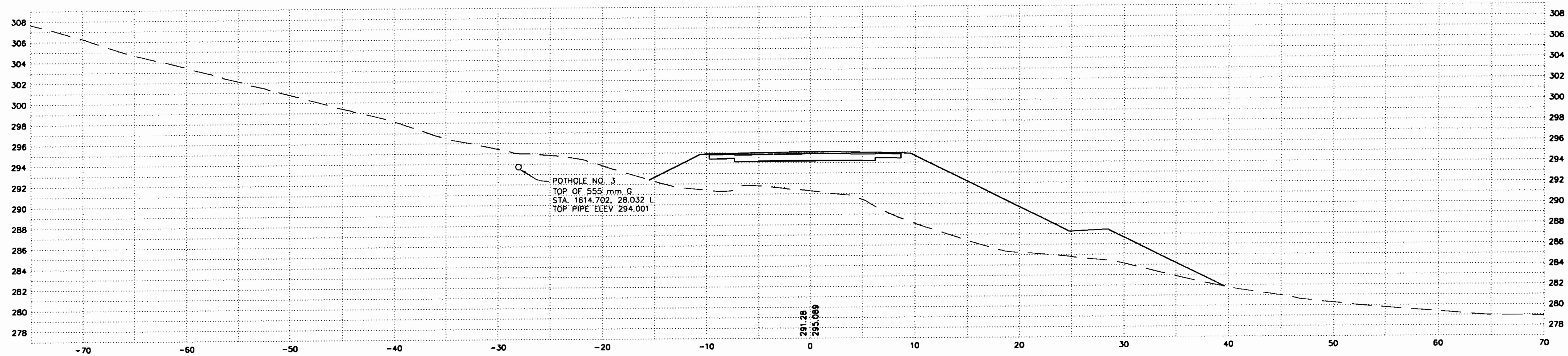
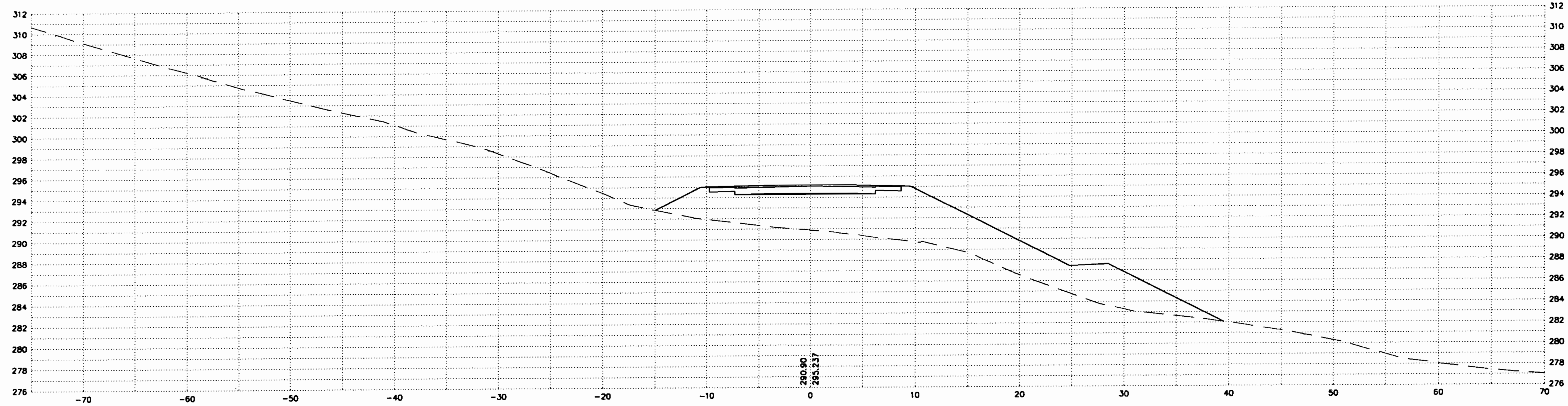


POTHOLE NO. 3
TOP OF 555 mm G.
STA. 1614.702, 28.032 L
TOP PIPE ELEV 294.001

1+600



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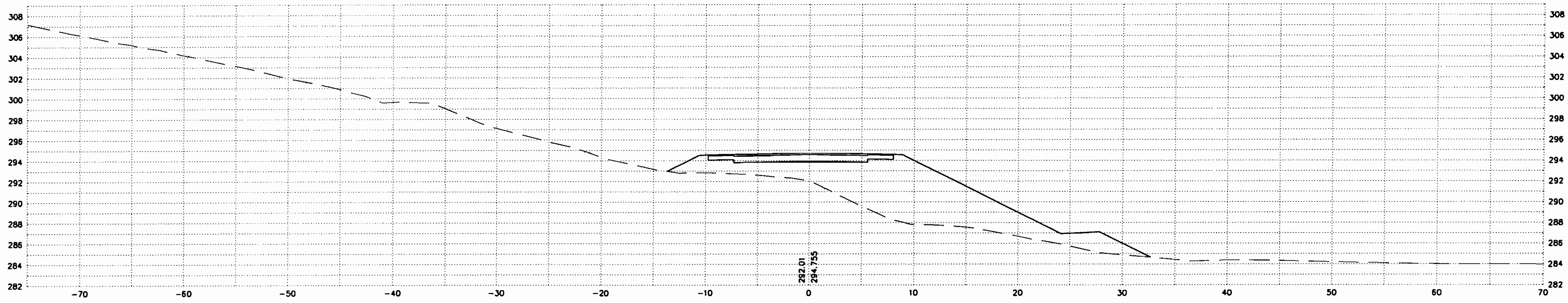

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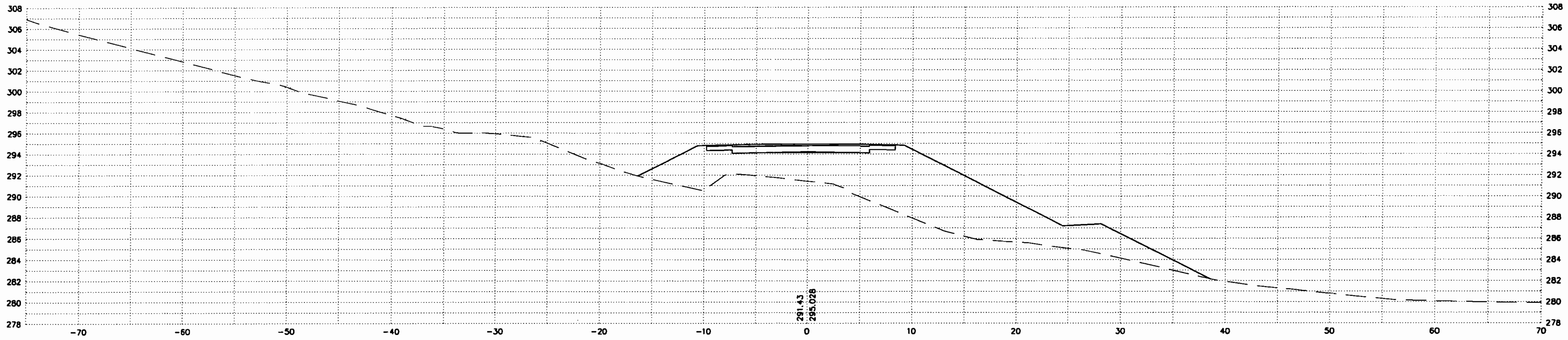
1+620



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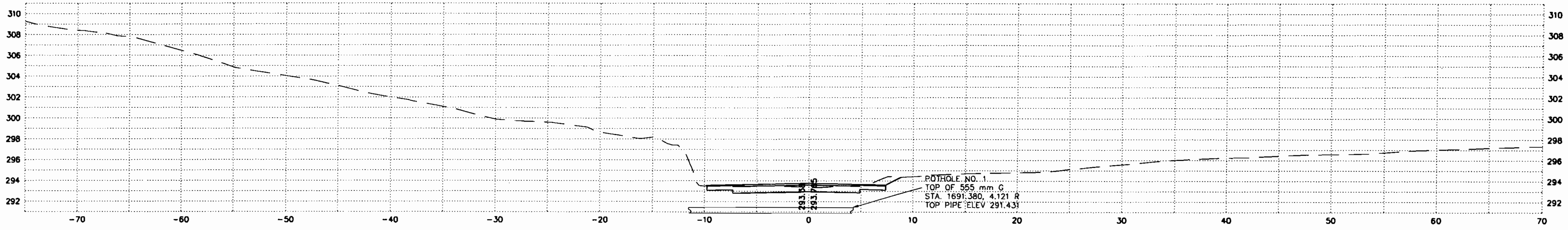

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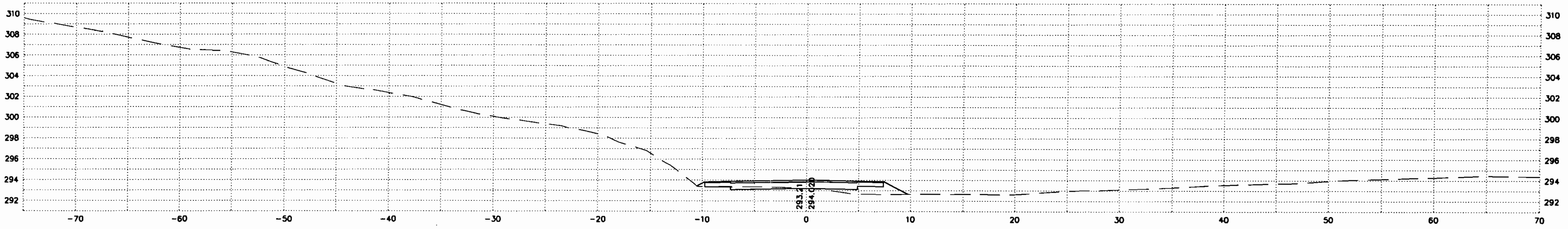

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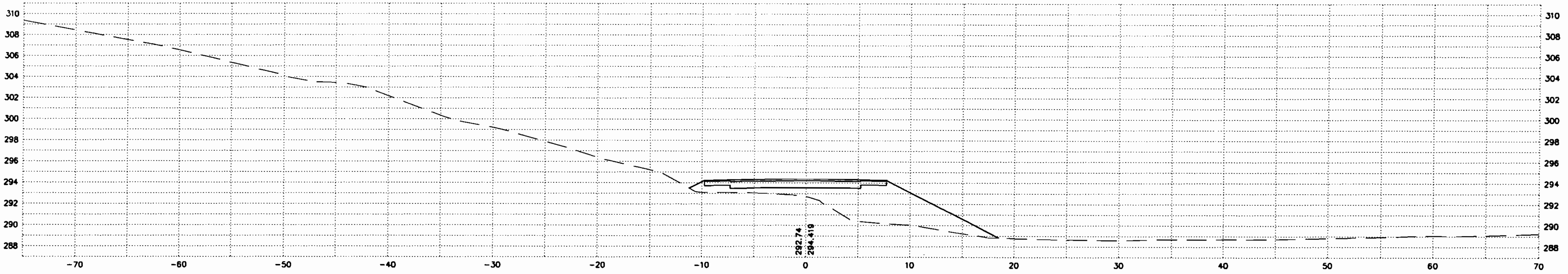

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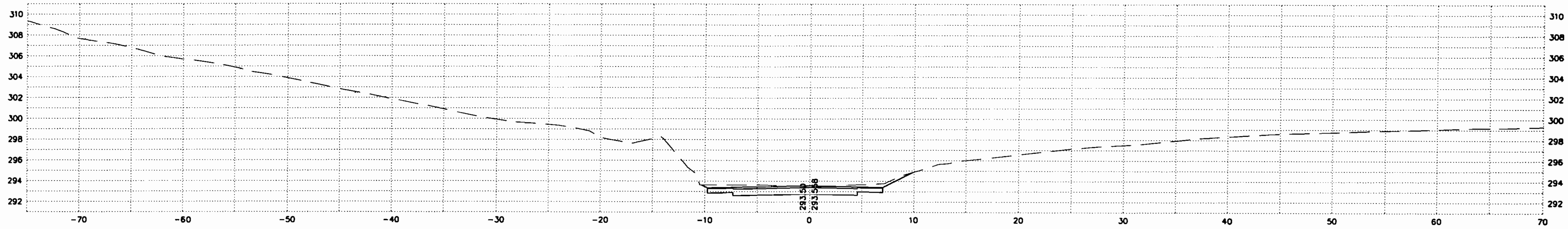

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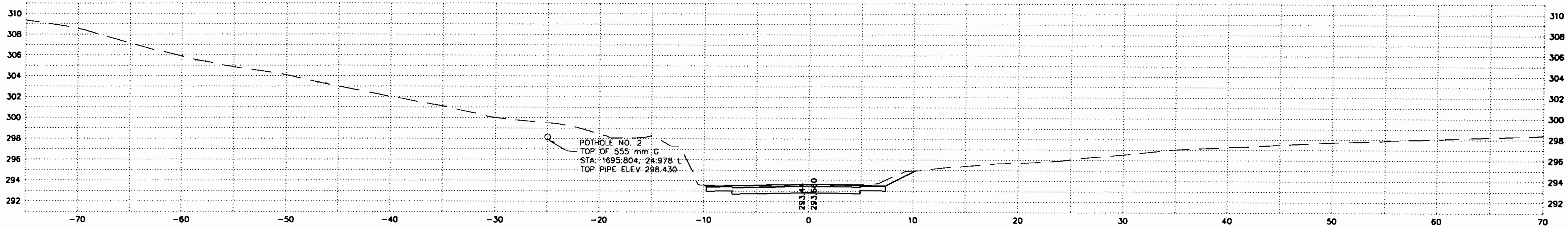

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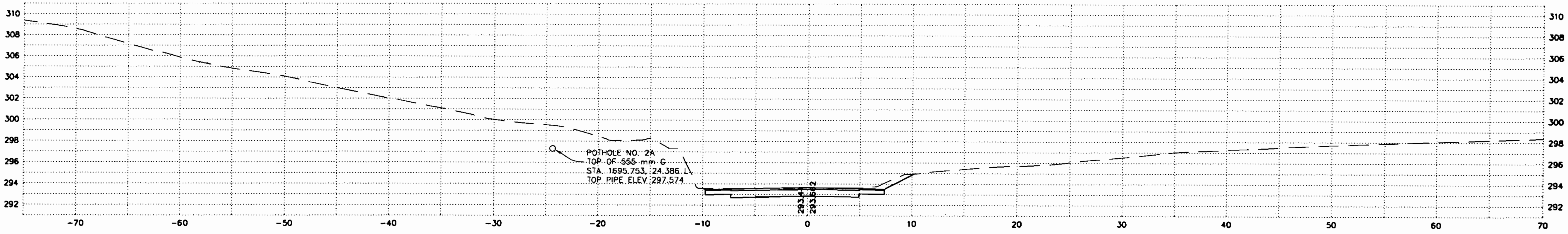

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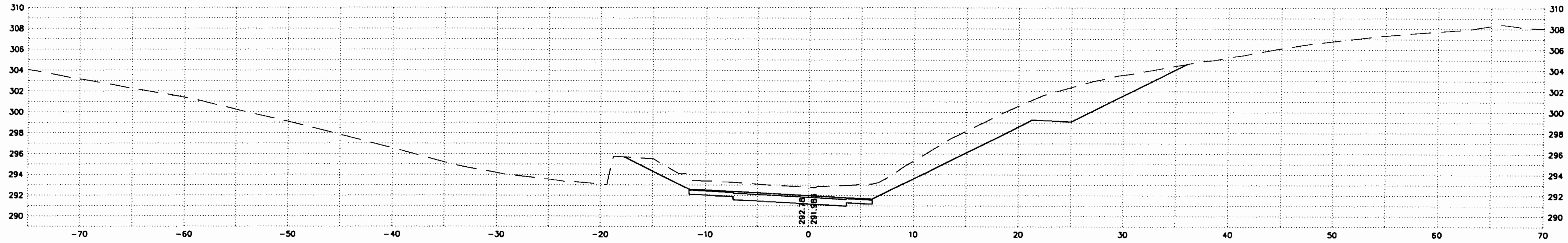

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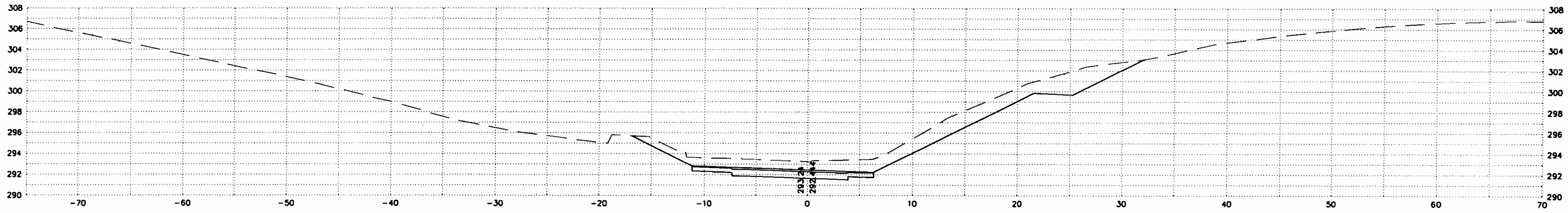

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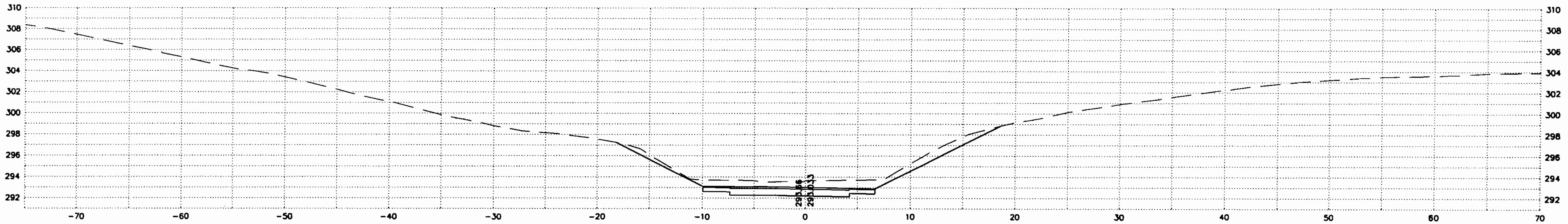

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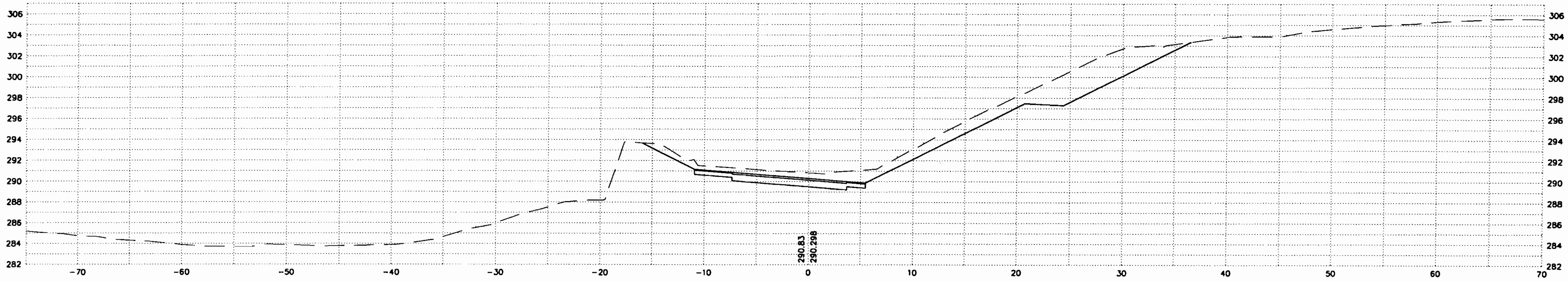

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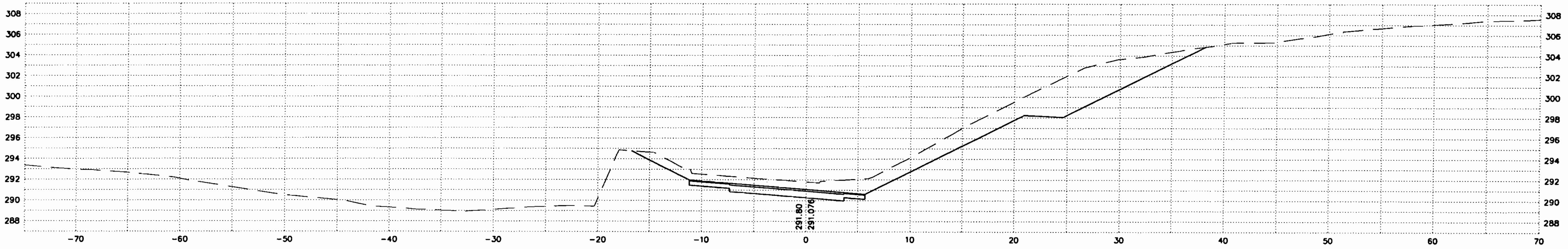

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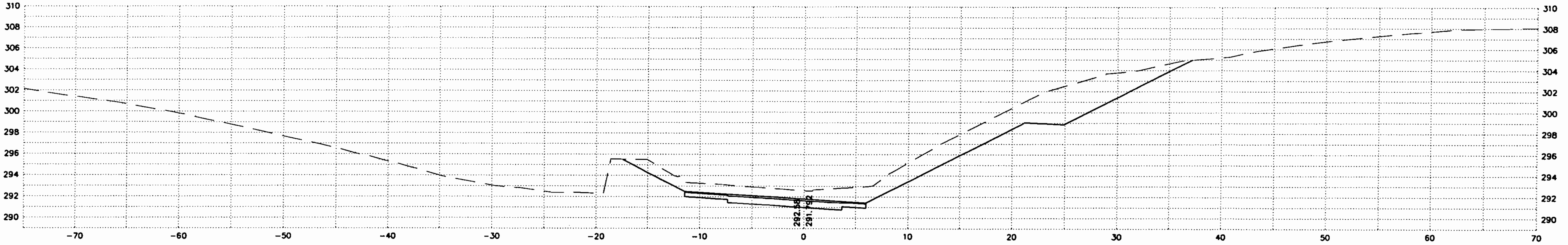

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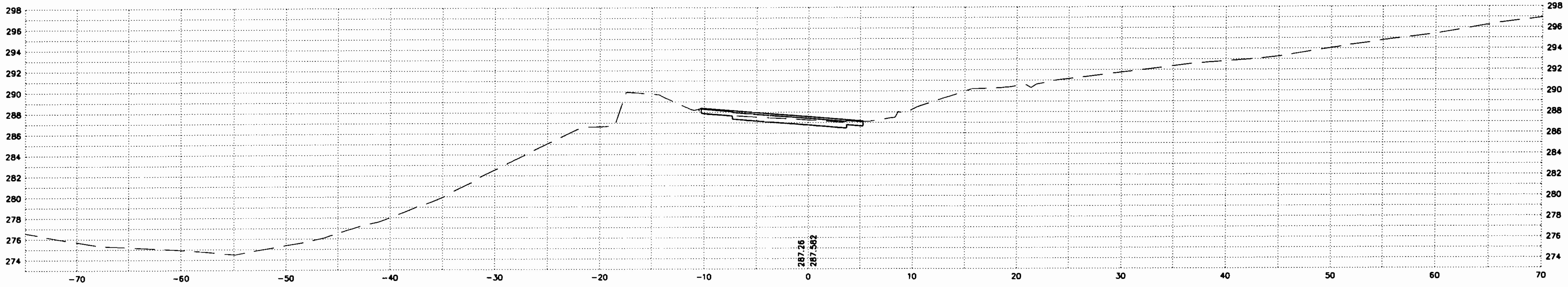

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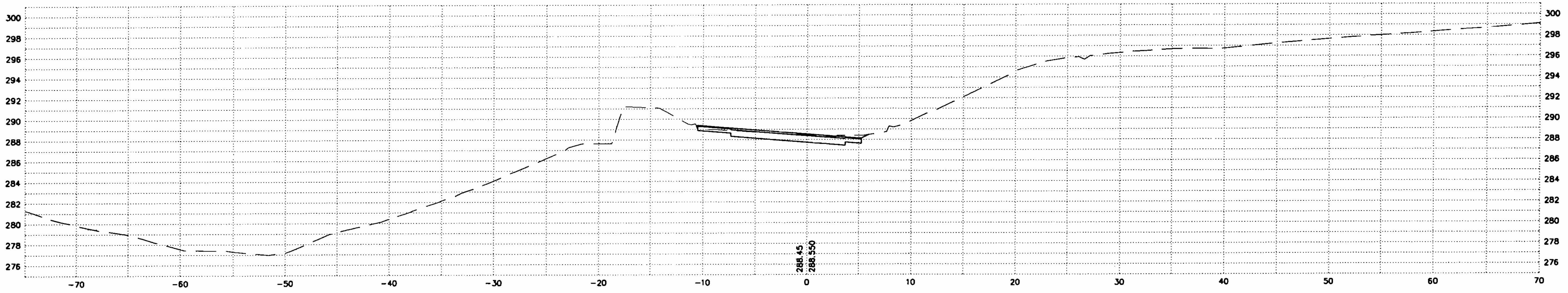

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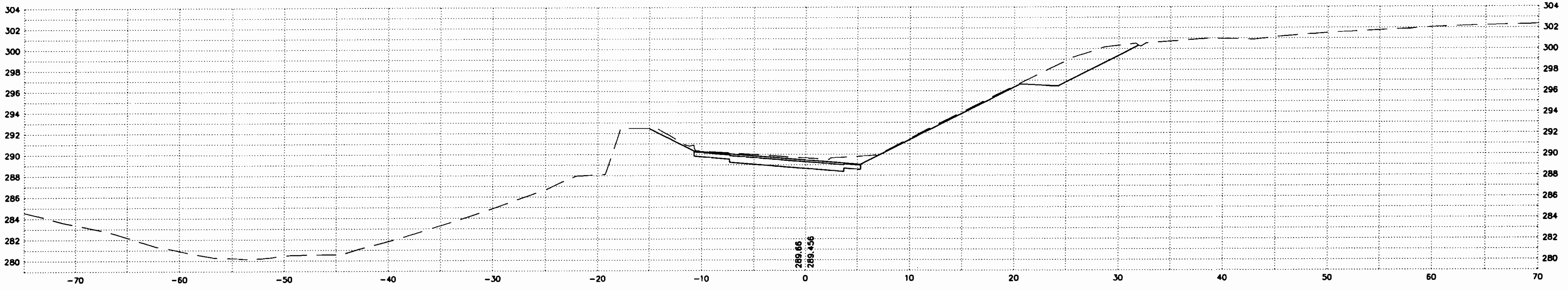

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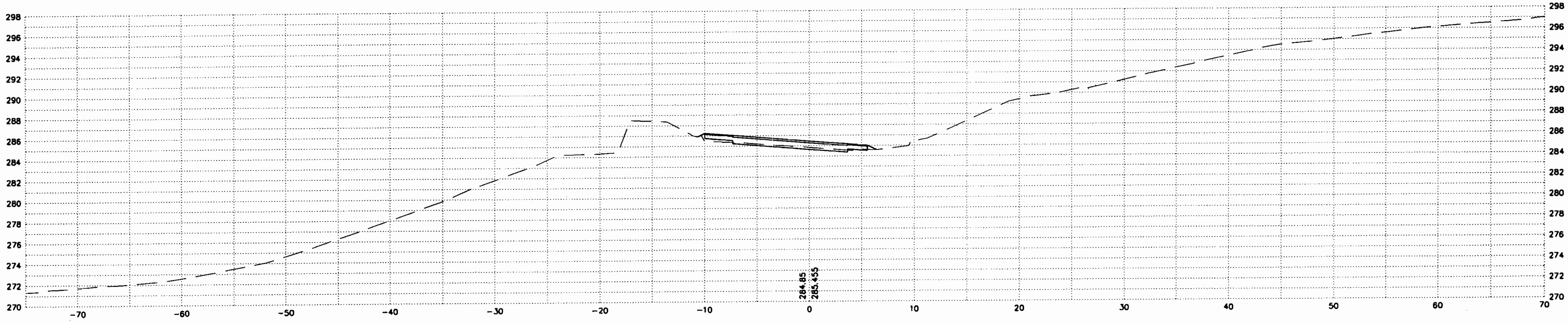
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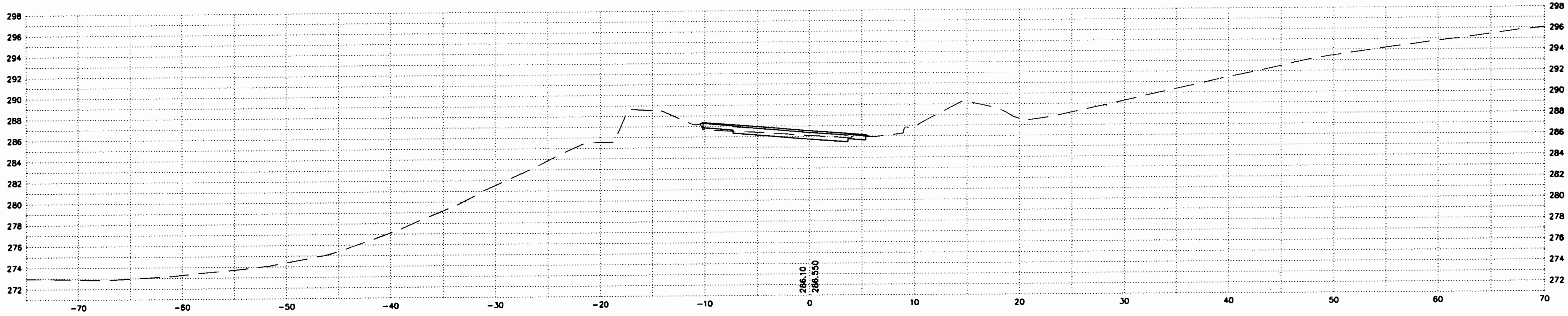
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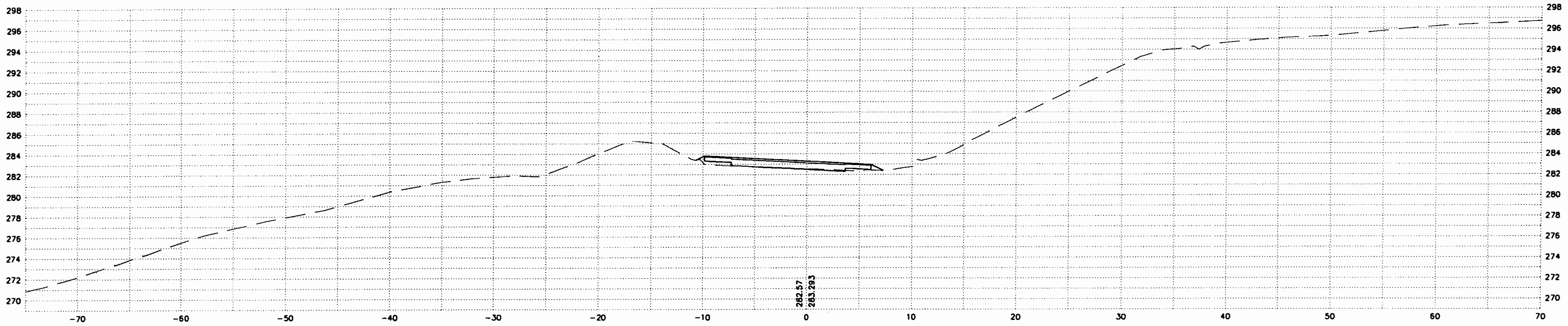

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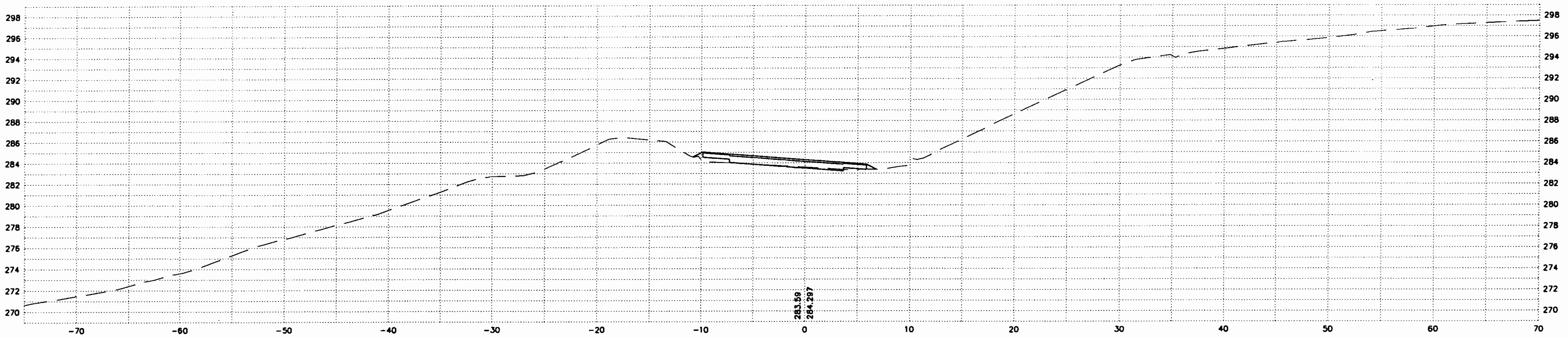

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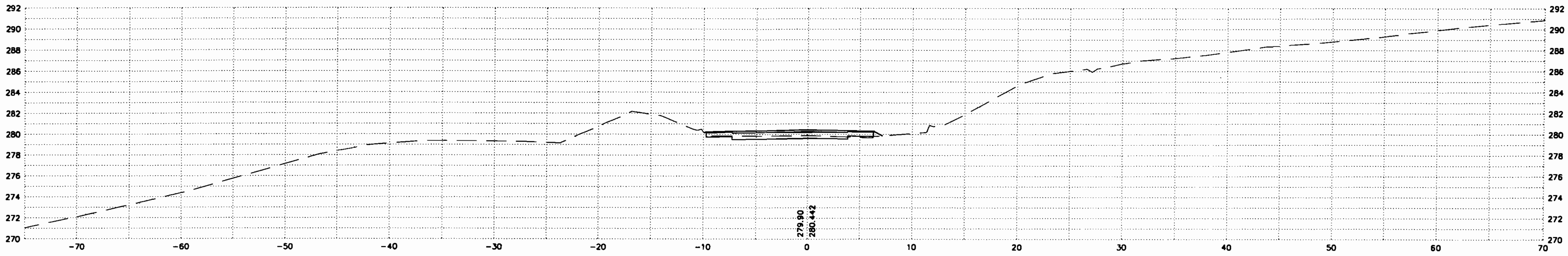

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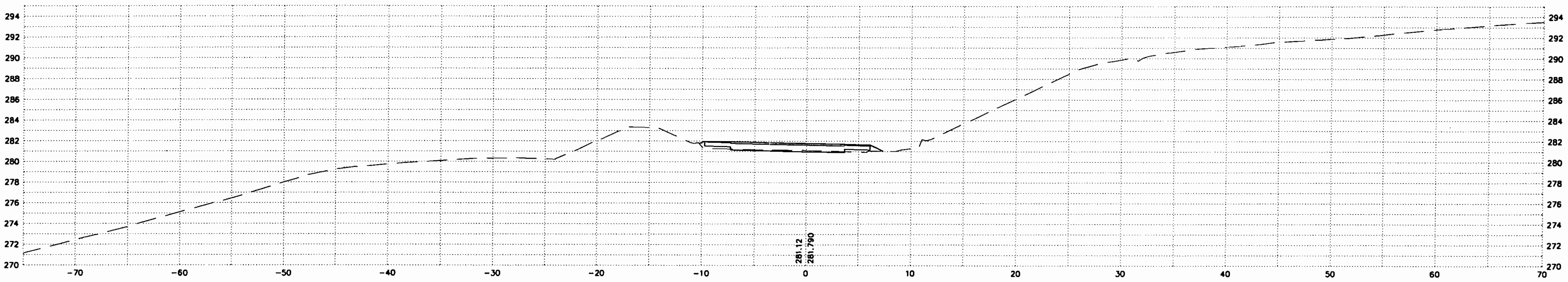

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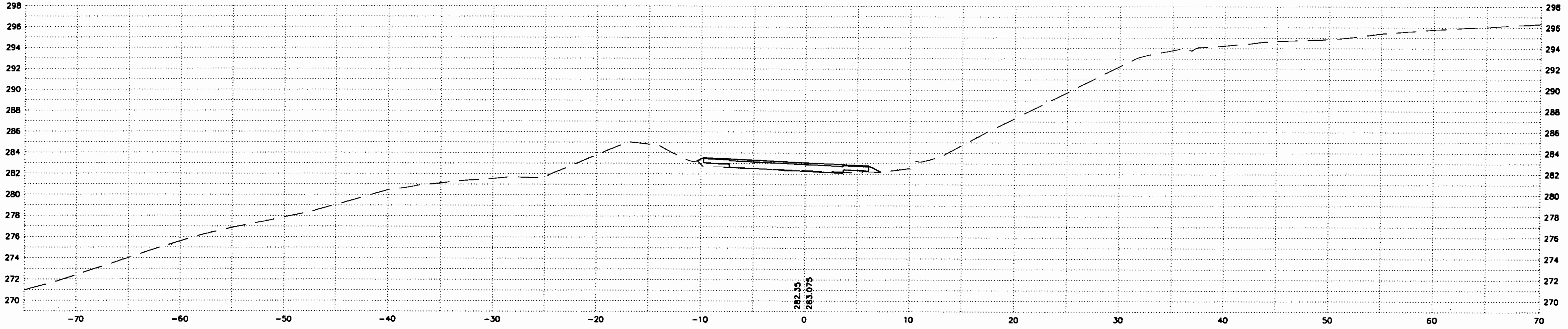

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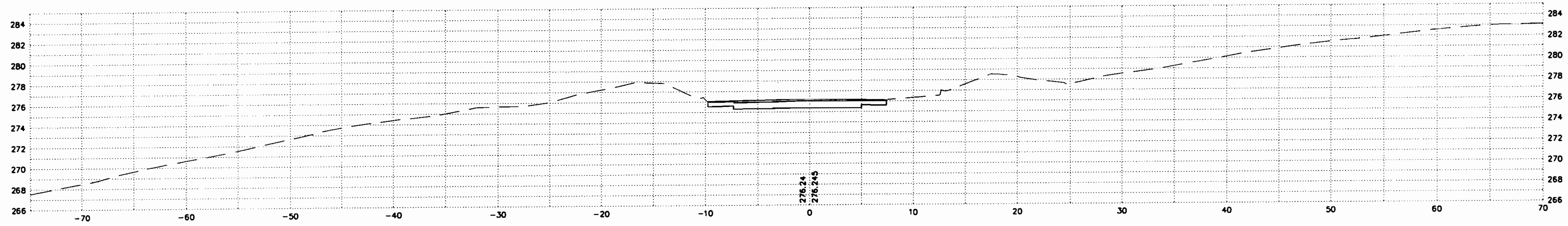

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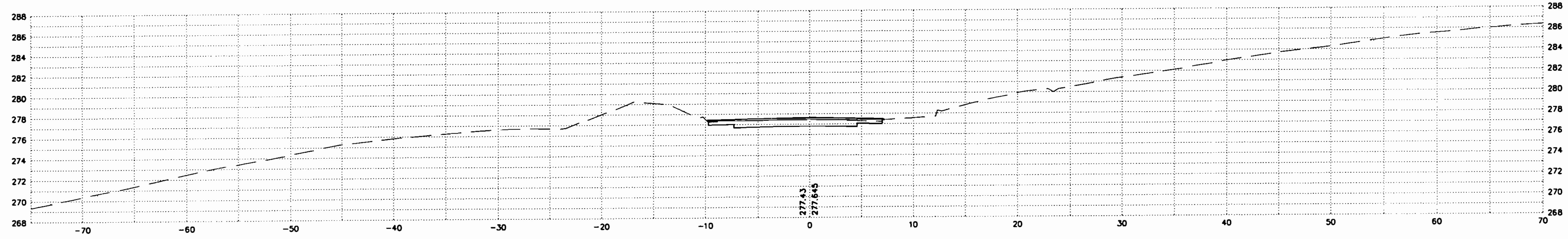

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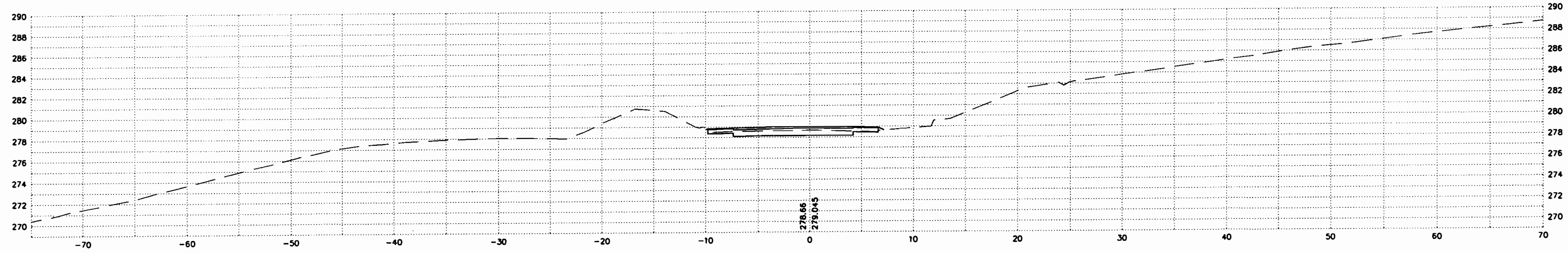
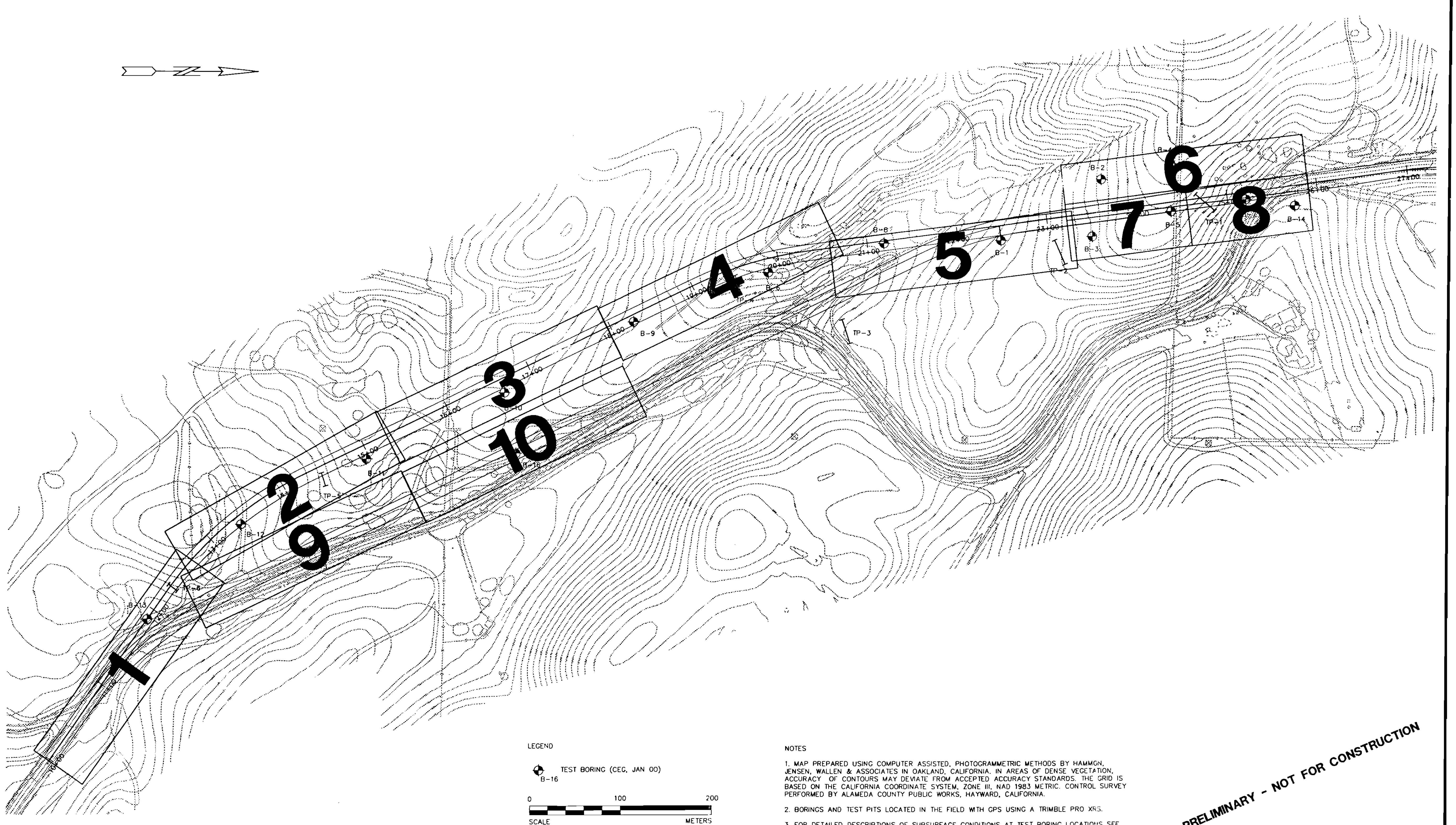


Appendix C



LEGEND

⊕ TEST BORING (CEG, JAN 00)
B-16

0 100 200
SCALE METERS

NOTES

1. MAP PREPARED USING COMPUTER ASSISTED, PHOTOGRAMMETRIC METHODS BY HAMMON, JENSEN, WALLEN & ASSOCIATES IN OAKLAND, CALIFORNIA. IN AREAS OF DENSE VEGETATION, ACCURACY OF CONTOURS MAY DEVIATE FROM ACCEPTED ACCURACY STANDARDS. THE GRID IS BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 1983 METRIC. CONTROL SURVEY PERFORMED BY ALAMEDA COUNTY PUBLIC WORKS, HAYWARD, CALIFORNIA.

2. BORINGS AND TEST PITS LOCATED IN THE FIELD WITH GPS USING A TRIMBLE PRO XRS.

3. FOR DETAILED DESCRIPTIONS OF SUBSURFACE CONDITIONS AT TEST BORING LOCATIONS SEE THE LOG OF TEST BORINGS ATTACHED TO THE GEOTECHNICAL DATA REPORT.

PRELIMINARY - NOT FOR CONSTRUCTION

ALAMEDA COUNTY Metric
UNITS ARE IN METERS
UNLESS OTHERWISE NOTED

CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

GEOTECHNICAL DESIGN REPORT
VASCO ROAD SAFETY IMPROVEMENTS
IN ALAMEDA COUNTY FROM MP 3.4 TO MP 4.3

INDEX TO LOG OF TEST BORINGS

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	INDEX TO L.O.T.B.

\CEG\990850\DR extoLOTB.dwb

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

LEGEND OF EARTH MATERIALS

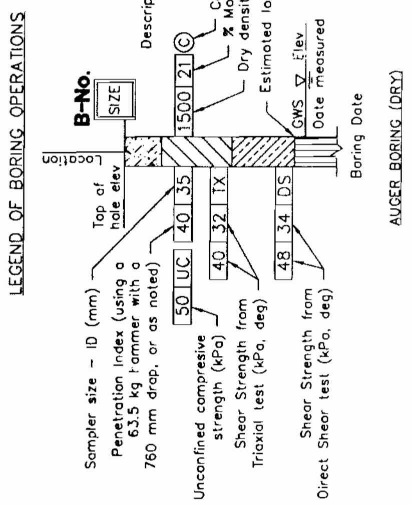
▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▨	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▨	METAMORPHIC ROCK
▨	CLAYEY SILT		

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

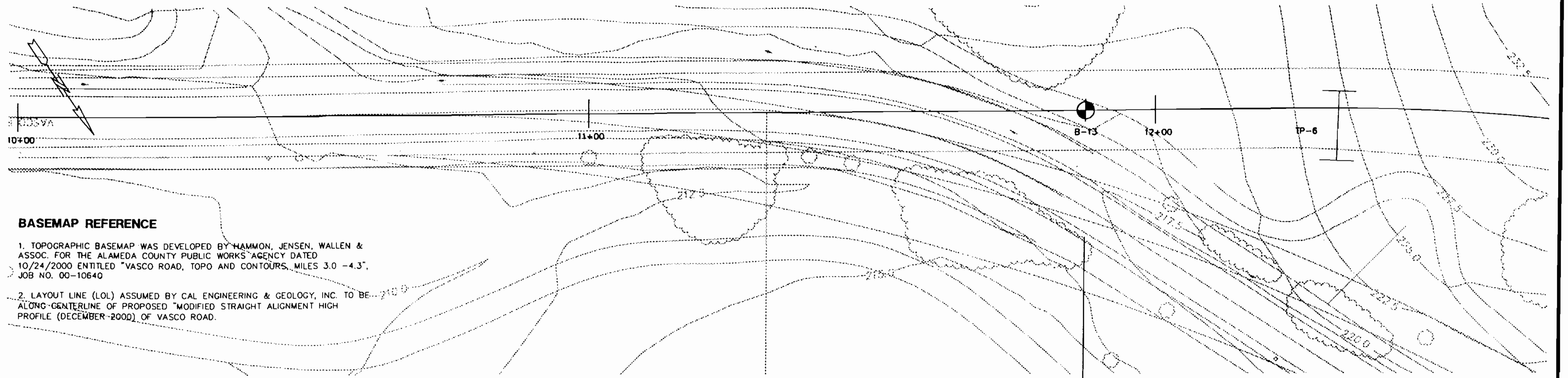
●	57 mm CONE PENETROMETER
SIZE	SAMPLE BORING (DRY)
SIZE	ROTARY SAMPLE BORING (WET)
SIZE	AUGER BORING (DRY)
⊢⊣	TEST TRENCH
◇ SIZE	DIAMOND CORE BORING
SIZE	JET BORING
▲	ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF BORING OPERATIONS



AUGER BORING (DRY)



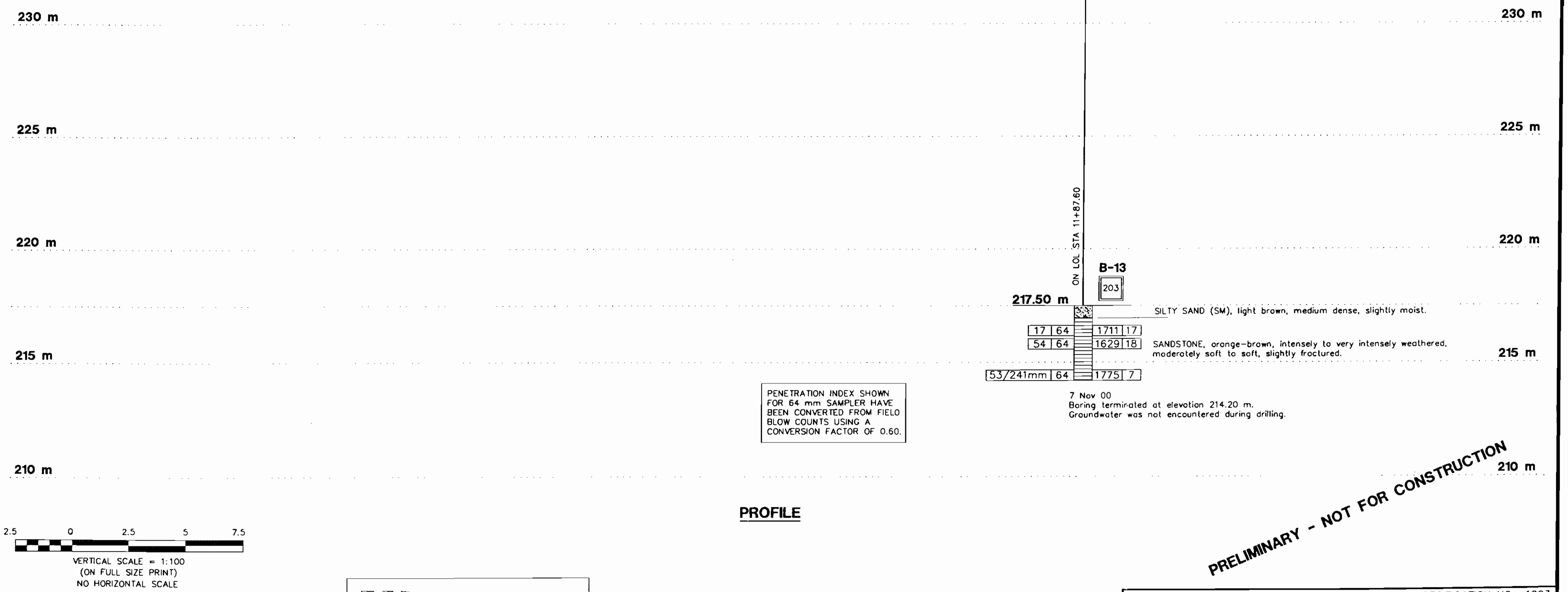
BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.

SCALE = 1:400
(ON FULL SIZE PRINT)

PLAN



SILTY SAND (SM), light brown, medium dense, slightly moist.

SANDSTONE, orange-brown, intensely to very intensely weathered, moderately soft to soft, slightly fractured.

7 Nov 00
Boring terminated at elevation 214.20 m.
Groundwater was not encountered during drilling.

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

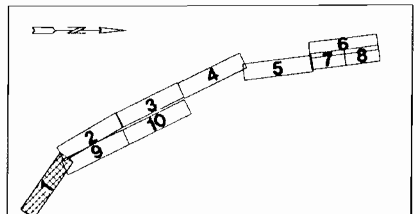
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

PROFILE

PRELIMINARY - NOT FOR CONSTRUCTION

SOIL DESCRIPTION ABBREVIATIONS

vfg	VERY FINE GRAINED
fg	FINE GRAINED
mg	MEDIUM GRAINED
cg	COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
UNITS ARE IN METERS UNLESS OTHERWISE NOTED

CE&G
CAL ENGINEERING & GEOLOGY
1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

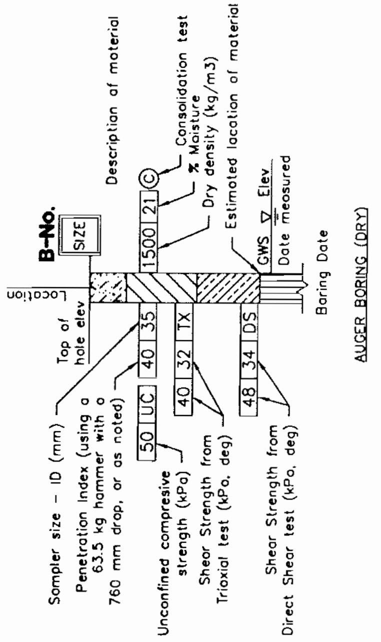
LOG OF TEST BORINGS

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

CEG REF NO.	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C1	C10

//CEG/00186OVasco/PRELIMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0°
PLOT SCALE: 100(TEXT ROTATION: 0°
LOG OF TEST BORIN K-999-X --

LEGEND OF BORING OPERATIONS



AUGER BORING (DRY)

● 57 mm CONE PENETROMETER

SIZE SAMPLE BORING (DRY)

SIZE ROTARY SAMPLE BORING (WET)

SIZE AUGER BORING (DRY)

TEST TRENCH

SIZE DIAMOND CORE BORING

SIZE JET BORING

▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▨	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▨	METAMORPHIC ROCK
▨	CLAYEY SILT		

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

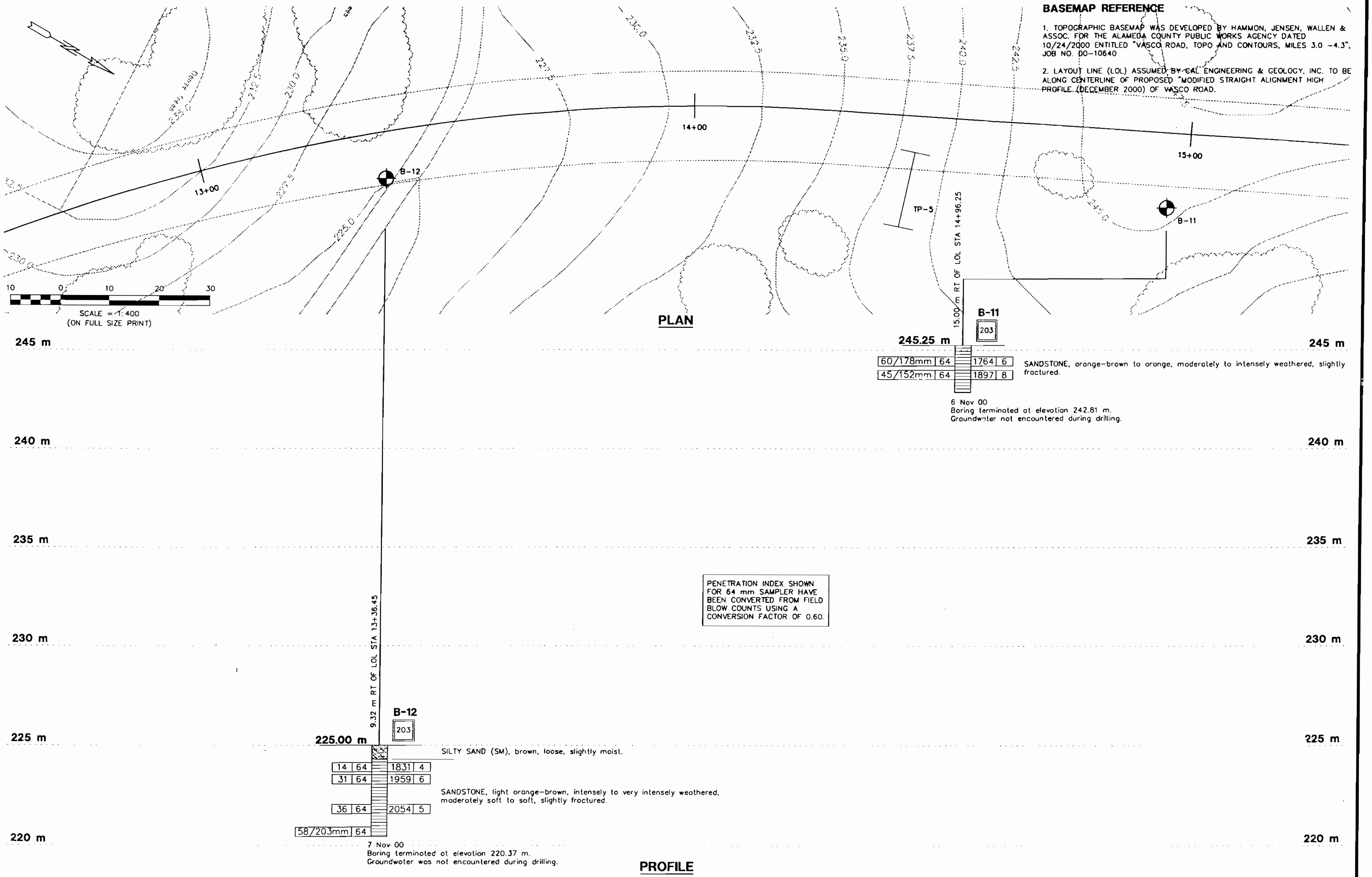
Penetration Index (Blows/0.3m)	Granular	Cohesive
0–4	Very Loose	Very Soft
5–9	Loose	Soft
10–19	Slightly Compact	Stiff
20–34	Compact	Very Stiff
35–69	Dense	Hard
>70	Very Dense	Very Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 –4.3", JOB NO. D0–10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



SILTY SAND (SM), brown, loose, slightly moist.

SANDSTONE, light orange-brown, intensely to very intensely weathered, moderately soft to soft, slightly fractured.

7 Nov 00
Boring terminated at elevation 220.37 m.
Groundwater was not encountered during drilling.

SANDSTONE, orange-brown to orange, moderately to intensely weathered, slightly fractured.

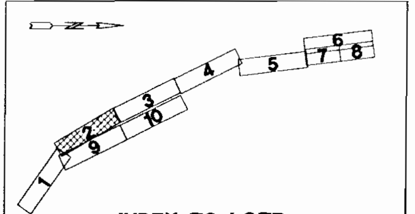
6 Nov 00
Boring terminated at elevation 242.81 m.
Groundwater not encountered during drilling.

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

2.5 0 2.5 5 7.5
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

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CAL ENGINEERING & GEOLOGY
1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265 SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

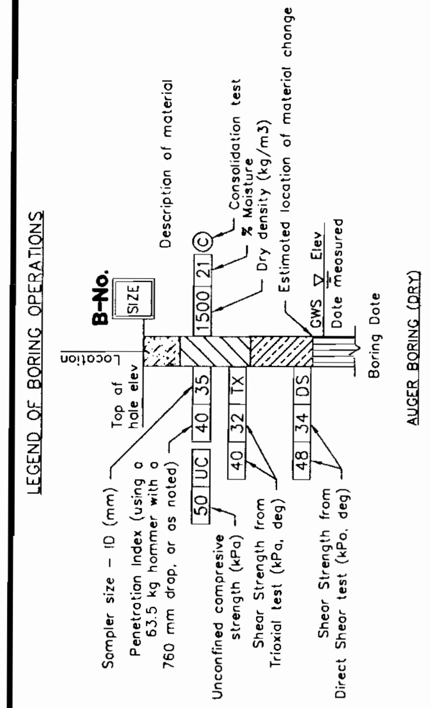
LOG OF TEST BORINGS

CEG REF NO.	BORING LOCS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C2	C10

LEGEND OF BORING OPERATIONS

- ● 57 mm CONE PENETROMETER
- SIZE SAMPLE BORING (DRY)
- SIZE ROTARY SAMPLE BORING (WET)
- SIZE AUGER BORING (DRY)
- TEST TRENCH
- SIZE DIAMOND CORE BORING
- SIZE JET BORING
- ▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm



LEGEND OF EARTH MATERIALS

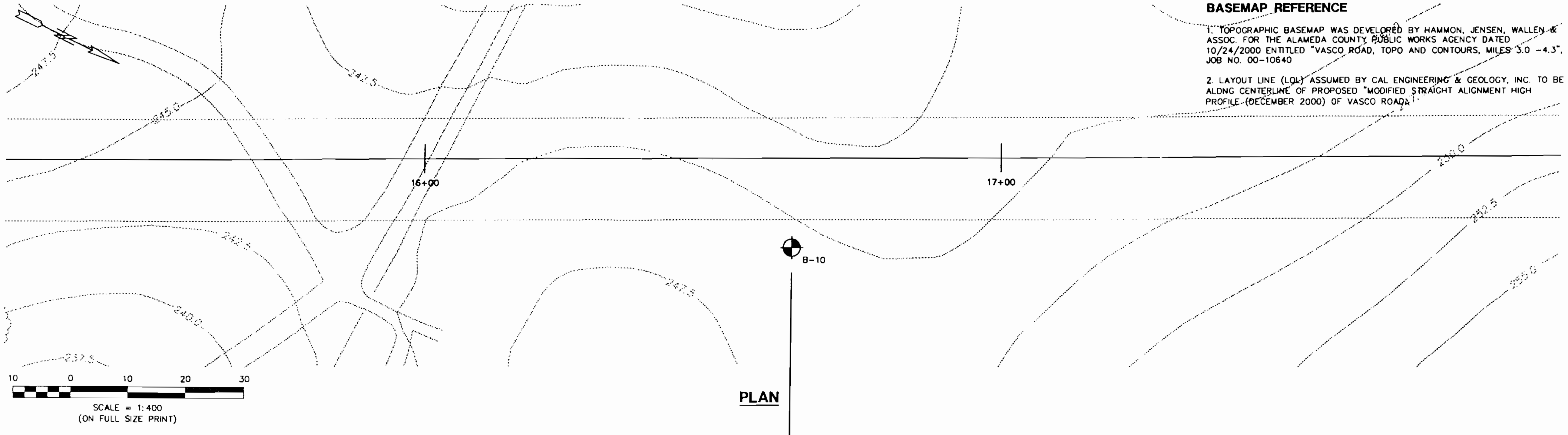
- GRAVEL
- SAND
- SILT
- CLAY
- SANDY SILT or SILTY SAND
- SANDY CLAY or CLAYEY SAND
- CLAYEY SILT
- SILTY CLAY
- PEAT and/or ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.



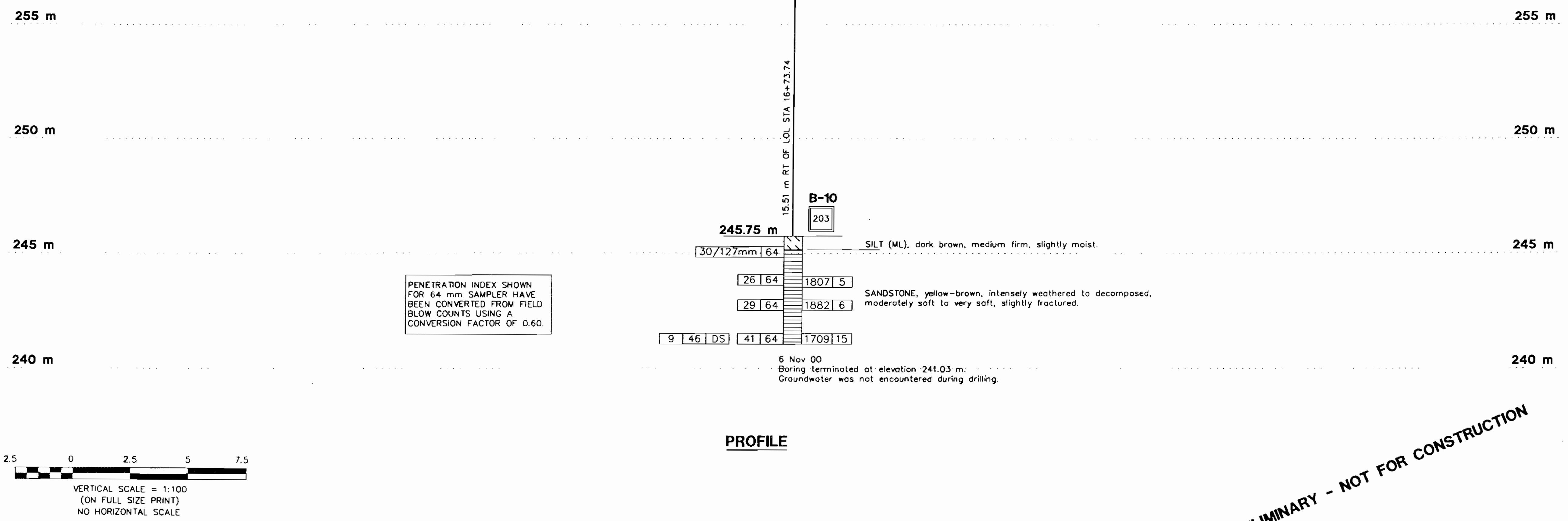
SCALE = 1:400
(ON FULL SIZE PRINT)

PLAN

BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD."



SILT (ML), dark brown, medium firm, slightly moist.

SANDSTONE, yellow-brown, intensely weathered to decomposed, moderately soft to very soft, slightly fractured.

6 Nov 00
Boring terminated at elevation 241.03 m.
Groundwater was not encountered during drilling.

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

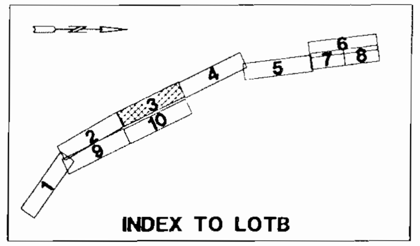
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

PROFILE

PRELIMINARY - NOT FOR CONSTRUCTION

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



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W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

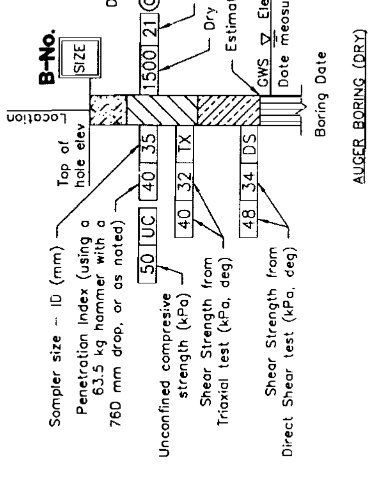
LOG OF TEST BORINGS

CEG REF NO.	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C3	C10

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

//CEG/001860Vasco/P[illegible]INARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0°
PLOT SCALE: 1000 TEXT ROTATION: 0°
LOG OF TEST BORING: -999-X --

LEGEND OF BORING OPERATIONS



- ● 57 mm CONE PENETROMETER
- SIZE SAMPLE BORING (DRY)
- SIZE ROTARY SAMPLE BORING (WET)
- SIZE AUGER BORING (DRY)
- ⊢⊣ TEST TRENCH
- ◇ DIAMOND CORE BORING
- SIZE JET BORING
- ▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

CONSISTENCY CLASSIFICATION FOR SOILS

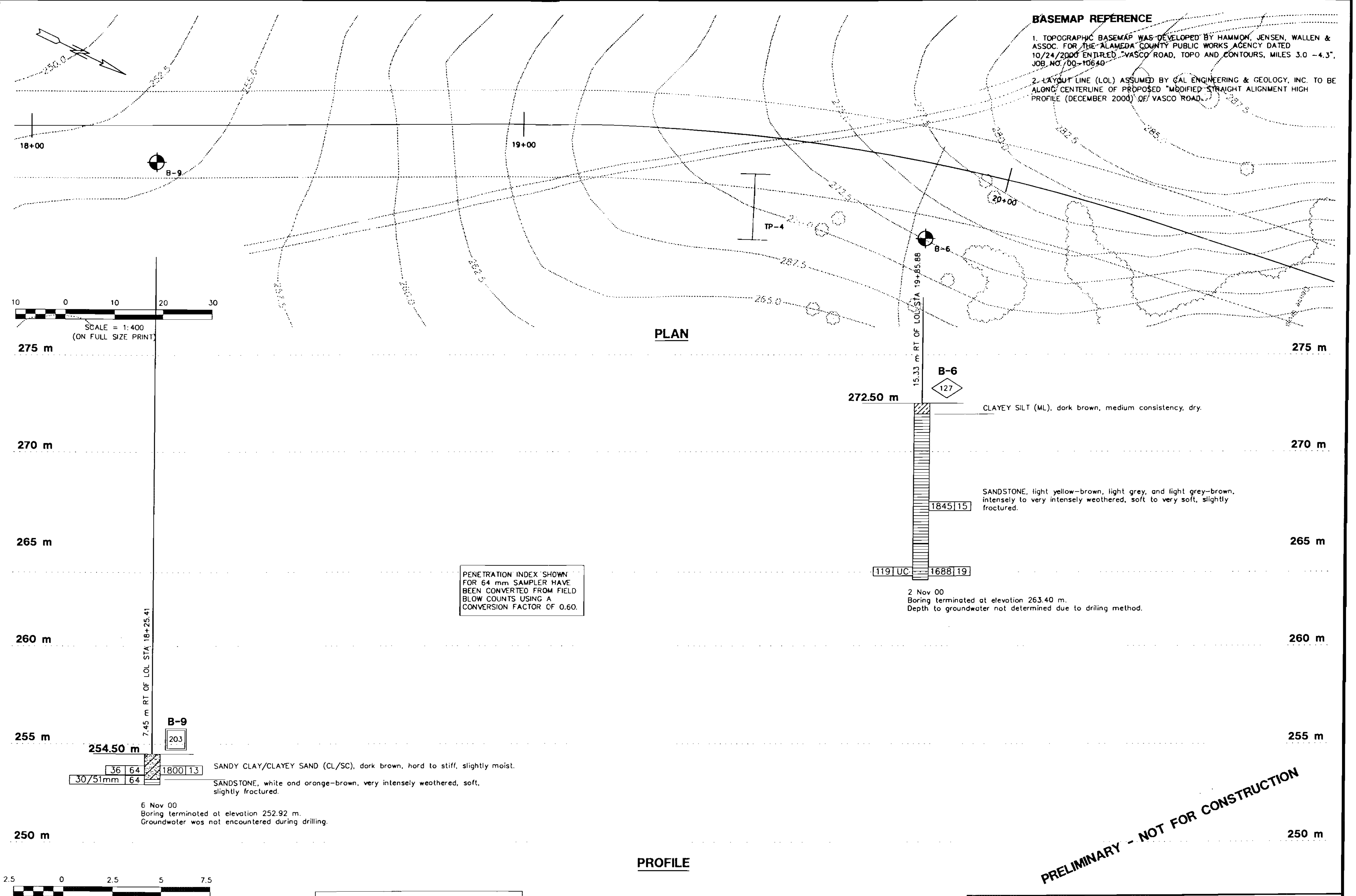
According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0–4	Very Loose	Very Soft
5–9	Loose	Soft
10–19	Slightly Compact	Stiff
20–34	Compact	Very Stiff
35–69	Dense	Hard
>70	Very Dense	Very Hard

LEGEND OF EARTH MATERIALS

▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▥	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▤	METAMORPHIC ROCK
▨	CLAYEY SILT		

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.



BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 –4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.

CLAYEY SILT (ML), dark brown, medium consistency, dry.

SANDSTONE, light yellow-brown, light grey, and light grey-brown, intensely to very intensely weathered, soft to very soft, slightly fractured.

2 Nov 00
Boring terminated at elevation 263.40 m.
Depth to groundwater not determined due to driling method.

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

SANDY CLAY/CLAYEY SAND (CL/SC), dark brown, hard to stiff, slightly moist.

SANDSTONE, white and orange-brown, very intensely weathered, soft, slightly fractured.

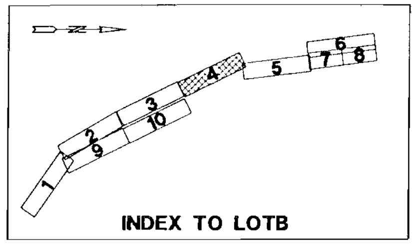
6 Nov 00
Boring terminated at elevation 252.92 m.
Groundwater was not encountered during drilling.

PRELIMINARY - NOT FOR CONSTRUCTION

VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

SOIL DESCRIPTION ABBREVIATIONS

- vfg VERY FINE GRAINED
- fg FINE GRAINED
- mg MEDIUM GRAINED
- cg COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
UNITS ARE IN METERS UNLESS OTHERWISE NOTED

CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

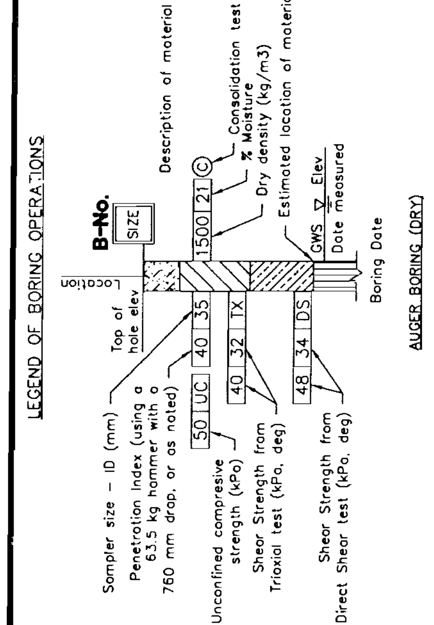
LOG OF TEST BORINGS

CLG REF NO.	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C4	C10

//CEG/00186OVasco/PRELIMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0°
PLOT SCALE: 100C TEXT ROTATION: 0°
LOG OF TEST BORING K-999-X --

//CEG/001860Vasco/PRELIMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0'
PLOT SCALE: 100f TEXT ROTATION: 0'
LOG OF TEST BORIN K-999-X --

LEGEND OF BORING OPERATIONS



- ● 57 mm CONE PENETROMETER
- SIZE SAMPLE BORING (DRY)
- SIZE ROTARY SAMPLE BORING (WET)
- SIZE AUGER BORING (DRY)
- ⊢⊣ TEST TRENCH
- ◇ SIZE DIAMOND CORE BORING
- SIZE JET BORING
- ▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

- ▨ GRAVEL
- ▨ SAND
- ▨ SILT
- ▨ CLAY
- ▨ SANDY SILT or SILTY SAND
- ▨ SANDY CLAY or CLAYEY SAND
- ▨ CLAYEY SILT
- ▨ SILTY CLAY
- ▨ PEAT and/or ORGANIC MATTER
- ▨ FILL MATERIAL
- ▨ IGNEOUS ROCK
- ▨ SEDIMENTARY ROCK
- ▨ METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

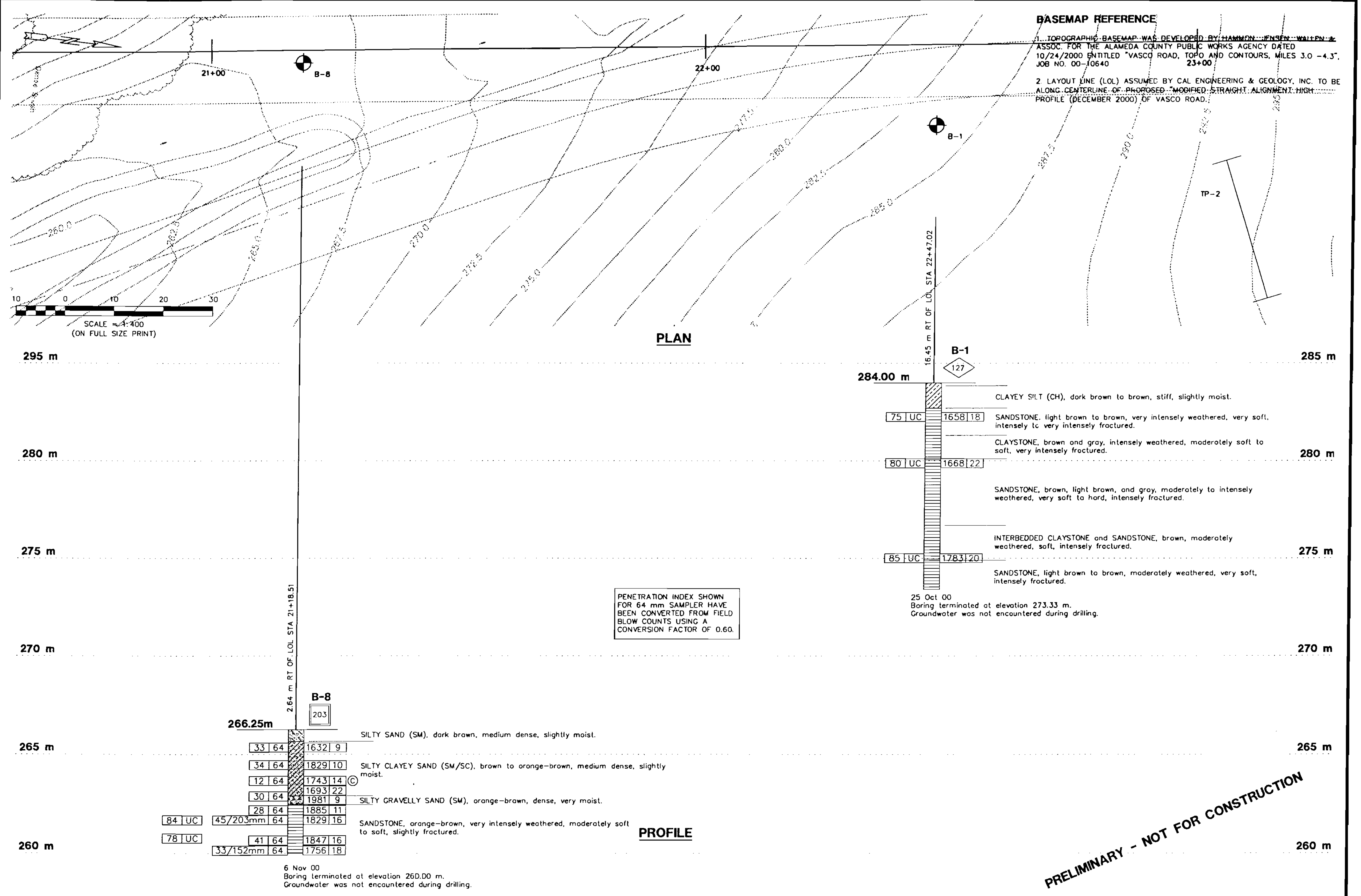
Penetration Index (Blows/0.3m)	Granular	Cohesive
0–4	Very Loose	Very Soft
5–9	Loose	Soft
10–19	Slightly Compact	Stiff
20–34	Compact	Very Stiff
35–69	Dense	Hard
>70	Very Dense	Very Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 –4.3", JOB NO. 00–10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



B-1

CLAYEY SILT (CH), dark brown to brown, stiff, slightly moist.

SANDSTONE, light brown to brown, very intensely weathered, very soft, intensely to very intensely fractured.

CLAYSTONE, brown and gray, intensely weathered, moderately soft to soft, very intensely fractured.

SANDSTONE, brown, light brown, and gray, moderately to intensely weathered, very soft to hard, intensely fractured.

INTERBEDDED CLAYSTONE and SANDSTONE, brown, moderately weathered, soft, intensely fractured.

SANDSTONE, light brown to brown, moderately weathered, very soft, intensely fractured.

25 Oct 00
Boring terminated at elevation 273.33 m.
Groundwater was not encountered during drilling.

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

B-8

SILTY SAND (SM), dark brown, medium dense, slightly moist.

SILTY CLAYEY SAND (SM/SC), brown to orange-brown, medium dense, slightly moist.

SILTY GRAVELLY SAND (SM), orange-brown, dense, very moist.

SANDSTONE, orange-brown, very intensely weathered, moderately soft to soft, slightly fractured.

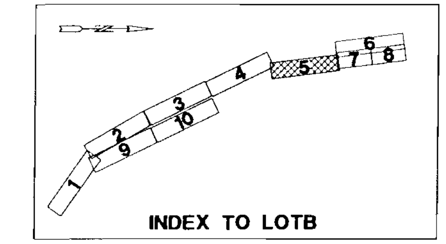
6 Nov 00
Boring terminated at elevation 260.00 m.
Groundwater was not encountered during drilling.

PRELIMINARY - NOT FOR CONSTRUCTION

2.5 0 2.5 5 7.5
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

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Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

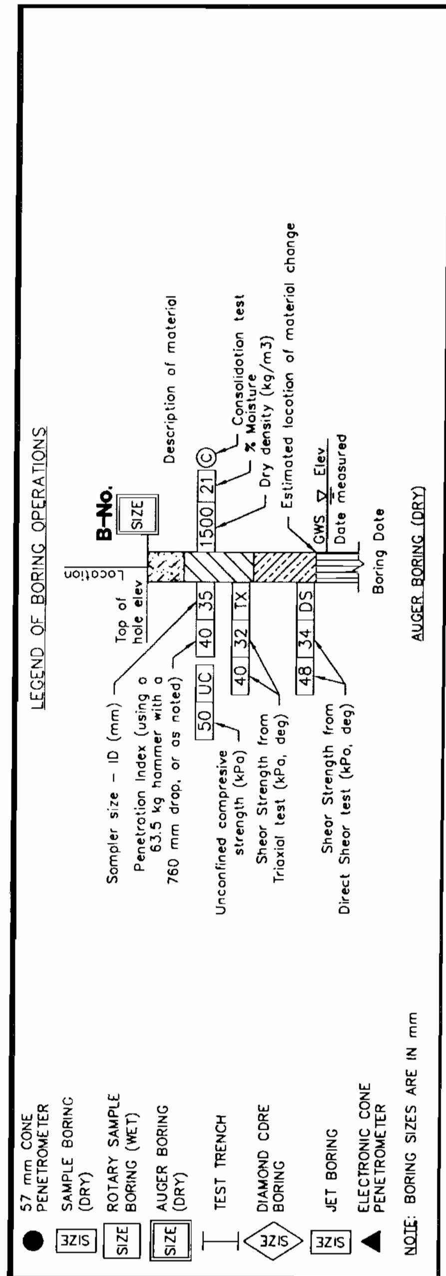
REVIEWED
REVIEWED
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

LOG OF TEST BORINGS

CEG REF NO	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P GREGORY	------	AS SHOWN	K-999-X	C5	C10

LEGEND OF BORING OPERATIONS



NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

- GRAVEL
- SAND
- SILT
- CLAY
- SANDY SILT or SILTY SAND
- SANDY CLAY or CLAYEY SAND
- CLAYEY SILT
- SILTY CLAY
- PEAT and/or ORGANIC MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

CONSISTENCY CLASSIFICATION FOR SOILS

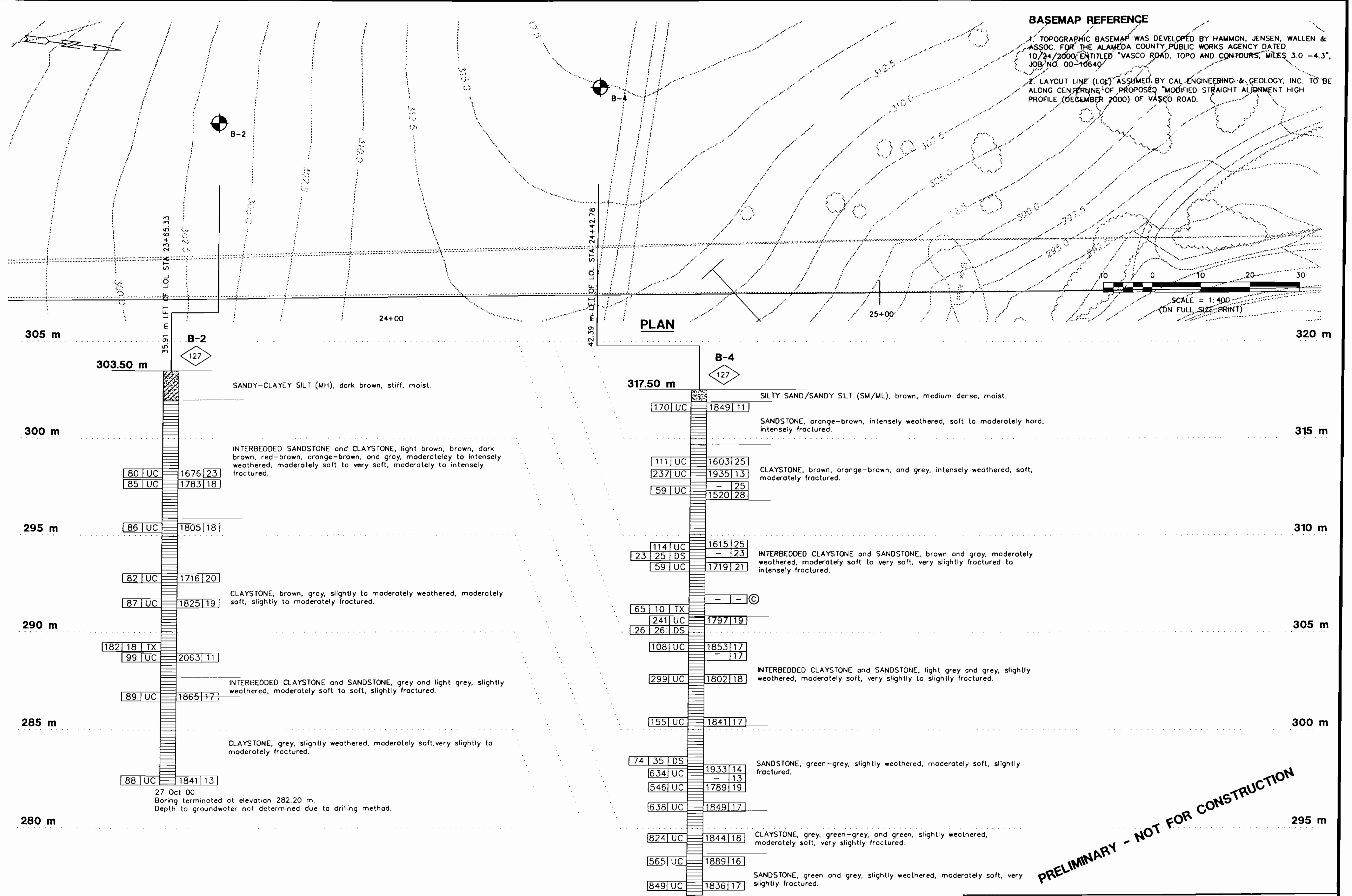
According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



B-2

SANDY-CLAYEY SILT (MH), dark brown, stiff, moist.

INTERBEDDED SANDSTONE and CLAYSTONE, light brown, brown, dark brown, red-brown, orange-brown, and gray, moderateley to intensely weathered, moderately soft to very soft, moderately to intensely fractured.

CLAYSTONE, brown, gray, slightly to moderately weathered, moderately soft, slightly to moderately fractured.

INTERBEDDED CLAYSTONE and SANDSTONE, grey and light grey, slightly weathered, moderately soft to soft, slightly fractured.

CLAYSTONE, grey, slightly weathered, moderately soft,very slightly to moderately fractured.

27 Oct 00
Boring terminated at elevation 282.20 m.
Depth to groundwater not determined due to drilling method.

B-4

SILTY SAND/SANDY SILT (SM/ML), brown, medium dense, moist.

SANDSTONE, orange-brown, intensely weathered, soft to moderately hard, intensely fractured.

CLAYSTONE, brown, orange-brown, and grey, intensely weathered, soft, moderately fractured.

INTERBEDDED CLAYSTONE and SANDSTONE, brown and gray, moderately weathered, moderately soft to very soft, very slightly fractured to intensely fractured.

INTERBEDDED CLAYSTONE and SANDSTONE, light grey and grey, slightly weathered, moderately soft, very slightly to slightly fractured.

SANDSTONE, green-grey, slightly weathered, moderately soft, slightly fractured.

CLAYSTONE, grey, green-grey, and green, slightly weathered, moderately soft, very slightly fractured.

SANDSTONE, green and grey, slightly weathered, moderately soft, very slightly fractured.

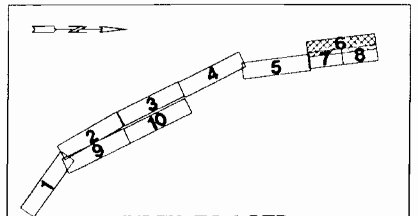
2 Nov 00
Boring terminated at elevation 291.60 m.
Depth to groundwater not determined due to drilling method.

PRELIMINARY - NOT FOR CONSTRUCTION

2.5 0 2.5 5 7.5
VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
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Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

LOG OF TEST BORINGS

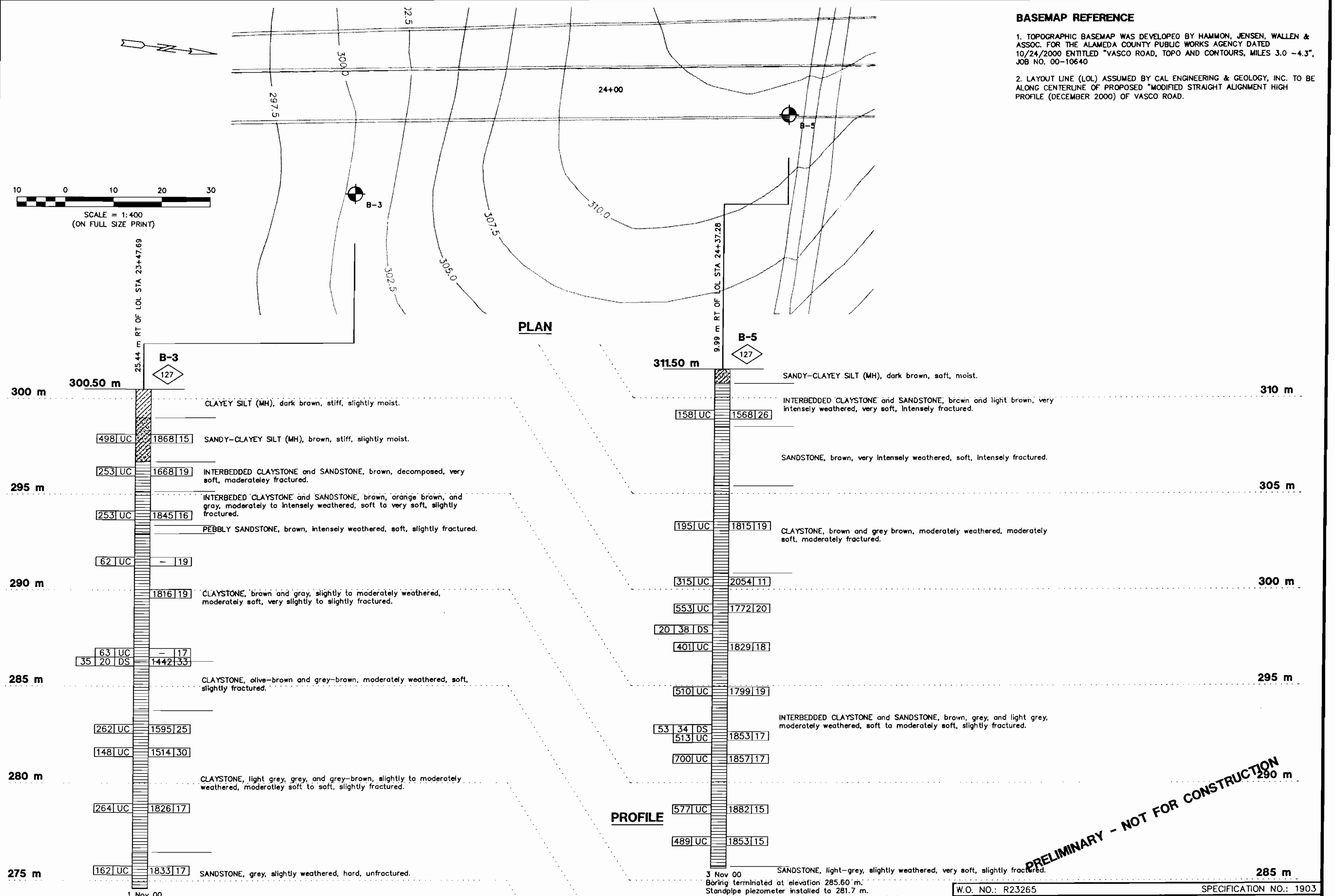
CEG REF NO	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO	SHEET NO	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C6	C10

//CEG/001860Vasco/PRELIMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0'
PLOT SCALE: 100' TEXT ROTATION: 0'
LOG OF TEST BORIN K-999-X --

BASEMAP REFERENCE

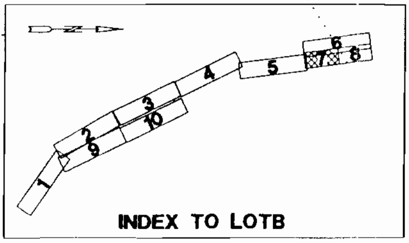
1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



2.5 0 2.5 5 7.5

VERTICAL SCALE = 1:100
(ON FULL SIZE PRINT)
NO HORIZONTAL SCALE

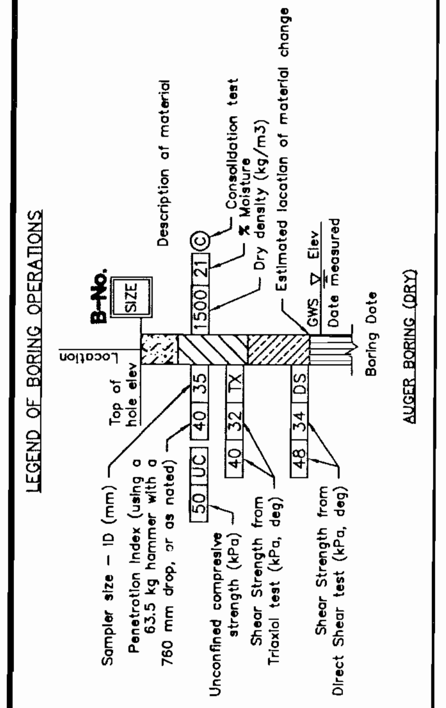


INDEX TO LOTB

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED

LEGEND OF BORING OPERATIONS



Sampler size – ID (mm)
Penetration Index (using a 63.5 kg hammer with a 760 mm drop, or as noted)
Unconfined compresive strength (kPa)
Shear Strength from Triaxial test (kPa, deg)
Shear Strength from Direct Shear test (kPa, deg)
Description of material
Consolidation test
% Moisture
Dry density (kg/m3)
Estimated location of material change

● 57 mm CONE PENETROMETER
SIZE SAMPLE BORING (DRY)
SIZE ROTARY SAMPLE BORING (WET)
SIZE AUGER BORING (DRY)
⊢⊣ TEST TRENCH
◇SIZE DIAMOND CORE BORING
SIZE JET BORING
▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

▨ GRAVEL	▨ SILTY CLAY
▨ SAND	▨ PEAT and/or ORGANIC MATTER
▨ SILT	▨ FILL MATERIAL
▨ CLAY	▨ IGNEOUS ROCK
▨ SANDY SILT or SILTY SAND	▨ SEDIMENTARY ROCK
▨ SANDY CLAY or CLAYEY SAND	▨ METAMORPHIC ROCK
▨ CLAYEY SILT	

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

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CAL ENGINEERING & GEOLOGY
1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

CEG REF NO. 001860	BORING LOGS RS/SW	DRAWN MM/BW	CHECKED P.GREGORY	

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

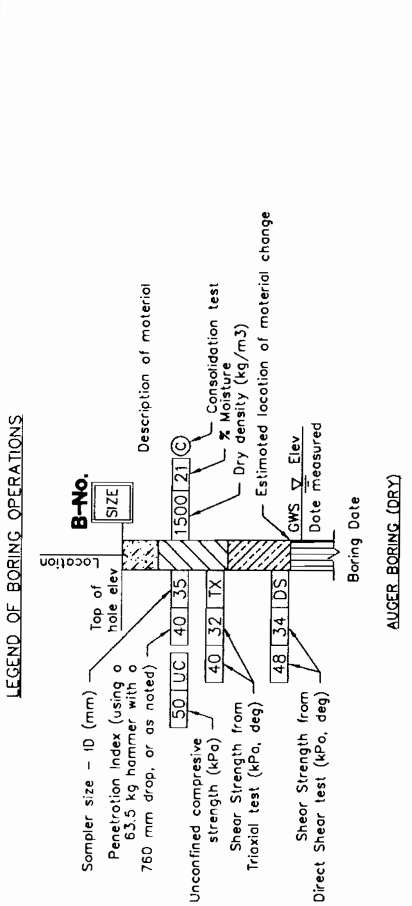
VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

LOG OF TEST BORINGS

DATE	SCALE	FILE NO.	SHEET NO.	OF
----------	AS SHOWN	K-999-X	C7	C10

/CEG/001860Vasco/ ...INARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0'
PLOT SCALE: 1000 TEXT ROTATION: 0'
LOG OF TEST BORINGS: K-999-X --

LEGEND OF BORING OPERATIONS



- ● 57 mm CONE PENETROMETER
- SIZE SAMPLE BORING (DRY)
- SIZE ROTARY SAMPLE BORING (WET)
- SIZE AUGER BORING (DRY)
- TEST TRENCH
- ◇ SIZE DIAMOND CORE BORING
- SIZE JET BORING
- ▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▨	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▨	METAMORPHIC ROCK
▨	CLAYEY SILT		

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0–4	Very Loose	Very Soft
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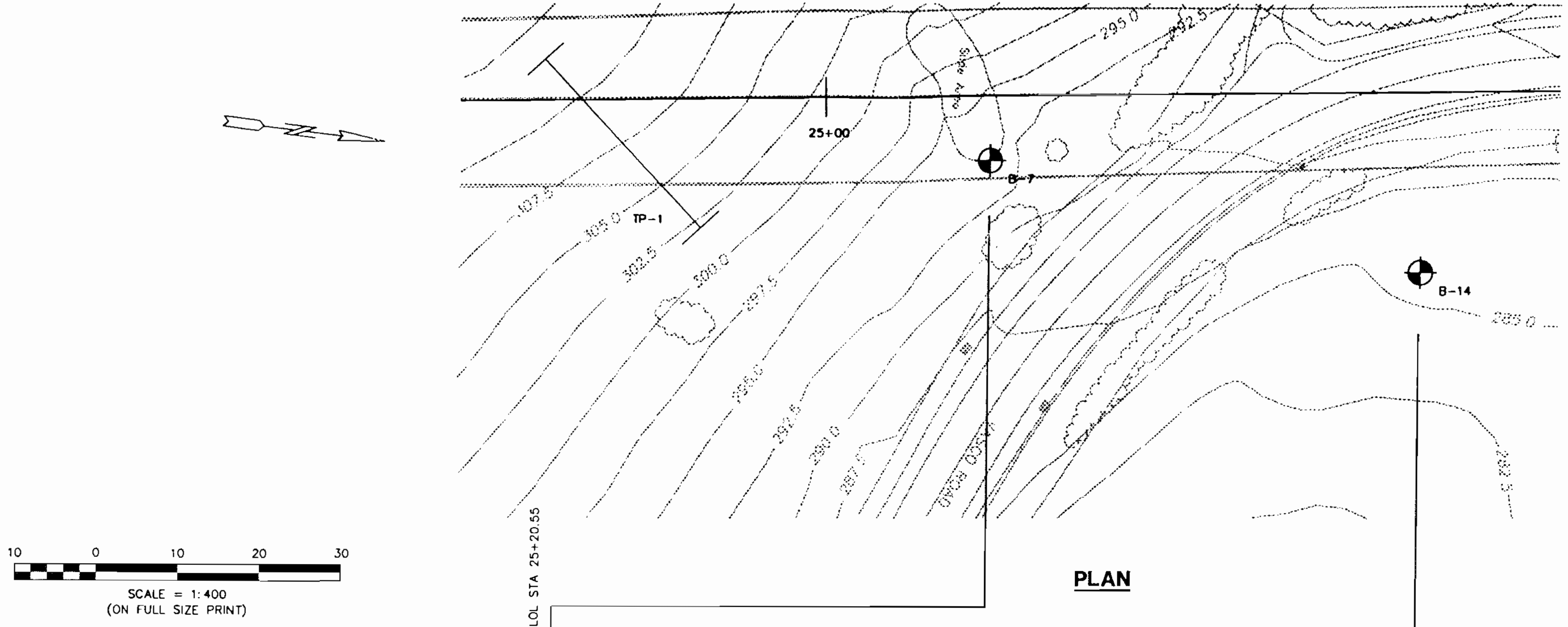
35–69	Dense	Hard
>70	Very Dense	Very Hard

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

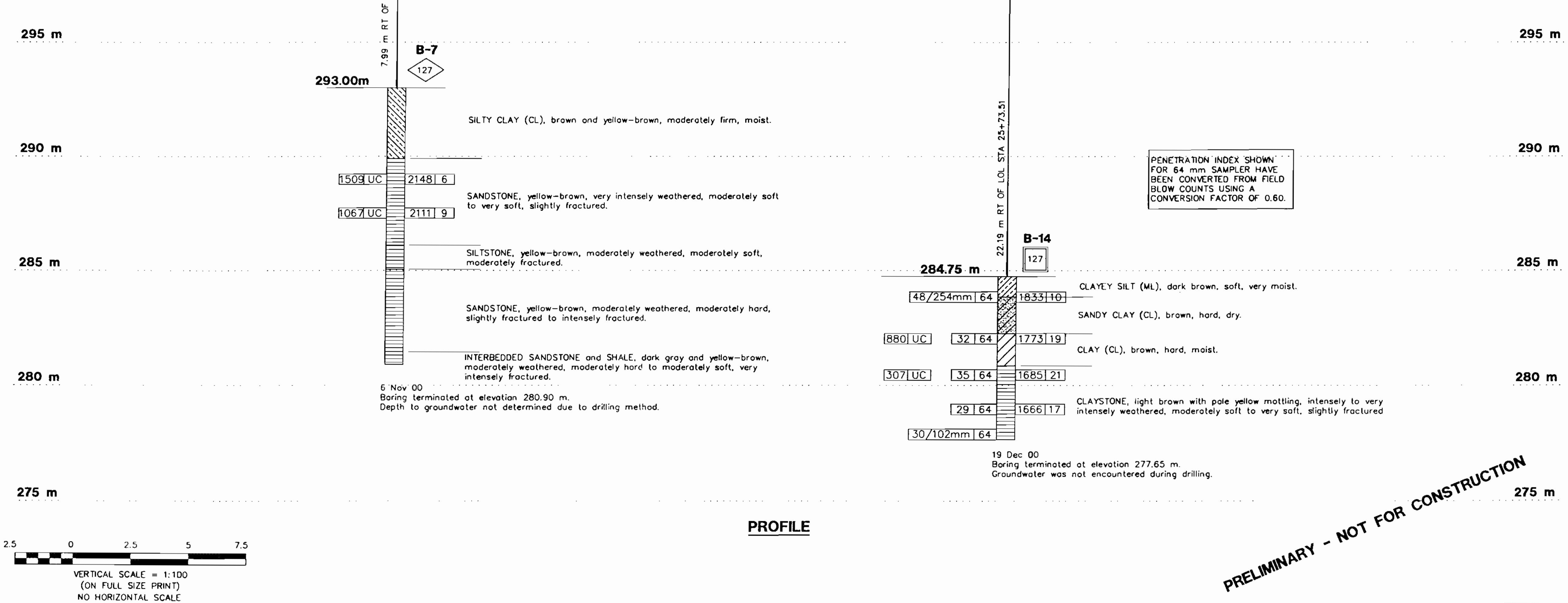


PLAN

BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 –4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



SILTY CLAY (CL), brown and yellow-brown, moderately firm, moist.

SANDSTONE, yellow-brown, very intensely weathered, moderately soft to very soft, slightly fractured.

SILTSTONE, yellow-brown, moderately weathered, moderately soft, moderately fractured.

SANDSTONE, yellow-brown, moderately weathered, moderately hard, slightly fractured to intensely fractured.

INTERBEDDED SANDSTONE and SHALE, dark gray and yellow-brown, moderately weathered, moderately hard to moderately soft, very intensely fractured.

6 Nov 00
Boring terminated at elevation 280.90 m.
Depth to groundwater not determined due to drilling method.

CLAYEY SILT (ML), dark brown, soft, very moist.

SANDY CLAY (CL), brown, hard, dry.

CLAY (CL), brown, hard, moist.

CLAYSTONE, light brown with pale yellow mottling, intensely to very intensely weathered, moderately soft to very soft, slightly fractured

19 Dec 00
Boring terminated at elevation 277.65 m.
Groundwater was not encountered during drilling.

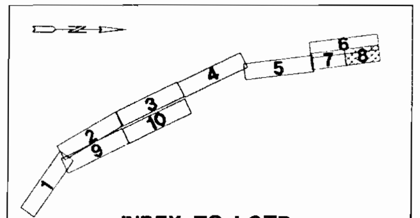
PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

PROFILE

PRELIMINARY - NOT FOR CONSTRUCTION

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



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W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3

LOG OF TEST BORINGS

CEG REF NO	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C8	C10

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

//CEG/D01860Vasco ...IMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0°
PLOT SCALE: 100(TEXT ROTATION: 0°
LOG OF TEST BORING K-999-X --

//CEG/001860Vasco ... IMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0°
PLOT SCALE: 100C TEXT ROTATION: 0°
LOG OF TEST BORIN... -999-X

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

LEGEND OF EARTH MATERIALS

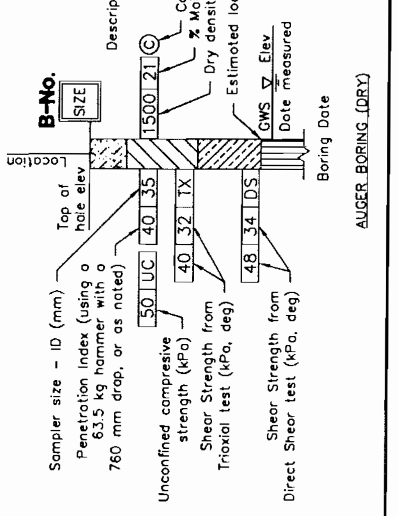
▨	GRAVEL	▨	SILTY CLAY
▨	SAND	▨	PEAT and/or ORGANIC MATTER
▨	SILT	▨	FILL MATERIAL
▨	CLAY	▨	IGNEOUS ROCK
▨	SANDY SILT or SILTY SAND	▨	SEDIMENTARY ROCK
▨	SANDY CLAY or CLAYEY SAND	▨	METAMORPHIC ROCK
▨	CLAYEY SILT		

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

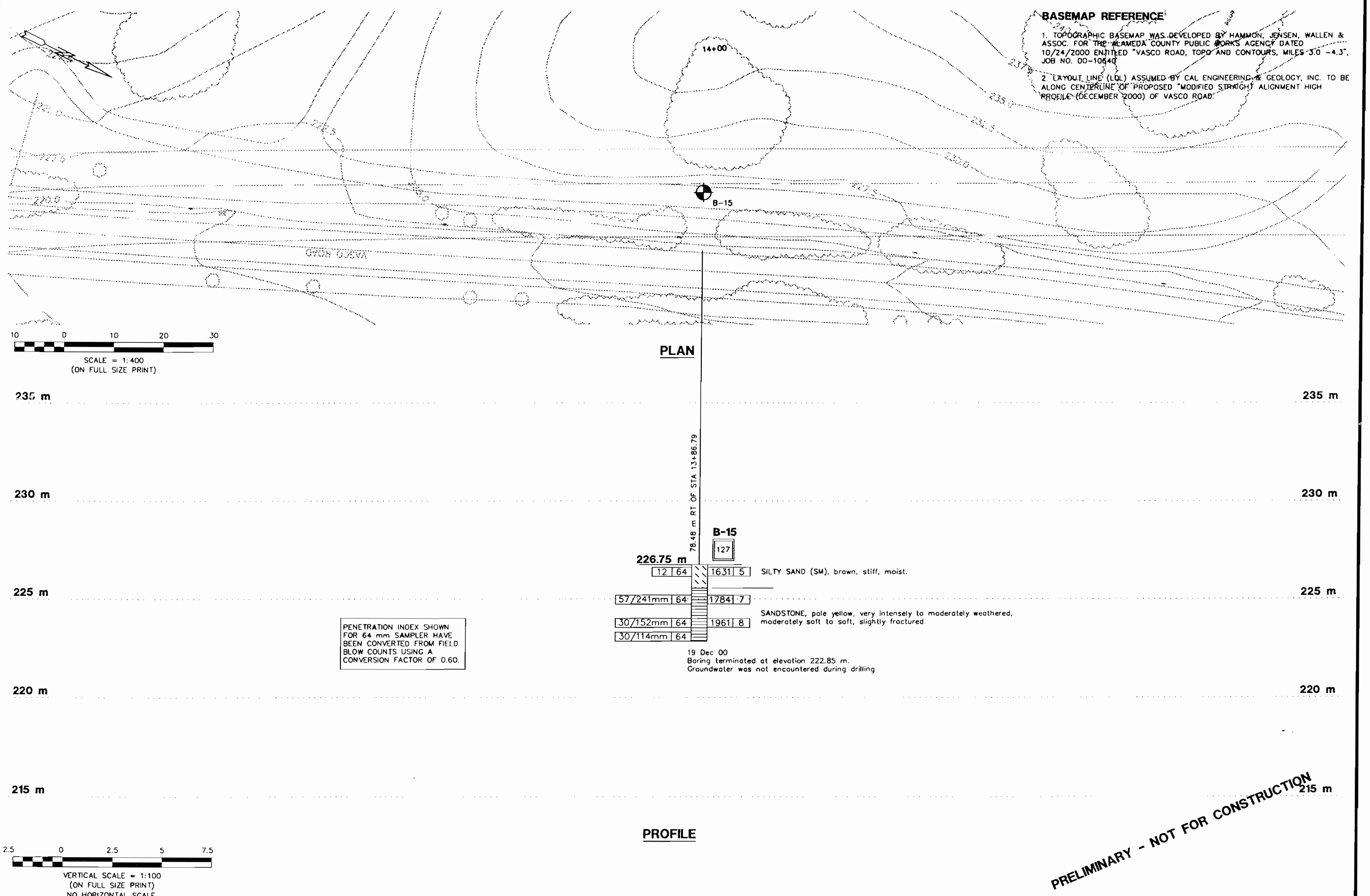
●	57 mm CONE PENETROMETER
SIZE	SAMPLE BORING (DRY)
SIZE	ROTARY SAMPLE BORING (WET)
SIZE	AUGER BORING (DRY)
⊢⊣	TEST TRENCH
◇ SIZE	DIAMOND CORE BORING
SIZE	JET BORING
▲	ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF BORING OPERATIONS



AUGER BORING (DRY)



BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.

SILTY SAND (SM), brown, stiff, moist.

SANDSTONE, pale yellow, very intensely to moderately weathered, moderately soft to soft, slightly fractured.

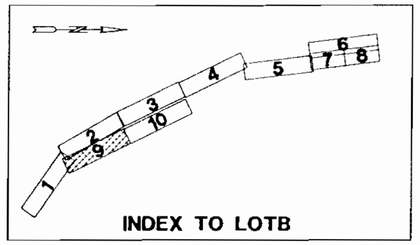
19 Dec 00
Boring terminated at elevation 222.85 m.
Groundwater was not encountered during drilling

PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

PRELIMINARY - NOT FOR CONSTRUCTION

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
UNITS ARE IN METERS UNLESS OTHERWISE NOTED

CE&G
CAL ENGINEERING & GEOLOGY
1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

CEG REF NO.	BORING LOGS	DRAWN	CHECKED
001860	RS/SW	MM/BW	P.GREGORY

W.O. NO.: R23265
SPECIFICATION NO.: 1903

COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

REVIEWED

REVIEWED

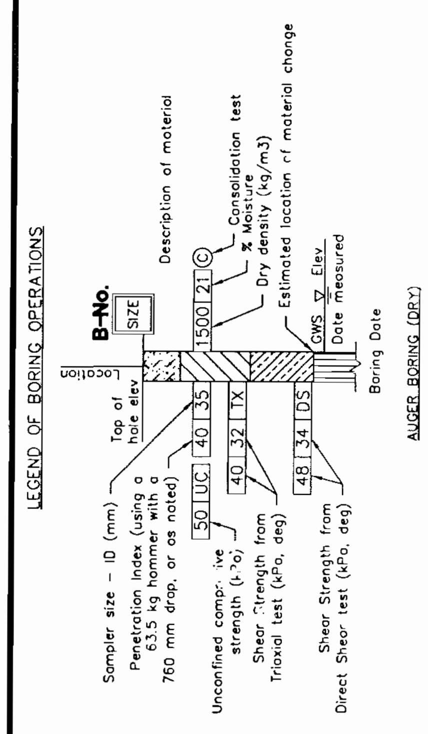
APPROVAL RECOMMENDED

VASCO ROAD SAFETY IMPROVEMENT
VASCO ROAD [illegible] MILES 3.0
AND [illegible] ALAMEDA COUNTY

LOG OF TEST BORINGS

DATE	SCALE	FILE NO.	SHEET NO.	OF
-------	AS SHOWN	K-999-X	C9	C10

LEGEND OF BORING OPERATIONS



● 57 mm CONE PENETROMETER
SIZE SAMPLE BORING (DRY)
SIZE ROTARY SAMPLE BORING (WET)
SIZE AUGER BORING (DRY)
TEST TRENCH
SIZE DIAMOND CORE BORING
SIZE JET BORING
▲ ELECTRONIC CONE PENETROMETER

NOTE: BORING SIZES ARE IN mm

LEGEND OF EARTH MATERIALS

GRAVEL	SILTY CLAY
SAND	PEAT and/or ORGANIC MATTER
SILT	FILL MATERIAL
CLAY	IGNEOUS ROCK
SANDY SILT or SILTY SAND	SEDIMENTARY ROCK
SANDY CLAY or CLAYEY SAND	METAMORPHIC ROCK
CLAYEY SILT	

NOTE: Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

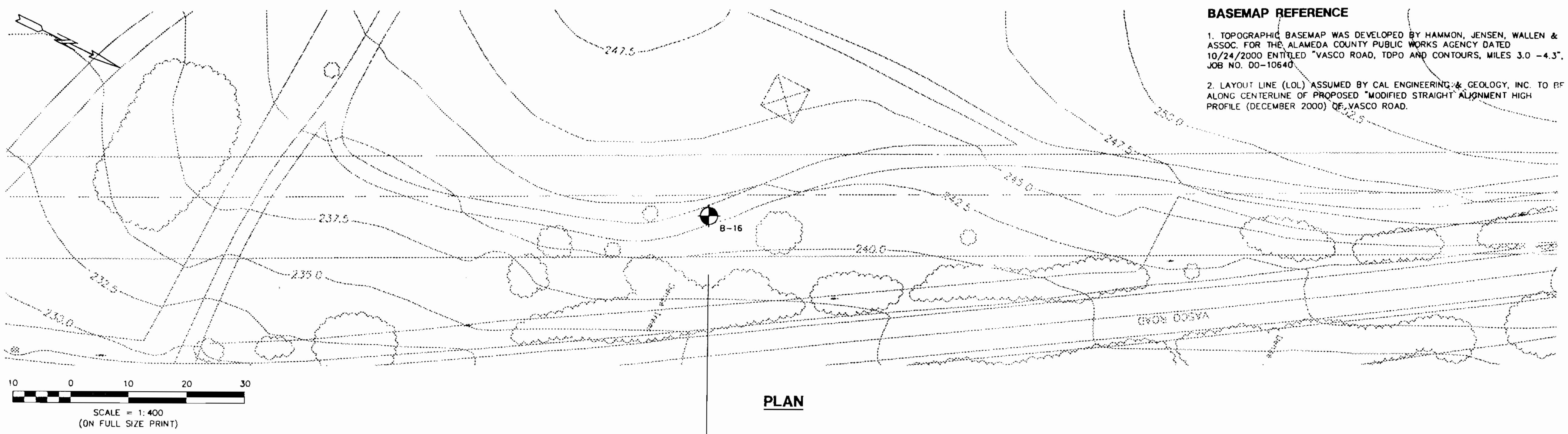
Penetration Index (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-9	Loose	Soft
10-19	Slightly Compact	Stiff
20-34	Compact	Very Stiff
35-69	Dense	Hard
>70	Very Dense	Very Hard

//CEG/001860Vasco' "IMINARYBoringLogs1.dwg 2/01 VIEWPOINT ROTATION: 0'
PLOT SCALE: 100: TEXT ROTATION: 0'
LOG OF TEST BORIN... K-999-X --

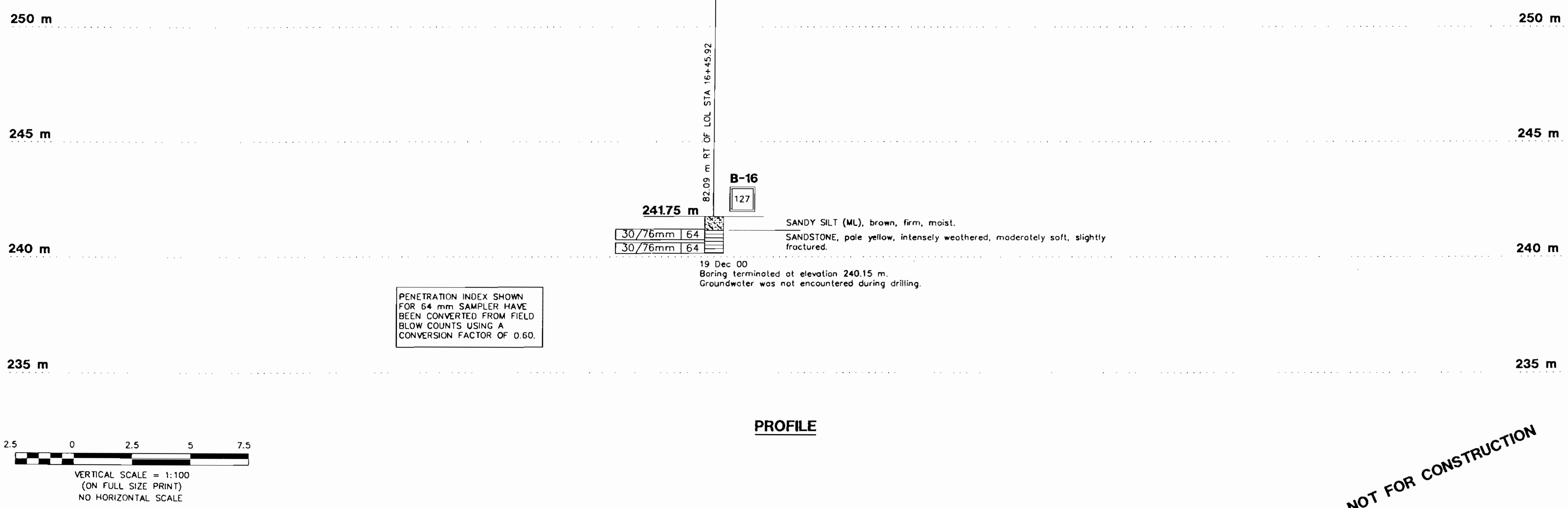
BASEMAP REFERENCE

1. TOPOGRAPHIC BASEMAP WAS DEVELOPED BY HAMMON, JENSEN, WALLEN & ASSOC. FOR THE ALAMEDA COUNTY PUBLIC WORKS AGENCY DATED 10/24/2000 ENTITLED "VASCO ROAD, TOPO AND CONTOURS, MILES 3.0 -4.3", JOB NO. 00-10640.

2. LAYOUT LINE (LOL) ASSUMED BY CAL ENGINEERING & GEOLOGY, INC. TO BE ALONG CENTERLINE OF PROPOSED "MODIFIED STRAIGHT ALIGNMENT HIGH PROFILE (DECEMBER 2000) OF VASCO ROAD.



PLAN



SANDY SILT (ML), brown, firm, moist.

SANDSTONE, pale yellow, intensely weathered, moderately soft, slightly fractured.

19 Dec 00
Boring terminated at elevation 240.15 m.
Groundwater was not encountered during drilling.

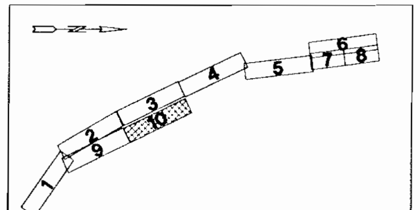
PENETRATION INDEX SHOWN FOR 64 mm SAMPLER HAVE BEEN CONVERTED FROM FIELD BLOW COUNTS USING A CONVERSION FACTOR OF 0.60.

PROFILE

PRELIMINARY - NOT FOR CONSTRUCTION

SOIL DESCRIPTION ABBREVIATIONS

vfg VERY FINE GRAINED
fg FINE GRAINED
mg MEDIUM GRAINED
cg COARSE GRAINED



INDEX TO LOTB

ALAMEDA COUNTY Metric
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CE&G
CAL ENGINEERING & GEOLOGY
1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

W.O. NO.: R23265
SPECIFICATION NO.: 1903

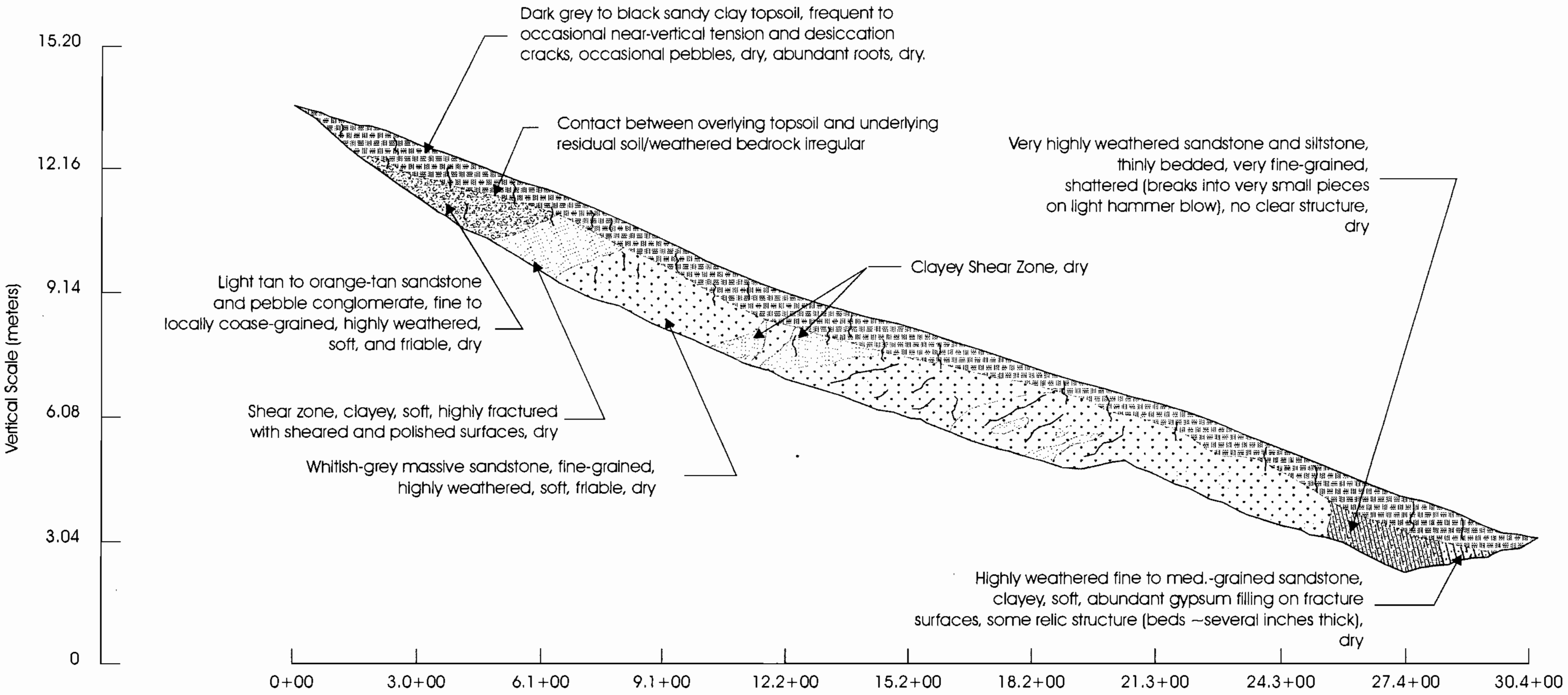
COUNTY OF ALAMEDA ☆ PUBLIC WORKS AGENCY

VASCO ROAD SAFETY IMPROVEMENT
IN ALAMEDA COUNTY
FROM MP 3.4 TO MP 4.3
LOG OF TEST BORINGS

CEG REF NO.	BORING LOGS	DRAWN	CHECKED	DATE	SCALE	FILE NO.	SHEET NO.	OF
001860	RS/SW	MM/BW	P.GREGORY	------	AS SHOWN	K-999-X	C10	C10

REVIEWED
REVIEWED
APPROVAL RECOMMENDED

Appendix D



TEST PIT NO. 1

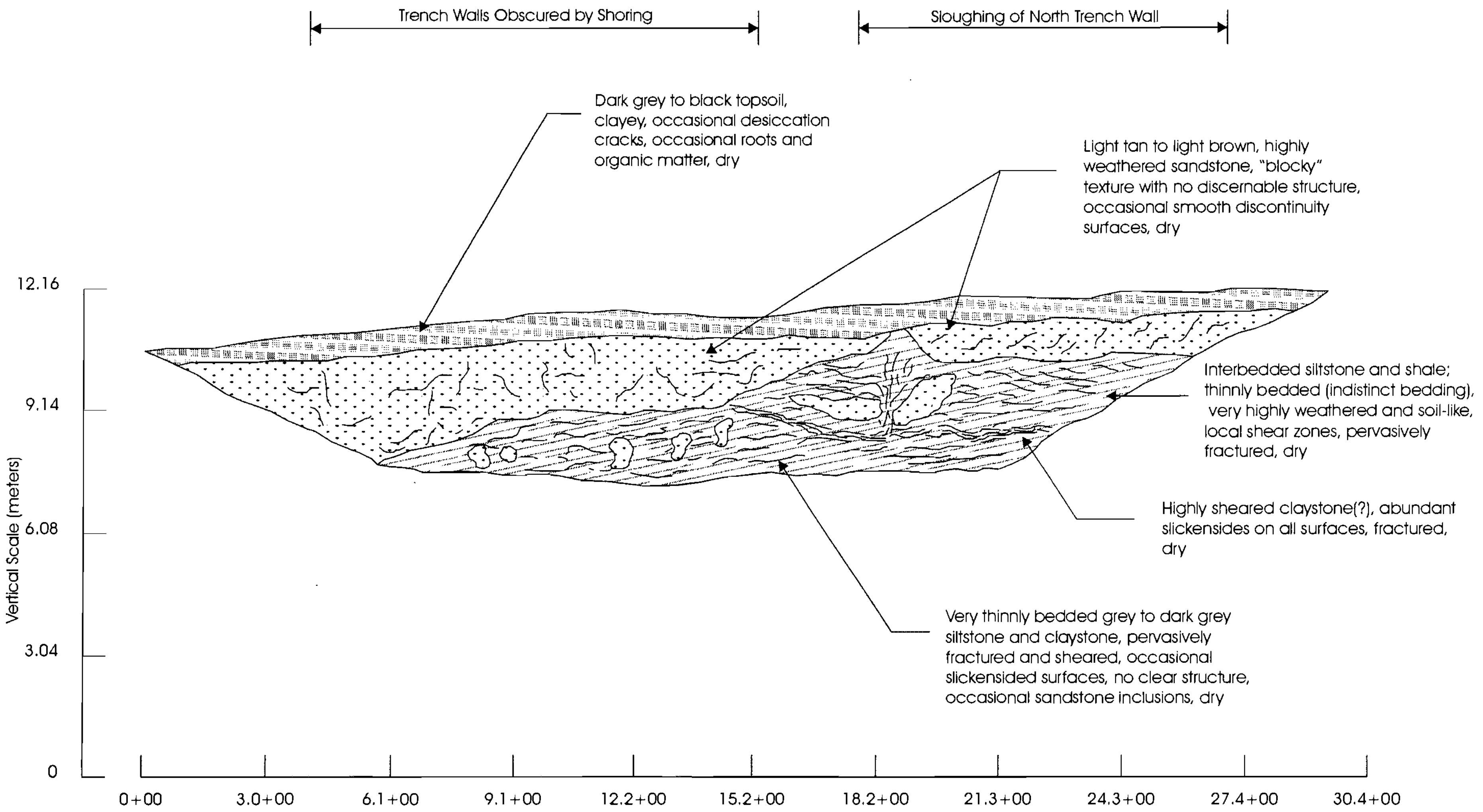
CE&G
Cal Engineering & Geology

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

GEOTECHNIICAL DESIGN REPORT
Vasco Road Safety Improvements
in Alameda County From MP 3.4 to MP 4.3

LOG OF TEST PIT NO. 1

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	D1 OF D4



Dark grey to black topsoil, clayey, occasional desiccation cracks, occasional roots and organic matter, dry

Light tan to light brown, highly weathered sandstone, "blocky" texture with no discernable structure, occasional smooth discontinuity surfaces, dry

Interbedded siltstone and shale; thinnly bedded (indistinct bedding), very highly weathered and soil-like, local shear zones, pervasively fractured, dry

Highly sheared claystone(?), abundant slickensides on all surfaces, fractured, dry

Very thinnly bedded grey to dark grey siltstone and claystone, pervasively fractured and sheared, occasional slickensided surfaces, no clear structure, occasional sandstone inclusions, dry

TEST PIT NO. 2

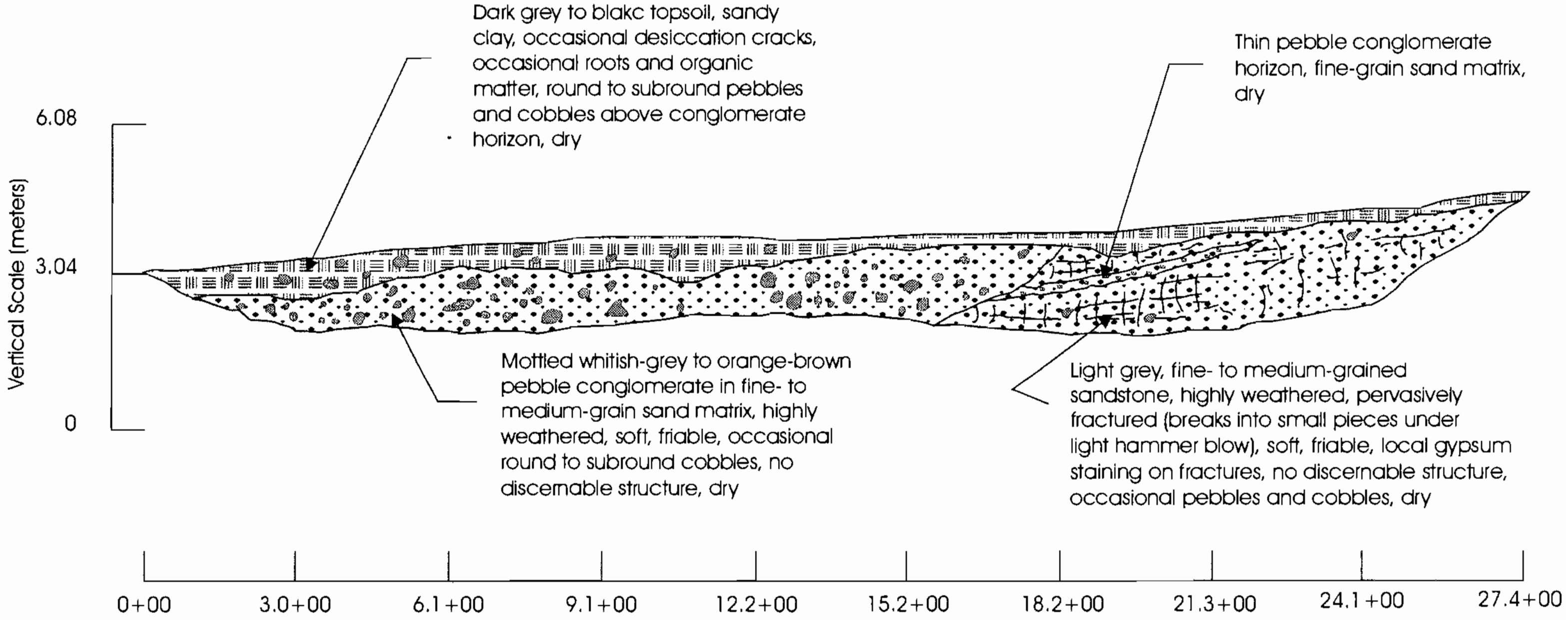
CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

GEOTECHNIICAL DESIGN REPORT
Vasco Road Safety Improvements
in Alameda County From MP 3.4 to MP 4.3

LOG OF TEST PIT NO. 2

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	D2 OF D4



TEST PIT NO. 3

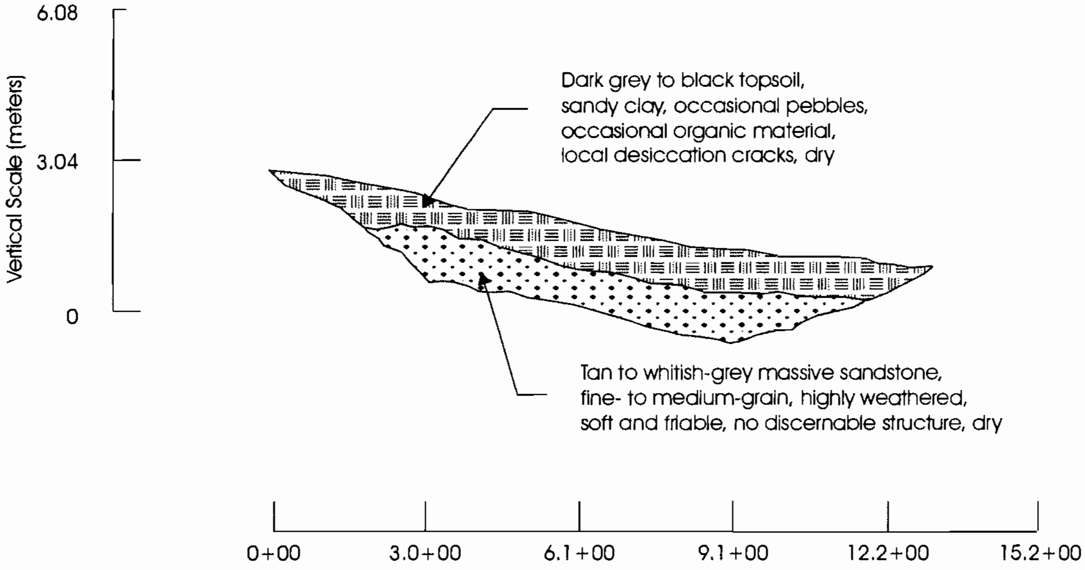
CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

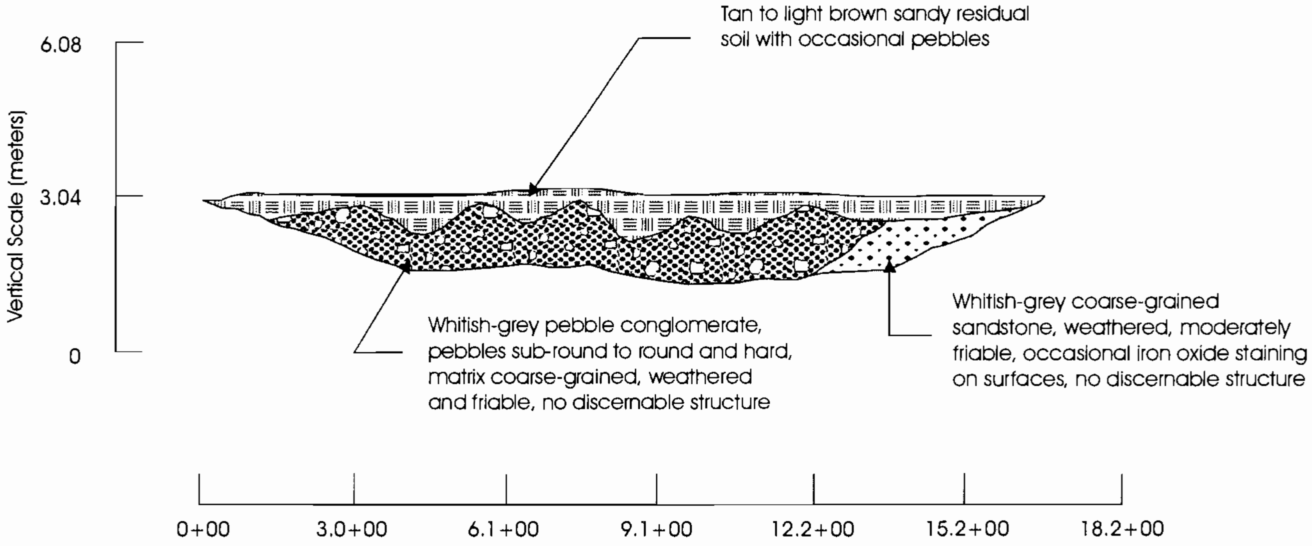
GEOTECHNIICAL DESIGN REPORT
Vasco Road Safety Improvements
in Alameda County From MP 3.4 to MP 4.3

LOG OF TEST PIT NO. 3

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	D3 OF D4



TEST PIT NO. 4



TEST PIT NO. 5

CE&G
CAL ENGINEERING & GEOLOGY

1870 Olympic Blvd.
Suite 100
Walnut Creek, CA 94596
Phone: (925) 935-9771

GEOTECHNIICAL DESIGN REPORT
Vasco Road Safety Improvements
in Alameda County From MP 3.4 to MP 4.3

LOG OF TEST PITS NO. 4 AND NO. 5

JOB NO. R23265	SPEC NO. 1903	JUNE 2001	D4 OF D4

Appendix E

J R ASSOCIATES

Engineering Geophysics
1886 Emory Street
San Jose, CA 95126
(408) 293-7390

SEISMIC REFRACTION SURVEY AT THE VASCO ROAD REALIGNMENT, PHASE I CONTRA COSTA COUNTY, CALIFORNIA

January 17, 2001

for

Cal Engineering and Geology
1870 Olympic Boulevard, Suite 100
Walnut Creek, California, 94596

by

James Rezowalli, GP-921

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

I INTRODUCTION

This report presents the results of a seismic refraction investigation performed at the proposed Vasco Road realignment north of Livermore, California. The investigation was performed for Cal Engineering and Geology by J R Associates. The purpose of the investigation was to measure bedrock depth and rippability. James Rezowalli, Principal Geophysicist, and Robert Wing, Technician, of J R Associates performed the field work in January of 2001.

A. Site Conditions

The site is on the west side of Vasco Road approximately 3.5 miles north of Highway 580 in Livermore, California (Drawing 1). The geology at the site consists of a thin soil cover overlying marine sandstone. Realigning Vasco Road requires excavation into the hill side. Shallow bedrock could make excavating difficult. The purpose of this investigation was to determine the depth and rippability of the bedrock along the proposed new road alignment.

II METHODOLOGY

Seismic refraction data are used to help determine the depth and strength of bedrock. Studies by tractor companies show a relationship between rock strength and seismic compressional (P) wave velocities. The studies show that rocks with fast P-wave velocities are more difficult to rip than rocks with slow P-wave velocities. Both the Caterpillar and Komatsu tractor handbooks contain tables of P-wave velocities versus ripping ease.

A. Field Procedures

Data were collected along two seismic refraction lines (Drawing 2). The locations of the refraction lines were marked with wooden stakes in the field. The lines were 800 feet long and contained 24 geophones and 3 shot points. The shot points were at the beginning, the end and in the middle of the lines. Small charges consisting of 2/3 pounds of ammonium-nitrate based explosives were used to create seismic energy at the shot points.

Vibrations were monitored along a PG&E gas transmission line during the seismic survey. Vibration monitoring was performed to provide documentation that vibrations from the shot points did not exceed levels acceptable to PG&E. The results of the vibration monitoring are presented in Appendix A.

B. Instrumentation

Litton LRS-1011 14-Hz geophones detected the seismic signals. A cable connected the geophones to a pair of Geometrics, Incorporated, 1210F signal enhancement seismographs. The seismographs filtered, stacked and recorded the signals. A 60-Hz notch filter attenuated signals associated with the high voltage power lines. A CRT displayed the seismograph recordings in the field for quality control and a strip chart recorder printed permanent records.

C. Data Reduction

Data reduction began by picking the arrival times from the seismograph recordings. An arrival time is the time a P-wave spent traveling from shot point to geophone. The wave could either travel along the ground surface or be refracted from an interface between materials. For a refraction to occur, the materials below the interface must have a greater P-wave velocity than the materials above the interface. The arrival times were entered into a computer program with elevation, location and layer control information.

The interpretation program, FSIP, performs a first approximation delineation of the refracting horizons using a delay-time method. The approximation is then tested and improved by the program's ray-tracing procedure in which ray travel times computed for the model are compared against measured travel times. The model is subsequently adjusted iteratively to minimize the discrepancy between the computed and measured travel times. A Bureau of Mines Report of Investigation describes the program[1].

---

[1] Scott, James H., Computer Analysis of Seismic Refraction Data, BuMines RI 7595, 1972.

III RESULTS

The results of the computer analysis of the refraction data are presented in Drawing 3 and Table 1. The drawing contains two-dimensional diagrams profiling the seismic layering and layer velocities measured along the refraction lines. Table 1 summarizes the results presented in the drawing.

Table 1. Summary of Refraction Results

Line Number	Depth to Layer 2 (feet)	Depth to Layer 3 (feet)	Layer 1 Velocity (fps)	Layer 2 Velocity (fps)	Layer 3 Velocity (fps)
1	7 to 26	61 to 88	1100	3500	9100
2	10 to 27	47 to 92	1300	5300	6900

A. Seismic Layering

We found three seismic layers beneath the refraction lines. The layers were distinguished by their compressional (P) wave velocities. Layer 1 included the ground surface and had a P-wave velocity ranging between 1100 and 1300 feet per second (fps). The P-wave velocity suggested the first seismic layer consisted of dry to partially saturated colluvium and highly weathered fractured bedrock.

The second seismic layer was distinguished by a P-wave velocity that ranged from 3500 to 5300 fps. The depth to the top of the second seismic layer ranged from 7 to 27 feet. The P-wave velocities suggest the second seismic layer consisted of moderately weathered and/or fractured sandstone.

The third seismic layer was distinguished by a P-wave velocity that ranged from 6900 to 9100 fps. The depth to the top of the third seismic layer ranged from 47 to 92 feet. The P-wave velocities suggest the third seismic layer consisted of moderately weathered and/or fractured sandstone to relatively unweathered sandstone.

B. Rippability

Drawing 4 illustrates a rippability table presented in the 20th edition of the Caterpillar Performance Handbook for the D9N Tractor. Based on the measured P-wave velocities and the D9N table presented in the 20th edition of the Caterpillar Performance Handbook, the first and second seismic layers should be rippable given the proper combination of tractor and ripper.

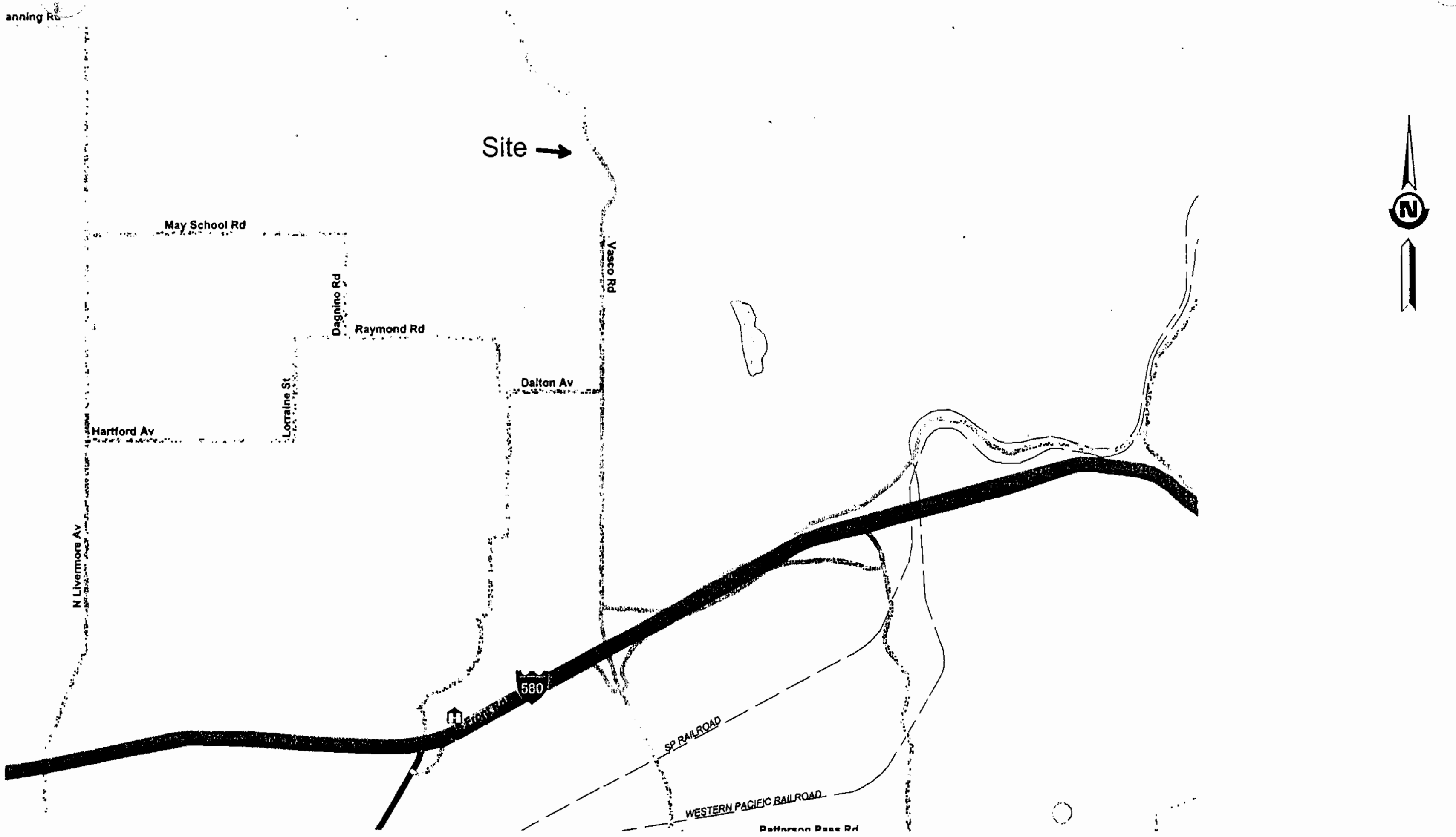
The third seismic layer beneath refraction line SL-2 should be rippable with the right combination of tractor and ripper. The third seismic layer below refraction line SL-1 is marginally rippable to nonrippable.

C. Limitations

Seismic layers do not always correspond directly to lithologic changes that might be found in borehole or trenching data. A seismic layer is an interface between materials with different P-wave velocities. Factors such as weathering, cementation, induration, and saturation as well as lithologic changes can create changes in seismic velocities. Also, there can be lithologic changes without velocity changes. However, our field experience indicates that seismic layers often correspond to major changes in lithology or saturation to within ±20% of the depth to the interface.

Factors that determine rippability include rock characteristics such as P-wave velocity and weathering, the type and condition of the tractor and ripper and the experience of the tractor operator. Our estimates of rippability based on P-wave velocities are obtained from the D9N ripper chart shown in the Caterpillar Performance Handbook published by the Caterpillar Tractor Company. There are other charts for other sized tractors. These performance charts were developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and among rocks of a specific type, our estimate must be recognized as only one indicator of rippability.

IV DRAWINGS



Vicinity Map- Rippability Survey
Vasco Road
Alameda County, California

SCALE: No Scale

DATE: 1-9-2001

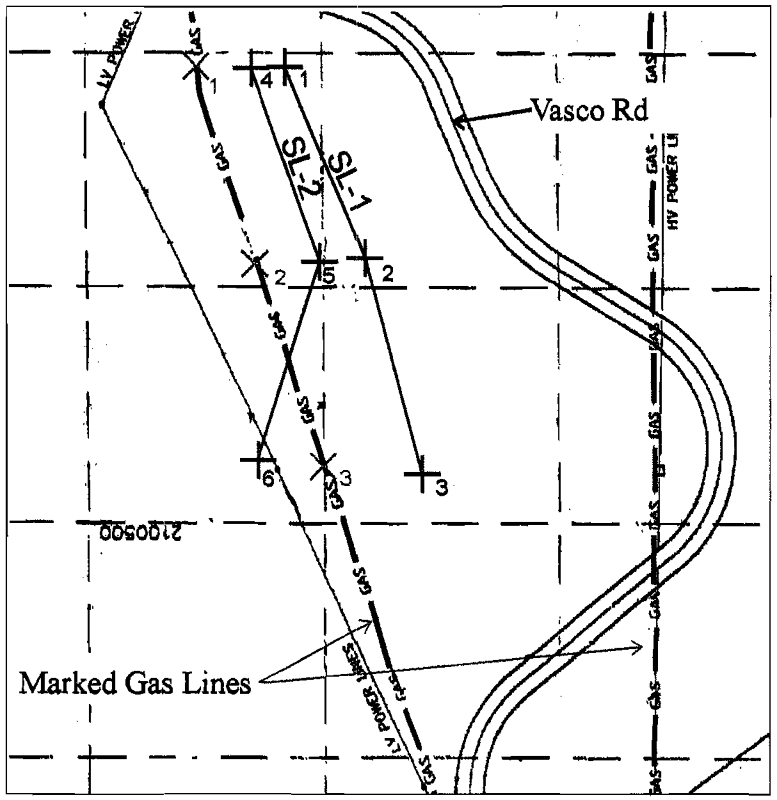
JOB NUMBER: 102-171-01

DRAWN BY: J.J.R.

REVISED:

J R ASSOCIATES Civil and Environmental Geophysics
1886 Emory Street, San Jose, CA (408) 293-7390

DRAWING ER: 1



EXPLANATION:

———	Seismic Line
$+_1$	Shot Point
$\times_1$	Vibration Monitoring Location

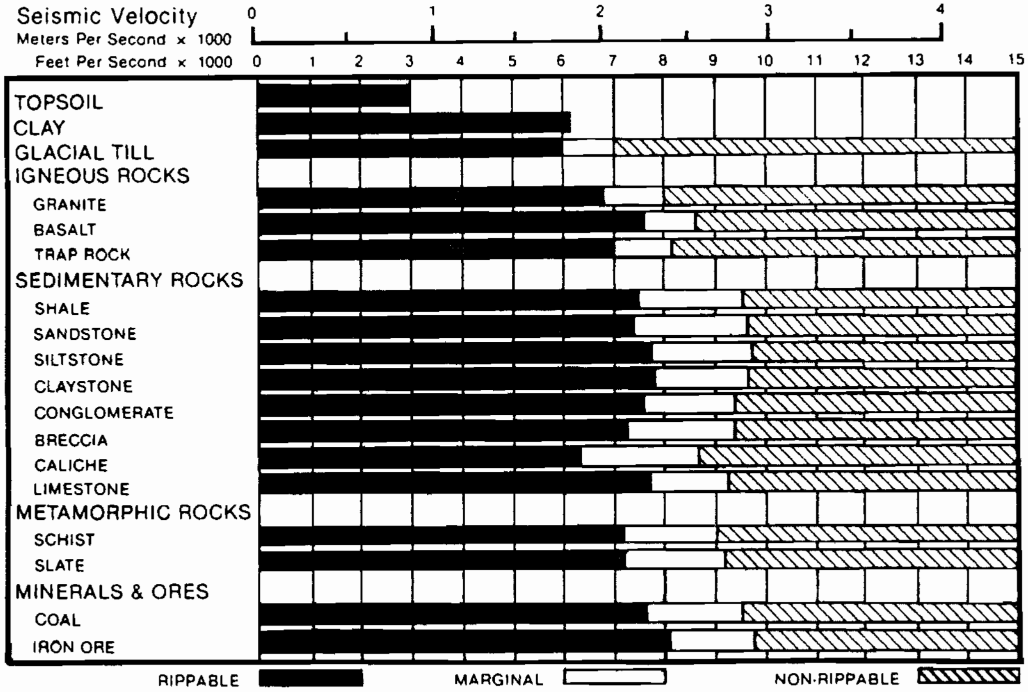
Site Map- Rippability Survey
Vasco Road
Alameda County, California

SCALE: No Scale		DRAWN BY: J.J.R.
DATE: 1-9-2001	JOB NUMBER: 102-171-01	REVISED:

J R ASSOCIATES Civil and Environmental Geophysics
1886 Emory Street, San Jose, CA (408) 293-7390

DRAWING NUMBER: 2

D9N Ripper Performance
- Multi or Single Shank No. 9 Ripper
- Estimated by Seismic Wave Velocities



Ripper Chart- Rippability Survey
Vasco Road
Alameda County, California

SCALE: No Scale		DRAWN BY: J.J.R.	
DATE: 1-09-2001	JOB NUMBER: 102-171-010	REVISED:	

J R ASSOCIATES Civil and Environmental Geophysics
1886 Emory Street, San Jose, CA (408) 293-7390

DRAWING N : 4

V APPENDIX A

Vibration Monitoring

Vibration monitoring was performed along a PG&E gas transmission line that ran parallel to the two seismic refraction lines. PG&E requested an estimate of the expected vibration levels at the gas transmission line during the seismic shooting. The calculated vibration level at the pipeline from a 1-lb explosion 100 feet away was 0.1 inch per second (ips). This level was acceptable to PG&E. As a precaution, a Blastmate III vibration monitor was used to monitor vibrations at the transmission line during the seismic shooting. Vibrations were monitored at different locations along the transmission line. The locations were chosen so that the vibration monitoring occurred at the point along the transmission line closest to the shot point being detonated. Table 1A shows the peak vector sum particle velocity measured for each shot point. The output from the Blastmate III is given in the pages that follow.

Shot Number	Seismic Line Number	Peak Particle Velocity (ips)	Distance between Shot & Gas Line (feet)
1	SL-1	0.02	140
2	SL-1	0.03	170
3	SL-1	0.06	115
4	SL-2	0.07	100
5	SL-2	0.06	100
6	SL-2	0.07	100
Background Level		0.007	--

Vasco Road, Refraction Survey

Histogram Start Time	14:12:07 January 8, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	14:32:54 January 8, 2001	**Battery Level**	6.4 Volts
Number of Intervals	20 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D0A.470
Sample Rate	1024sps		

Notes

Vasco sp1	Line 1
Client:	CE&G
User Name:	Jim
General:	

Extended Notes

Post Event Notes

Seismic Line 1, Shot Pint 1, Vibration Monitoring Location 1

Microphone	Linear Weighting
PSPL	0.00138 psi(L) on January 8, 2001 at 14:20:07
ZC Freq	28 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 579 mv)

	Tran	Vert	Long	
PPV	0.0187	0.0175	0.0144	in/s
ZC Freq	8.5	16	17	Hz
Date	Jan 8 /01	Jan 8 /01	Jan 8 /01	
Time	14:20:07	14:20:07	14:20:07	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0200 in/s on January 8, 2001 at 14:20:07

Vasco Road, Refraction Survey

Histogram Start Time	14:39:00 January 8, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	14:51:39 January 8, 2001	**Battery Level**	6.3 Volts
Number of Intervals	12 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D0B.D00
Sample Rate	1024sps		

Notes

Vasco SP 2	Line 1
Client:	CE&G
User Name:	Jim
General:	

Extended Notes

Post Event Notes

Seismic Line 1, Shot Point 2, Vibration Monitoring Location 2

Microphone	Linear Weighting
PSPL	0.00134 psi(L) on January 8, 2001 at 14:43:00
ZC Freq	43 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 627 mv)

	Tran	Vert	Long	
PPV	0.0269	0.0175	0.0225	in/s
ZC Freq	9.3	13	13	Hz
Date	Jan 8 /01	Jan 8 /01	Jan 8 /01	
Time	14:43:00	14:43:00	14:43:00	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0306 in/s on January 8, 2001 at 14:43:00

Vasco Road, Refraction Survey

Histogram Start Time	14:57:14 January 8, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	15:17:49 January 8, 2001	**Battery Level**	6.3 Volts
Number of Intervals	20 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D0C.7E0
Sample Rate	1024sps		

Notes

Vasco SP 3	Line 1
Client:	CE&G
User Name:	Jim
General:	

Extended Notes

Post Event Notes

Seismic Line 1, Shot Point 3, Vibration Monitoring Location 3

Microphone	Linear Weighting
PSPL	0.00174 psi(L) on January 8, 2001 at 15:03:14
ZC Freq	43 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 630 mv)

	Tran	**Vert**	**Long**	
PPV	0.0481	0.0381	0.0575	in/s
ZC Freq	16	20	18	Hz
Date	Jan 8 /01	Jan 8 /01	Jan 8 /01	
Time	15:03:14	15:03:14	15:03:14	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0581 in/s on January 8, 2001 at 15:03:14

Vasco Roa action Survey

Histogram Start Time	12:59:06 January 9, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	13:41:31 January 9, 2001	**Battery Level**	6.3 Volts
Number of Intervals	42 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D21.EI0
Sample Rate	1024sps		

Notes

Vasco Line 2	SP 4
Client:	CE&G
User Name:	Jim Rezowallll
General:	Monitoring PG&E Line

Extended Notes

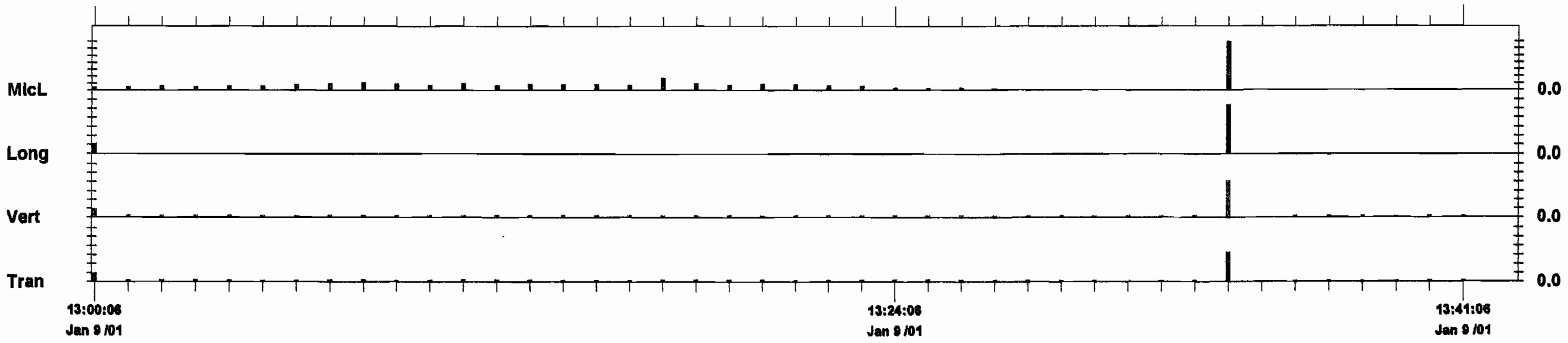
Post Event Notes

Seismic Line 2, Shot Point 4, Vibration Monitoring Location 1

Microphone	Linear Weighting
PSPL	0.00714 psi(L) on January 9, 2001 at 13:34:06
ZC Freq	51 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 643 mv)

	Tran	Vert	Long	
PPV	0.0337	0.0419	0.0556	in/s
ZC Freq	12	11	20	Hz
Date	Jan 9 /01	Jan 9 /01	Jan 9 /01	
Time	13:34:06	13:34:06	13:34:06	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0684 in/s on January 9, 2001 at 13:34:06



Time Scale: 1 minute /div **Amplitude Scale:** Geo: 0.01000 in/s/div Mic: 0.00100 psi(L)/div

Printed: January 19, 2001 (V 4.02 - 4.02)

Vasco Road, raction Survey

Histogram Start Time	13:46:46 January 9, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	14:05:38 January 9, 2001	**Battery Level**	6.3 Volts
Number of Intervals	18 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D23.LY0
Sample Rate	1024sps		

Notes

Vasco Line 2	SP 5
Client:	CE&G
User Name:	Jim Rezowalll
General:	Monitoring PG&E Line

Extended Notes

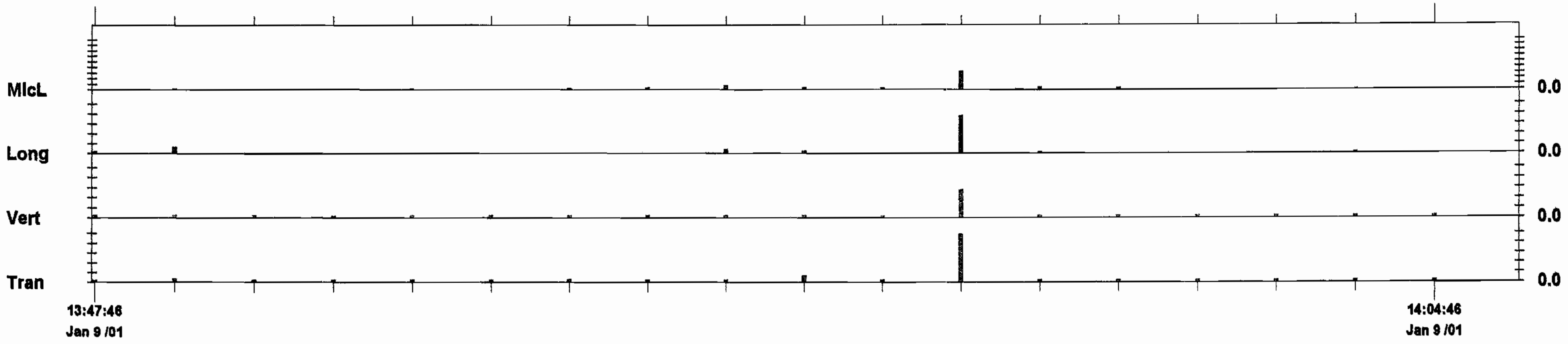
Post Event Notes

Seismic Line 2, Shot Point 5, Vibration Monitoring Location 2

Microphone	Linear Weighting
PSPL	0.00170 psi(L) on January 9, 2001 at 13:58:46
ZC Freq	47 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 649 mv)

	Tran	Vert	Long	
PPV	0.0500	0.0287	0.0394	in/s
ZC Freq	12	19	12	Hz
Date	Jan 9 /01	Jan 9 /01	Jan 9 /01	
Time	13:58:46	13:58:46	13:58:46	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0584 in/s on January 9, 2001 at 13:58:46



Scale: 1 minute /div **Amplitude Scale:** Geo: 0.01000 in/s/div Mic: 0.00050 psi

Printed: January 19, 2001 (V 4.02 - 4.02)

Vasco Roa raction Survey

Histogram Start Time	14:10:06 January 9, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	14:32:43 January 9, 2001	**Battery Level**	6.3 Volts
Number of Intervals	22 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D24.OU0
Sample Rate	1024sps		

Notes

Vasco Line 2	SP 6
Client:	CE&G
User Name:	Jim Rezowallll
General:	Monitoring PG&E Line

Extended Notes

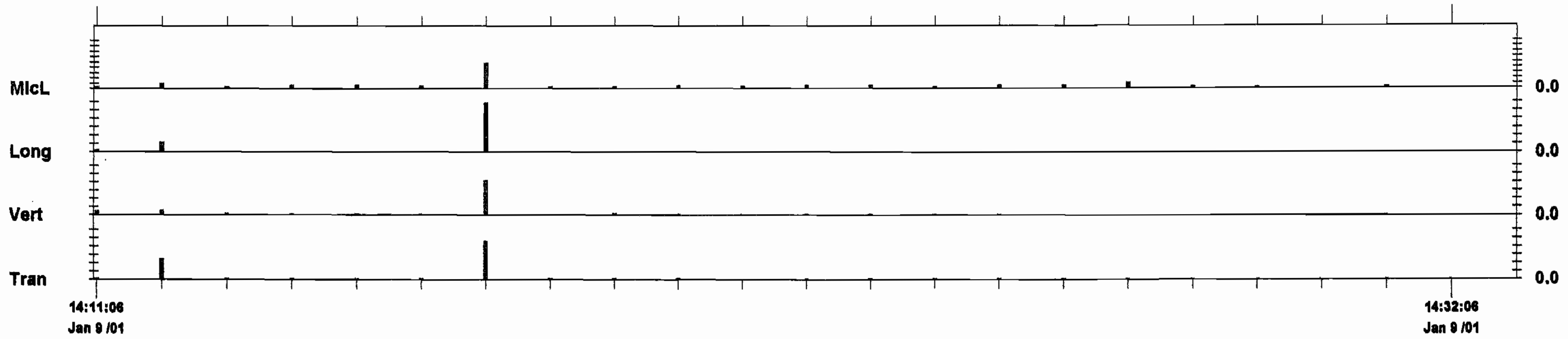
Post Event Notes

Seismic Line 2, Shot Point 6, Vibration Monitoring Location 3

Microphone	Linear Weighting
PSPL	0.00243 psi(L) on January 9, 2001 at 14:17:06
ZC Freq	73 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 581 mv)

	Tran	**Vert**	**Long**	
PPV	0.0469	0.0425	0.0594	in/s
ZC Freq	22	22	19	Hz
Date	Jan 9 /01	Jan 9 /01	Jan 9 /01	
Time	14:17:06	14:17:06	14:17:06	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.0732 in/s on January 9, 2001 at 14:17:06



Time Scale: 1 minute /div **Amplitude Scale:** Geo: 0.01000 in/s/div Mic: 0.00050 psi(L)/div

Printed: January 19, 2001 (V 4.02 - 4.02) **Format Cop**

Vasco Road, 'action Survey

Histogram Start Time	11:18:48 January 9, 2001	**Serial Number**	BA7110 V 4.02-4.02 BlastMate III
Histogram Finish Time	12:58:33 January 9, 2001	**Battery Level**	6.3 Volts
Number of Intervals	99 at 1 minute	**Calibration**	June 6, 2000 by Instantel Inc.
Range	Geo :1.25 in/s	**File Name**	I1108D1W.RC0
Sample Rate	1024sps		

Notes

Vasco Line 2	SP 4
Client:	CE&G
User Name:	Jim Rezowalli
General:	Monitoring PG&E Line

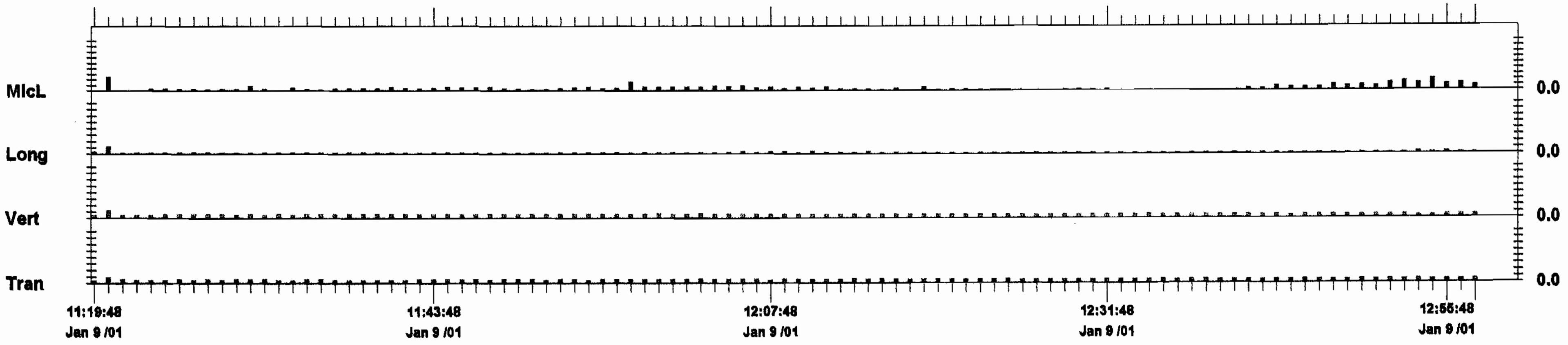
Extended Notes

Post Event Notes
Backgound monitoring at vibration location 1
No shot points were detonated during this period

Microphone	Linear Weighting
PSPL	0.00127 psi(L) on January 9, 2001 at 11:20:48
ZC Freq	>100 Hz
Channel Test	Passed (Freq = 19.7 Hz Amp = 668 mv)

	Tran	Vert	Long	
PPV	0.00437	0.00625	0.00625	in/s
ZC Freq	>100	>100	39	Hz
Date	Jan 9 /01	Jan 9 /01	Jan 9 /01	
Time	11:20:48	11:20:48	11:20:48	
Sensorcheck ®	Passed	Passed	Passed	

Peak Vector Sum 0.00742 in/s on January 9, 2001 at 11:20:48



Scale: 1 minute /div **Amplitude Scale:** Geo: 0.00500 in/s/div Mic: 0.00050 psi

Printed: January 19, 2001 (V 4.02 - 4.02)

Appendix F

MOISTURE / DRY DENSITY

(LABMD1.XLS)

CLIENT:	CAL Engineering and Geology								
PROJECT	Vasco Road								
PROJ. NO	001860								
DATE:	02/21/2000								
Boring	Depth	Length	Diameter	Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-1	5.5	5.03	2.40	13.9	742.4	632.2	122.0	103.5	0.178
B-1	13.5	5.91	2.41	13.8	909.2	750.7	126.5	104.1	0.215
B-1	29.5	5.41	2.40	13.7	869.3	728.8	133.2	111.3	0.196
							#DIV/0!	#DIV/0!	#DIV/0!
B-2	17.5	5.87	2.39	13.1	904.2	735.0	128.9	104.6	0.233
B-2	19.0	5.93	2.41	13.6	944.8	804.1	131.2	111.3	0.178
B-2	26.5	5.49	2.40	13.7	877.3	748.5	132.5	112.7	0.175
B-2	35.0	5.68	2.39	13.6	876.1	729.9	129.0	107.1	0.204
B-2	39.5	5.52	2.37	14.4	878.1	742.7	135.1	113.9	0.186
B-2	48.5	5.89	2.40	14.2	1017.1	915.0	143.4	128.8	0.113
B-2	55.0	5.86	2.39	13.6	955.1	816.9	136.4	116.4	0.172
B-2	69.0	4.27	2.41	13.9	679.4	601.3	130.2	114.9	0.133
							#DIV/0!	#DIV/0!	#DIV/0!
B-3	8.5	5.99	2.39	16.0	958.8	838.6	133.7	116.6	0.146
B-3	14.0	5.98	2.39	13.4	884.5	746.3	123.7	104.1	0.189
B-3	21.5	5.40	2.39	16.4	865.5	748.8	133.5	115.2	0.159
B-3	35.0	5.82	2.40	13.7	944.7	797.5	134.7	113.4	0.188
B-3	46.5	4.76	2.37	13.2	674.1	509.2	119.9	90.0	0.332
B-3	58.0	5.64	2.39	14.6	843.8	676.3	124.9	99.6	0.253
B-3	62.0	5.08	2.39	13.7	749.6	578.9	123.0	94.5	0.302
B-3	71.5	5.96	2.40	16.1	963.1	822.7	133.8	114.0	0.174
B-3	82.0	5.92	2.40	13.6	957.3	818.1	134.3	114.4	0.173
Dry Dens. Backcalc.							Insert		
Boring	Depth			Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

MOISTURE / DRY DENSITY
(LABMD1.XLS)

CLIENT:	CAL Engingering and Geology								
PROJECT	Vasco Road								
PROJ. NO	001860								
DATE:	02/21/2000								
Boring	Depth	Length	Diameter	Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-4	3.0	4.77	2.41	13.5	743.4	672.4	127.8	115.4	0.108
B-4	12.0	5.99	2.40	13.8	903.8	725.8	125.1	100.1	0.250
B-4	14.0	4.95	2.40	13.7	814.0	723.8	136.2	120.8	0.127
B-4	17.5	4.90	2.37	13.2	701.9	551.7	121.4	94.9	0.279
B-4	27.0	4.60	2.41	13.4	705.0	568.5	125.6	100.8	0.246
B-4	30.0	5.99	2.40	16.0	942.1	779.3	130.2	107.3	0.213
B-4	39.0	5.98	2.38	14.2	943.7	798.0	133.1	112.2	0.186
B-4	44.0	5.92	2.39	13.7	959.7	820.5	135.7	115.7	0.173
B-4	49.0	5.98	2.41	13.7	966.7	819.6	133.1	112.5	0.183
B-4	56.0	5.99	2.41	14.4	980.0	838.6	134.6	114.9	0.172
B-4	64.5	5.92	2.39	13.8	971.1	855.3	137.3	120.7	0.138
B-4	66.5	5.36	2.40	13.4	862.4	724.2	133.4	111.7	0.194
							#DIV/0!	#DIV/0!	#DIV/0!
B-4	70.5	5.95	2.39	14.2	962.8	822.7	135.4	115.4	0.173
B-4	75.5	5.94	2.37	13.8	944.1	805.4	135.3	115.1	0.175
B-4	79.5	5.04	2.37	14.0	809.0	702.3	136.2	117.9	0.155
B-4	83.5	5.97	2.39	13.2	952.5	818.9	133.6	114.6	0.166
							#DIV/0!	#DIV/0!	#DIV/0!
B-5	8.0	5.97	2.38	13.4	870.1	695.9	122.9	97.9	0.255
B-5	27.0	4.77	2.39	16.1	771.8	652.5	134.5	113.3	0.187
B-5	36.5	5.57	2.37	16.5	933.8	843.2	142.2	128.2	0.110
B-5	41.0	5.11	2.31	14.6	759.8	636.1	132.6	110.6	0.199
B-5	47.5	5.29	2.39	13.7	852.4	725.1	134.6	114.2	0.179
B-5	55.0	5.68	2.28	14.3	827.4	697.7	133.6	112.3	0.190
B-5	62.5	5.98	2.39	13.2	965.6	827.9	135.3	115.7	0.169
B-5	66.5	5.98	2.39	13.7	969.7	829.8	135.8	115.9	0.171
B-5	75.0	5.80	2.31	16.4	880.1	765.9	135.4	117.5	0.152
B-5	80.5	5.94	2.34	14.4	903.8	790.3	132.7	115.7	0.146
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
Dry Dens. Backcalc.							Insert		
Boring	Depth			Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

MOISTURE / DRY DENSITY

(LABMD1.XLS)

CLIENT:	CAL Enginering and Geology								
PROJECT	Vasco Road								
PROJ. NO	001860								
DATE:	02/21/2000								
Boring	Depth	Length	Diameter	Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-6	17.5	3.33	2.41	13.8	541.7	473.0	132.4	115.2	0.150
B-6	28.5	4.38	2.40	13.7	663.5	562.0	124.9	105.4	0.185
							#DIV/0!	#DIV/0!	#DIV/0!
B-7	13.0	5.87	2.38	13.5	986.7	933.1	142.0	134.1	0.058
B-7	18.0	5.87	2.38	16.0	997.5	919.7	143.2	131.8	0.086
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
Dry Dens. Backcalc.							Insert		
Boring	Depth			Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

MOISTURE / DRY DENSITY
(LABMD1.XLS)

CLIENT:	CAL Enginering and Geology								
PROJECT	Vasco Rd.								
PROJ. NO	001860								
DATE:	03/05/2001								
Boring	Depth	Length	Diameter	Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-8	3.0	5.43	2.41	13.7	735.7	676.4	111.1	101.9	0.089
B-8	6.0	5.56	2.41	15.9	848.9	776.2	125.1	114.2	0.096
B-8	8.5	3.67	2.42	13.9	565.4	495.9	124.5	108.8	0.144
B-8	10.5	5.58	2.42	16.0	881.3	727.8	128.5	105.7	0.216
B-8	11.0	5.43	2.42	13.2	898.0	823.9	135.0	123.7	0.091
B-8	13.5	5.80	2.42	16.0	930.6	839.9	130.6	117.7	0.110
B-8	15.3	5.87	2.42	13.7	951.7	823.1	132.4	114.2	0.159
B-8	18.5	5.75	2.42	16.0	943.6	816.4	133.6	115.3	0.159
B-8	20.0	5.22	2.42	13.5	828.4	704.0	129.3	109.6	0.180
							#DIV/0!	#DIV/0!	#DIV/0!
B-9	3.5	2.91	2.39	14.2	449.6	399.4	127.1	112.4	0.130
							#DIV/0!	#DIV/0!	#DIV/0!
B-10	6.5	5.76	2.42	16.0	842.3	800.3	118.8	112.8	0.054
B-10	10.0	5.56	2.42	13.5	849.4	802.0	124.5	117.5	0.060
B-10	14.5	5.37	2.42	16.0	810.9	backcalc	122.6	#VALUE!	#VALUE!
							#DIV/0!	#DIV/0!	#DIV/0!
B-11	2.5	3.51	2.42	13.6	508.2	480.3	116.7	110.1	0.060
B-11	5.0	4.31	2.42	13.8	679.4	630.1	127.9	118.4	0.080
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
Dry Dens. Backcalc.							Insert		
Boring	Depth			Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-10	14.5			13.6	446.4	390.1	122.6	106.7	0.150
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

MOISTURE / DRY DENSITY
(LABMD1.XLS)

CLIENT:	CAL Engineering and Geology								
PROJECT	Vasco Rd.								
PROJ. NO	001860								
DATE:	03/05/2001								
Boring	Depth	Length	Diameter	Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-12	3.5	5.47	2.42	13.7	800.9	768.5	119.2	114.3	0.043
B-12	5.5	5.21	2.42	13.4	826.7	782.8	129.3	122.3	0.057
B-12	10.5	5.86	2.42	16.5	967.5	923.6	134.4	128.2	0.048
							#DIV/0!	#DIV/0!	#DIV/0!
B-13	3.5	5.14	2.41	13.9	781.9	671.3	124.8	106.8	0.168
B-13	5.5	4.06	2.42	13.6	599.3	512.0	119.5	101.7	0.175
B-13	10.5	4.05	2.42	14.4	593.9	556.3	118.5	110.8	0.069
							#DIV/0!	#DIV/0!	#DIV/0!
B-14	3.0	5.20	2.42	16.0	807.2	734.2	126.0	114.4	0.102
B-14	9.0	5.68	2.37	13.6	877.4	742.0	131.3	110.7	0.186
B-14	14.0	5.76	2.38	13.5	871.1	721.2	127.5	105.2	0.212
B-14	19.0	4.32	2.42	16.1	650.7	558.8	121.7	104.0	0.169
							#DIV/0!	#DIV/0!	#DIV/0!
B-15	1.0	5.83	2.42	13.7	762.7	730.3	106.4	101.8	0.045
B-15	6.0	5.32	2.42	16.0	780.3	731.4	119.0	111.4	0.068
B-15	10.0	2.33	2.42	16.0	386.2	360.4	131.6	122.4	0.075
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
							#DIV/0!	#DIV/0!	#DIV/0!
Dry Dens. Backcalc.							Insert		
Boring	Depth			Cup Wt.	Wet+Cup	Dry+Cup	Wet Dens.	Dry Dens.	Moisture
B-10	14.5			13.6	446.4	390.1	122.6	106.7	0.150
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!
								#DIV/0!	#DIV/0!

MOISTURE CONT AND DRY DENSITY

Client Name: CAL ENGINEERING & GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ________ Date Received ________
Date Tested: 2/19/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-1	5.5	5.03	2.40	F-25	13.9	742.4	632.2	103.5	17.8	LT OLV BRN SILTY SANDSTONE/ VFG SANDY SILTSTONE
	13.5	5.91	2.41	F-31	13.8	909.2	750.7	104.1	21.5	GRY BRN + LT OLV BRN W/ YEL BRN SANDY SILTSTONE/SILTY SANDSTONE
	29.5	5.41	2.40	F-60	13.7	869.3	728.8	111.3	19.6	LT OLV BRN + BRN YEL CLAYSTONE

MOISTURE CONTENT AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ________ **Date Received** ________
Date Tested: 2/18/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-2	17.5	5.87	2.39	F-90	13.1	904.2	736.0	104.6	23.3	LT OLV BRN W/YEL BRN SANDY SILTSTONE/SILTY + CLAYEY SANDSTONE VFG
	19.0	5.93	2.41	F-104	13.6	944.8	804.1	111.3	17.8	LT OLV BRN W/YEL BRN CLAYSTONE W/SAND POCKETS/LAMINATIONS
	26.5	5.49	2.40	F-61	13.7	877.3	748.5	112.7	17.5	LT OLV BRN W/YEL BRN CLAYSTONE W/SANDY INCLUSIONS
	35.0	5.68	2.39	F-103	13.6	876.1	729.9	107.1	20.4	OLV BRN W/YEL BRN CLAYSTONE W/GYPSUM CRYSTALS
	39.5	5.52	2.37	F-33	14.4	878.1	742.7	113.9	18.6	BLK/VDK GRY CLAYSTONE
	48.5	5.89	2.40	F-21	14.2	1017.1	915.0	128.8	11.3	BLK + VDK GRY SANDY CLAYSTONE/CLAYEY SANDSTONE VFG
	55.0	5.86	2.39	F-101	13.6	955.1	816.9	116.4	17.2	BLK CLAYSTONE W/TR PEBBLES
	69.0	4.27	2.41	F-24	13.9	679.4	601.3	114.9	13.3	GRY + DK GRY SANDSTONE VFG

MOISTURE CONT AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ______ Date Received ______
Date Tested: 2/17/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-3	8.5	5.99	2.39	F-85	16.0	958.8	838.6	116.6	14.6	BRN CLAYSTONE/SANDY CLAY RESID SOIL W/WT PRECIP.
	14.0	5.98	2.39	F-105	13.4	884.5	746.3	104.1	18.9	LT OLV BRN W/YEL BRN CLAYEY SANDSTONE
	21.5	5.40	2.39	F-202	16.4	865.5	748.8	115.2	15.9	LT OLV BRN + LT YEL BRN CLAYEY SANDSTONE
	35.0	5.82	2.40	F-72	13.7	944.7	797.5	113.4	18.8	DK GRN GRY CLAYSTONE
	46.5	4.76	2.37	F-91	13.2	674.1	509.2	90.0	33.2	DK OLV GRY W/YEL BRN CLAYSTONE
	58.0	5.64	2.39	F-34	14.6	843.8	676.3	99.6	25.3	BLK + DK GRY CLAYSTONE W/SANDSTONE LAMINATIONS OR WEATH GRAV.
	62.0	5.08	2.39	F-67	13.7	749.6	578.9	94.5	30.2	DK GRN GRY + DK GRY CLAYSTONE TR VFG SAND + PEBBLES
	71.5	5.96	2.40	F-82	16.1	963.1	822.7	114.0	17.4	DK GRN GRY CLAYSTONE W/ LT GRY 1/4" SS LAMINATIONS, PRE EXIST BEDDING PARTIAL CRACK
	82.0	5.92	2.40	F-102	13.6	957.3	818.1	114.4	17.3	DK GRN GRY W/DK GRY CLAYSTONE

MOISTURE CONTE ND DRY DENSITY

Client Name: CAL ENGINEERING & GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ________ Date Received ________
Date Tested: 2/8/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-4	3.0	4.77	2.41	F-97	13.5	743.4	672.4	115.4	10.8	DK YEL BRN WEATH SANDSTONE, FRIABLE/ WEAK, GRAV <½", SL CLAYEY
	12.0	5.99	2.40	F-69	13.8	903.8	725.8	100.1	25.0	LT OLV BRN W/YEL BRN CLAYSTONE (WEATHERED)
	14.0	4.95	2.40	F-73	13.7	814.0	723.8	120.8	12.7	LT YEL BRN W/YEL BRN SANDSTONE FRIABLE/WEAK, VFG
	17.5	4.90	2.37	F-95	13.2	701.9	551.7	94.9	27.9	LT OLV BRN W/BRN YEL WEATHERED * CLAYSTONE (ALMOST RESID SOIL) VSILTY
	27.0	4.60	2.41	F-98	13.4	705.0	568.5	100.8	24.6	LT YEL BRN W/BRN YEL SANDY CLAYSTONE/SILTSTONE, VFG, WEAK
	29.5									
	30.0	5.99	2.40	F-81	16.0	942.1	779.3	107.3	21.3	OL BRN MOT W/YEL BRN WEATH CLAYSTONE, TR VFG SAND
	39.0	5.98	2.38	F-28	14.2	943.7	798.0	112.2	18.6	VDK GRY CLAYSTONE
	44.0	5.92	2.39	F-68	13.7	959.7	820.5	115.7	17.3	VDK GRY CLAYSTONE W/TR VFG SAND
	49.0	5.98	2.41	F-62	13.7	966.7	819.6	112.5	18.3	VDK GRY/BLK CLAYSTONE W/SAND LENSES <½" AND PEBBLES <½"
	56.0	5.99	2.41	F-23	14.4	980.0	838.6	114.9	17.2	BLK WEATHERED CLAYSTONE W/VFG SAND LENSES <¼"
	64.5	5.92	2.39	F-63	13.8	971.1	855.3	120.7	13.8	DK GRN GRY + GRN GRY CLAYEY SANDSTONE SANDY CLAYSTONE, INTERBED SANDY + CLAYG W/G <½
	66.5	5.36	2.40	F-99	13.4	862.4	724.2	111.7	19.4	DKGRN GRY SANDY CLAYSTONE VFG, TR FG + CG

moisden3.xls RAYMOND L. FISHER, P.E. Civil and Geotechnical Engineering, Geotechnical Testing

MOISTURE CONT AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ________ Date Received ________
Date Tested: 2/8/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-4	70.5	5.95	2.39	F-20	14.2	962.8	822.7	115.4	17.3	DK GRN GRY SANDY CLAYSTONE, ½" VFG SANDLENS IN UPPER 2"
	75.5	5.94	2.37	F-64	13.8	944.1	805.4	115.1	17.5	DK GRN GRY SANDY CLAYSTONE VFG W/TR CG
	79.5	5.04	2.37	F-22	14.0	809.0	702.3	117.9	15.5	DK GRN GRY SANDY CLAYSTONE VFG - FG
	83.5	5.97	2.39	F-94	13.2	952.5	818.9	114.6	16.6	DK GRN GRY CLAYSTONE + SANDSTONE VFG - FG

MOISTURE CONT AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD.
Client Project No: 001860

Date Sampled: ________ Date Received ________
Date Tested: 2/16/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-5	8.0	5.97	2.38 R	F-100	13.4	870.1	695.9	97.9	25.5	YEL BRN MOT W/DK BRN + GRY CLAYSTONE W/WT TUFF INCLUSIONS
	27.0	4.77	2.39	F-84	16.1	771.8	652.5	113.3	18.7	LT OLV BRN W/OLV YEL CLAYSTONE TR VFG SAND + PEBBLES
	36.5	5.57	2.37	F-201	16.5	933.8	843.2	128.2	11.0	LT YEL BRN + YEL BRN SANDSTONE VFG-FG
	41.0	5.11	AVG 2.31	F-32	14.6	759.8	636.1	110.6	19.9	LT OLV BRN W/YEL BRN SANDY CLAYSTONE, VFG
	47.5	5.29	2.39	F-71	13.7	852.4	725.1	114.2	17.9	YEL BRN MOT W/GRY BRN CLAYSTONE TR VFG SAND
	55.0	5.68	2.28	F-27	14.3	827.4	697.7	112.3	19.0	YEL BRN SANDY CLAYSTONE VFG
	62.5	5.98	2.39	F-92	13.2	965.6	827.9	115.7	16.9	YEL BRN CLAYEY SANDSTONE VFG-MG, TR WT + RD
	66.5	5.98	2.39	F-70	13.7	969.7	829.8	115.9	17.1	GRY BRN + LT OLV BRN CLAYEY SANDSTONE W/YEL BRN, VFG
	75.0	5.80	2.31	F-203	16.4	880.1	765.9	117.5	15.2	DK GRY W/YEL BRN CLAYEY SANDSTONE/SANDY CLAYSTONE VFG
	80.5	5.94	2.34	F-26	14.4	903.8	790.3	115.7	14.6	GRN GRY VFG SANDSTONE & DK GRN GRY CLAYEY SANDSTONE

MOISTURE CON AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: Date Received
Date Tested: 3/1/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-8	3.0	5.43	2.41	F-74	13.7	735.7	676.4	101.9	8.9	BRN SILTY SAND (SM) VFG-FG, TR MG-CG, MOD CEM, SL POROUS, W/V FINE ROOTS, V DENSE
	6.0	5.56	2.41	F-306	15.9	848.9	776.2	114.2	9.6	DK YEL BRN CLAYEY SAND (SC)/WEATH SANDSTONE, WELL CEM, VFG-FG, TR MG-CG, V DENSE RS
	8.5	c/s -200 3.67	2.42	F-30	13.9	565.4	495.9	108.8	14.4	DK YEL BRN CLAYEY SAND (SC) V CLAYEY FG-MG, TR CG, V MOIST, PP=3.5, SOME NON-CLAYEY
	10.5	5.85	2.42	F-307	16.0	881.3	727.8	105.7	21.6	YEL BRN CLAYEY SAND W/WT TUFF ZONES (½"-1") (SC) V MOIST, FG-MG, ALT CLAY/NON CLAY ZONES,
	11.0	5.43	2.42	F-93	13.2	898.0	823.9	123.7	9.1	DK YEL BRN CLAYEY SANDSTONE/CONGLOMERATE, FG-CG, W/GRAN TO 1", W/WT TUFF SEAM, V MOIST
	13.5	5.80	2.42	F-80	16.0	930.6	839.9	117.7	11.0	DK YEL BRN + GRY BRN CLAYEY SANDSTONE VFG-CG, FRIABLE, V MOIST
	UNC 15.25	5.87	2.42	F-304	13.7	951.7	823.1	114.2	15.9	DK YEL BRN CLAYEY SANDSTONE, FG-MG, V MOIST
	UNC 18.5	5.75	2.42	F-308	16.0	943.6	816.4	115.3	15.9	DK YEL BRN CLAYEY SANDSTONE, FG-MG, V MOIST
	20.0	5.22	2.42	F-302	13.5	828.4	704.0	109.6	18.0	DK YEL BRN SANDSTONE, COMPL WEATH, FRIABLE, V MOIST, FG, TR MG
B-9	3.5	2.91	2.39	F-21	14.2	449.6	399.4	112.4	13.0	DK BRN SANDY CLAY (CH) V STIFF, FG-MG, TR CG, GRAN FRAG ≤ 1½" (NOT IN HYD [illegible]

RAYMOND L. FISHER, P.E.

Civil and Geotechnical Engineering, Geotechnical Testing

MOISTURE CONT AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: Date Received
Date Tested: 3/1/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-10	6.5'	5.76	2.42	F-309	16.0	842.3	800.3	112.8	5.4	WT. W/PALE YEL SANDSTONE, WEATHERED VFG-FG, FRIABLE
	10.0	5.56	2.42	F-301	13.5	849.4	802.0	117.5	6.0	WT, YEL, +GRY SANDSTONE, WEATH FRIABLE, LT+DK GRY GRAN(WEATH SHALE) VFG-FG
	14.5	5.37	2.42	F-313	16.0	810.9	BACKCALC	106.7	15.0	YEL BRN + PALE YEL SANDSTONE, WEATH, FRIABLE, VFG-FG
B-11	2.5	3.51	2.42	F-103	13.6	508.2	480.3	110.1	6.0	STR BRN + PALE YEL SANDSTONE, (ORN BRN FG-MG, TR CG, MOD CEM
	5.0	4.31	2.42	F-65	13.8	679.4	630.1	118.4	8.0	PALE YEL + YEL BRN SANDSTONE, MOD CEM, VFG-MG, SOME CG + GRAN < 3/4", SL CLA
B-10	14.5	—	—	F-303	13.6	446.4	390.1	—	15.0	SAME AS ABOVE M/C FOR BACKCALC

MOISTURE CON AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ________ Date Received ________
Date Tested: 3/2/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-12	3.5'	5.47	2.42	F-61	13.7	880.9	768.5	114.3	4.3	LT BRN SILTY SAND W/GRAV (SM) VFG-FG TR MG-CG, RND GRAV <1/2", SL MOIST
	5.5	5.21	2.42	F-100	13.4	826.7	782.8	122.3	5.7	LT BRN SILTY SAND (SM) VFG-FG, TR CG, TR GRAV <3/4", SL MOIST
	10.5	5.86	2.42	F-201	16.5	967.5	923.6	128.2	4.8	YEL BRN + PALE YEL CLAYEY CONGLOMERATE, SANDSTONE, VFG-CG, GRAV < 2", CLAYEY ZONES
B-13	3.5	5.14	2.41	F-24	13.9	781.9	671.3	106.8	16.8	BRN W/YEL BRN + YEL SANDY CLAYSTONE/ CLAYEY SANDSTONE, VFG-CG, V PLASTIC CLAY (PALE B
	5.5	4.06	2.42	F-101	13.6	599.3	512.0	101.7	17.5	BRN W/YEL + ORN BRN FeO CLAYEY SANDSTONE, VFG, SL MOIST, (PALE BRN)
	10.5	4.05	2.42	F-33	14.4	593.9	556.3	110.8	6.9	TOP 2" PALE BRN CLAYEY SANDSTONE/SANDY CLAYSTONE BOT 4' DK + LT YEL BRN SANDSTONE FG, SL MOIST, FR
B-14	3.0	5.20	2.42	F-311	16.0	807.2	734.2	114.4	10.2	DK BRN SANDY CLAY (CL/SC) FG-CG, WITH GRAV <1/2", V TIGHT, MOIST, FILL?
	9.0	5.68	2.37	F-104	13.6	877.4	742.0	110.7	18.6	V DK GRY BRN/OLV BRN CLAY W/SAND (CH) MG, UNIFORM COLOR, V STIFF, MOIST
	14.0	5.76	2.38	F-300	13.5	871.1	721.2	105.2	21.2	DK + LT YEL BRN CLAYSTONE
	19.0	4.32	2.42	F-314	16.1	650.7	558.8	104.0	16.9	LT OLV CLAYSTONE, TR VFG SAND SL MOIST, MOD WEATH

MOISTURE CONTE[illegible] AND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY

Project Name: VASCO RD

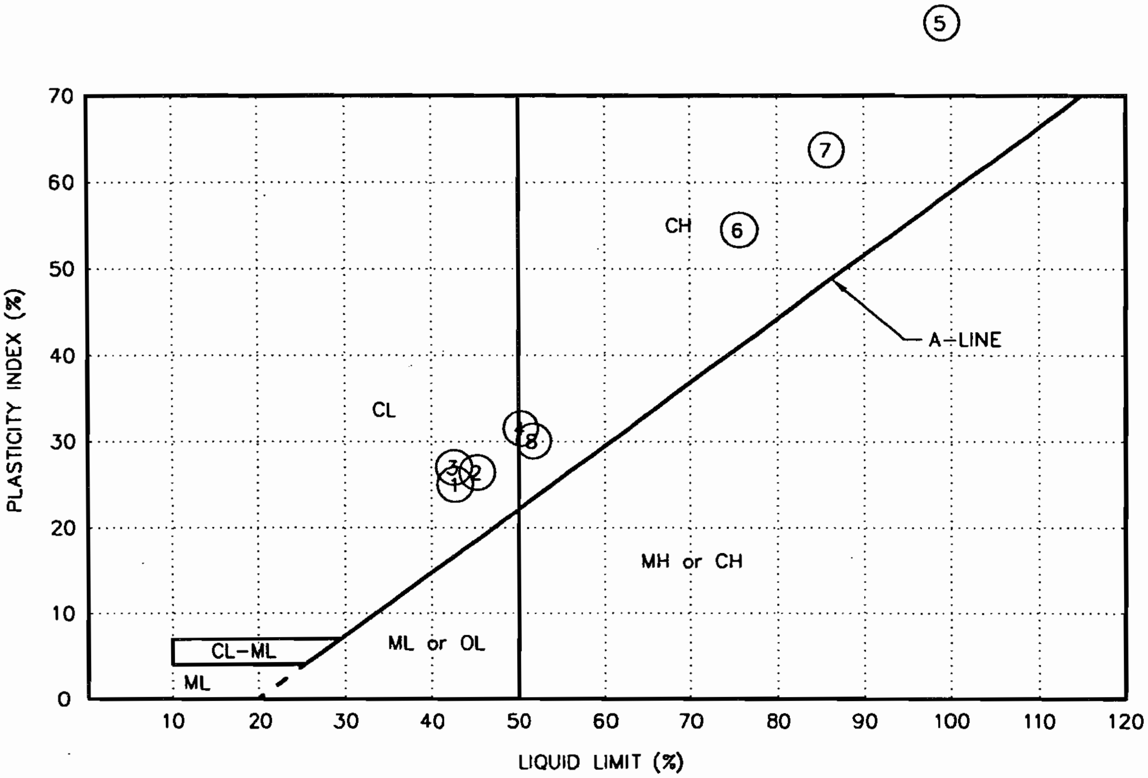
Client Project No: 001860

Date Sampled: ________ Date Received ________

Date Tested: 3/2/01

Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-15	1.0	5.83	2.42	F-305	13.7	762.7	730.3	101.8	4.5	BRN SILTY SAND (SM) VFG-FG
	6.0	5.32	2.42	F-312	16.0	780.3	731.4	111.4	6.8	PALE YEL W/GRY SANDSTONE, VFG-FG, W/ORN BRN 1/8" CLAY FILLED FRACT/SHEAR
	10.0	2.33	2.42	F-310	16.0	386.2	360.4	122.4	7.5	LT YEL BRN SANDSTONE, VFG, FRIABLE



NUMBER	BORING	DEPTH (FT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
①	B-2	17.5	42	18	24
②	B-3	14	45	19	26
③	B-3	21.5	42	16	26
④	B-3	35	50	19	31
⑤	B-3	46.5	99	20	79
⑥	B-3	58	75	21	54
⑦	B-3	62	86	23	63
⑧	B-3	71.5	51	21	30
⑨	B-3	82	56	18	38

CE&G
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VASCO ROAD REALIGNMENT
ALAMEDA COUNTY PUBLIC WORKS AGENCY
ALAMEDA COUNTY, CALIFORNIA

ATTERBERG LIMITS TEST RESULTS

JOB NO.: 001860 | DATE: JUNE 2001 | SHT 1 OF 2

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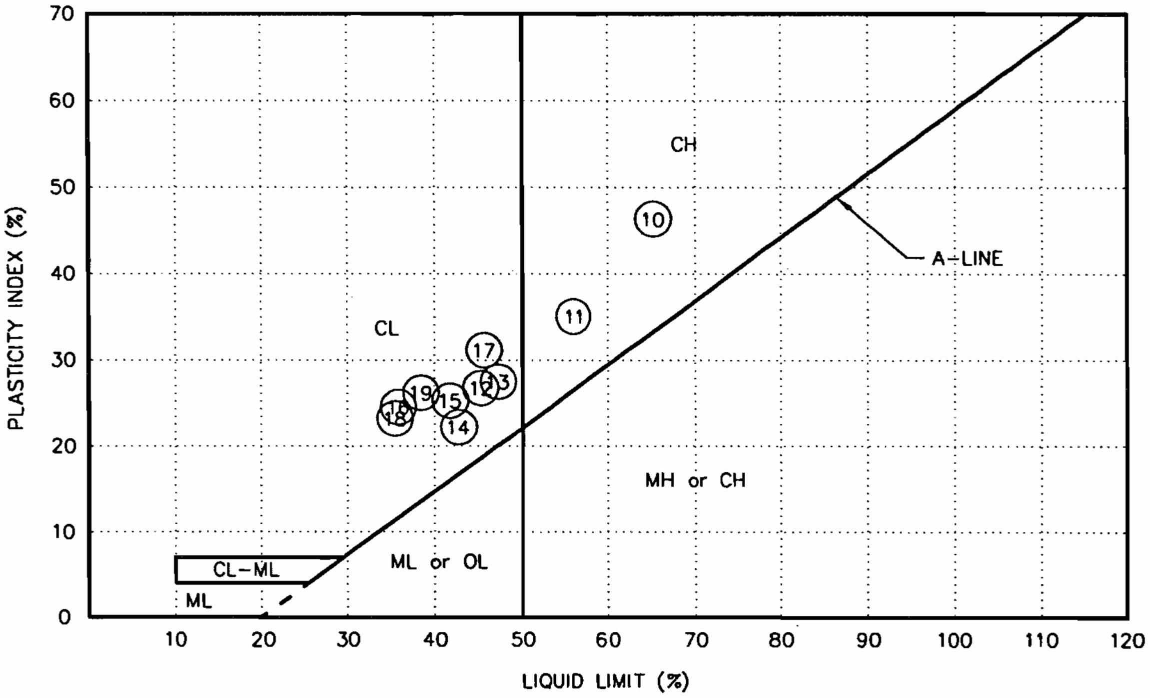

NUMBER	BORING	DEPTH (FT)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX
⑩	B-4	12	65	18	47
⑪	B-4	17.5	56	21	35
⑫	B-4	30	45	18	27
⑬	B-4	39	47	20	27
⑭	B-4	44	42	20	22
⑮	B-4	56	41	16	25
⑯	B-4	64.5	36	12	24
⑰	B-4	66.5	46	15	31
⑱	B-4	70.5	35	12	23
⑲	B-4	79.5	39	13	26

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Suite 100
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VASCO ROAD REALIGNMENT
ALAMEDA COUNTY PUBLIC WORKS AGENCY
ALAMEDA COUNTY, CALIFORNIA

ATTERBERG LIMITS TEST RESULTS

JOB NO.: 001860 | DATE: JUNE 2001 | SHT 2 OF 2

F-90

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

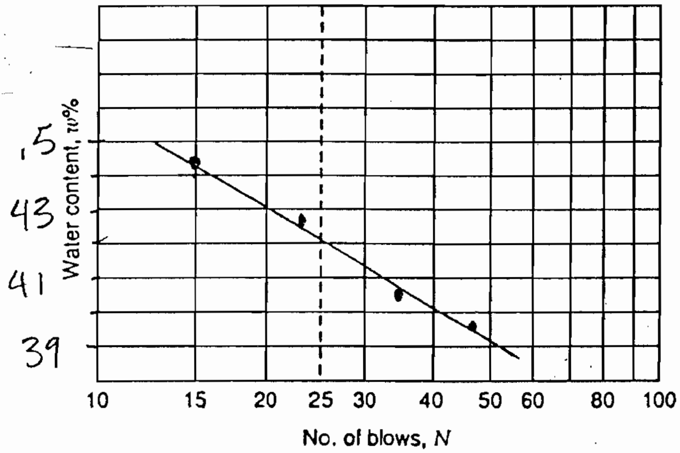
Location of Project Boring No. B-2 Sample No.

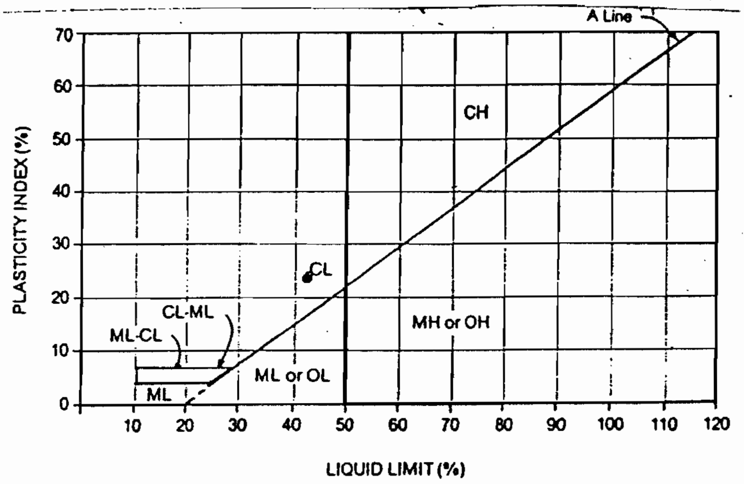
Description of Soil LT OLV BRN W/ YEL BRN SANDY SILTSTONE/SANDY CLAYSTONE

Depth of Sample 17.5 Tested By RLF Date 3/2/01

Liquid Limit Determination

Can no.	F-107	F-49	F-102	F-41	
Mass of wet soil + can	39.4	36.0	39.9	45.2	
Mass of dry soil + can	30.4	27.9	30.3	33.7	
Mass of can	7.7	7.9	7.8	7.8	
Mass of dry soil	22.7	20.0	22.5	25.9	
Mass of moisture	9.0	8.1	9.6	11.5	
Water content, w%	39.6	40.5	42.7	44.4	
No. of blows N	46	33	23	15	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-106	F-2	
Mass of wet soil + can	23.9	22.6	
Mass of dry soil + can	21.5	20.4	
Mass of can	7.7	7.9	
Mass of dry soil	13.8	12.5	
Mass of moisture	2.4	2.2	
Water content, w% = w_P	17.4	17.6	

Flow index F_i =

Liquid limit = 42

Plastic limit = 18

Plasticity index I_P = 24

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

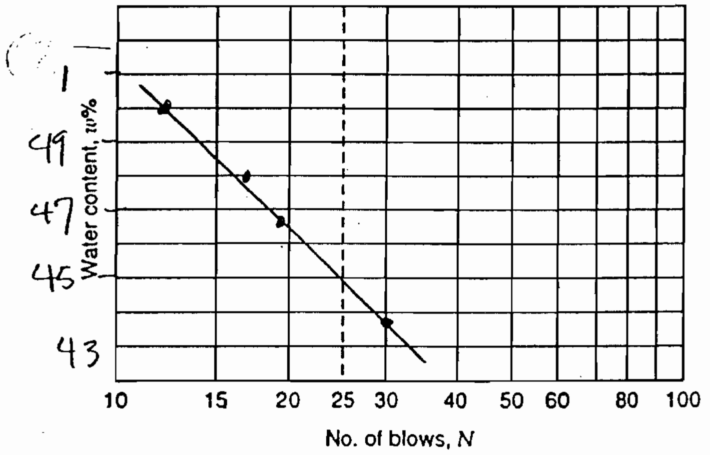
Location of Project ______ Boring No. B-3 Sample No. ______

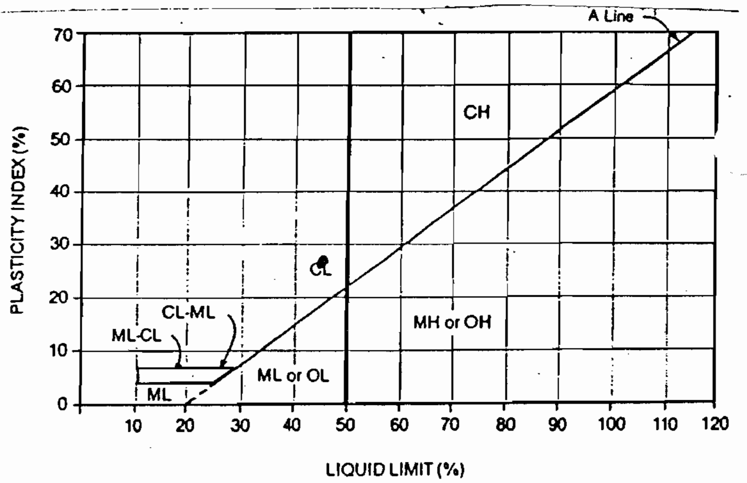
Description of Soil LT OLV BRN W/YEL BRN CLAYEY SANDSTONE/SANDY CLAYSTO

Depth of Sample 14.0' Tested By RLF Date 3/2/01

Liquid Limit Determination

Can no.	F-48	F-50	F-109	F-108	
Mass of wet soil + can	41.6	37.7	33.3	39.5	
Mass of dry soil + can	31.3	28.2	25.0	28.9	
Mass of can	7.8	7.9	7.7	7.7	
Mass of dry soil	23.5	20.3	17.3	21.2	
Mass of moisture	10.3	9.5	8.3	10.6	
Water content, w%	43.8	46.8	48.0	50.0	
No. of blows N	30	19	17	12	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-101	F-104	
Mass of wet soil + can	21.6	20.5	
Mass of dry soil + can	19.4	18.5	
Mass of can	7.9	7.8	
Mass of dry soil	11.5	10.7	
Mass of moisture	2.2	2.0	
Water content, $w\% = w_P$	19.1	18.7	

Flow index F_i = ______

Liquid limit = 45

Plastic limit = 19

Plasticity index I_P = 26

F-91

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

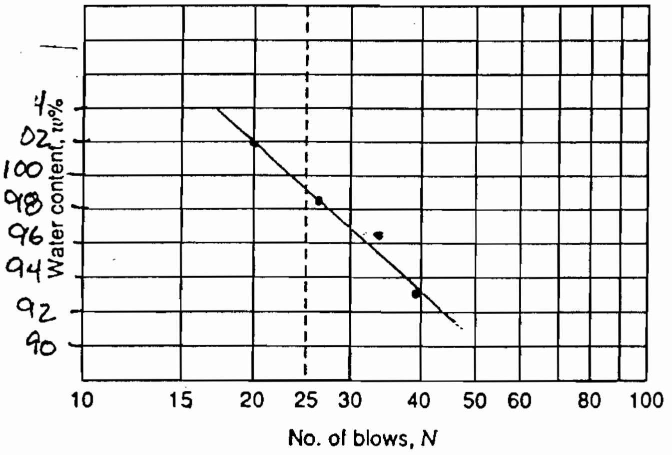
Location of Project Boring No. B-3 Sample No.

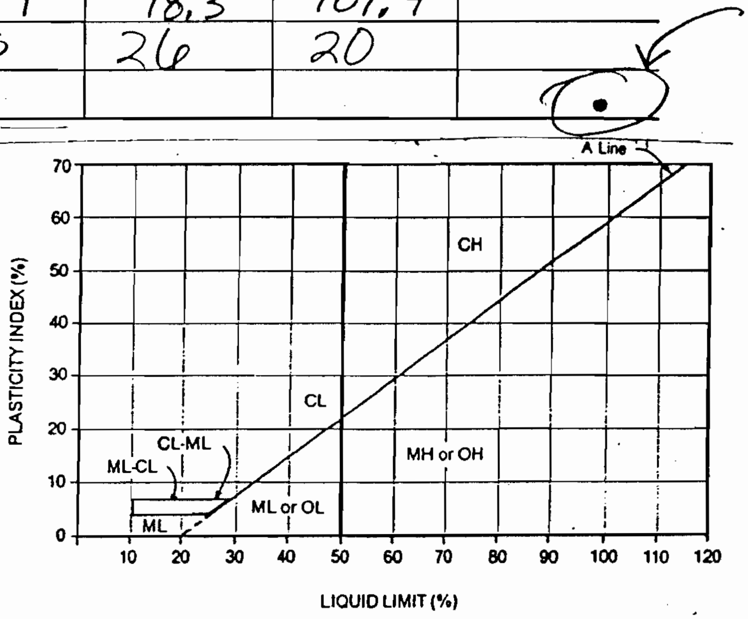
Description of Soil DK OLV GRY w/ YEL BRN CLAYSTONE

Depth of Sample 46.5' Tested By RLF Date 2/20/01

Liquid Limit Determination

Can no.	F-45	F-54	F-1	F-43	
Mass of wet soil + can	41.0	40.7	43.4	38.9	
Mass of dry soil + can	25.0	24.6	25.8	23.2	
Mass of can	7.8	7.9	7.9	7.8	
Mass of dry soil	17.2	16.7	17.9	15.4	
Mass of moisture	16.0	16.1	17.6	15.7	
Water content, w%	93.0	96.4	98.3	101.9	
No. of blows N	39	33	26	20	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-4	F-42	
Mass of wet soil + can	28.1	21.5	
Mass of dry soil + can	24.7	19.2	
Mass of can	7.9	7.9	
Mass of dry soil	16.8	11.3	
Mass of moisture	3.4	2.3	
Water content, $w\% = w_p$	20.2	20.4	AVE=20.3

Flow index F_i =

Liquid limit = 99

Plastic limit = 20

Plasticity index I_p = 79

ATTERBERG LIMITS DETERMINATION

Project Vasco Rd Job No. 001860

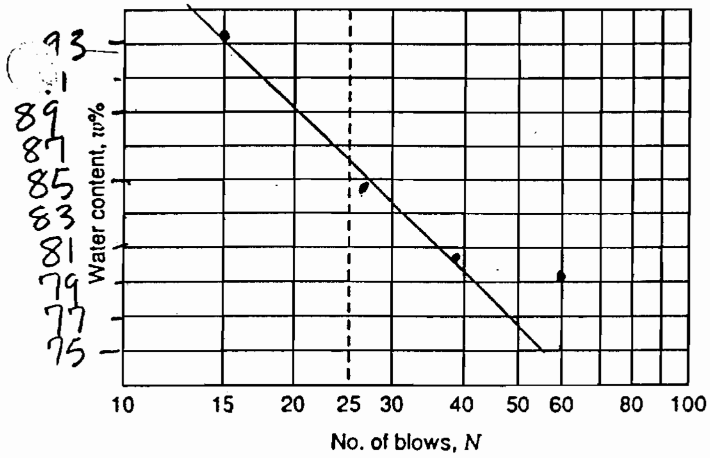
Location of Project Boring No. B-3 Sample No.

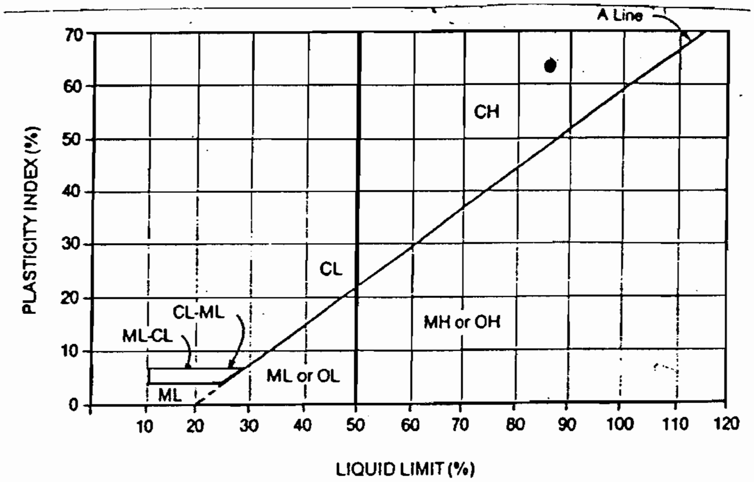
Description of Soil DK GRN GRY + DK GRY CLAYSTONE

Depth of Sample 62.0' Tested By RLF Date 2/26/01

Liquid Limit Determination

Can no.	F-2	F-3	F-40	F-105	
Mass of wet soil + can	38.7	38.7	35.5	42.3	
Mass of dry soil + can	25.1	25.0	22.8	25.6	
Mass of can	7.9	7.9	7.8	7.7	
Mass of dry soil	17.2	17.1	15.0	17.9	
Mass of moisture	13.6	13.7	12.7	16.7	
Water content, w%	79.1	80.3	84.7	93.3	
No. of blows N	60	39	27	15	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-100	F-300	
Mass of wet soil + can	23.3	26.3	
Mass of dry soil + can	20.3	23.0	
Mass of can	7.8	7.7	
Mass of dry soil	12.5	15.3	
Mass of moisture	3.0	3.3	
Water content, $w\% = w_P$	24.0	21.6	

Flow index F_i =

Liquid limit = 86

Plastic limit = 23

Plasticity index I_P = 63

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

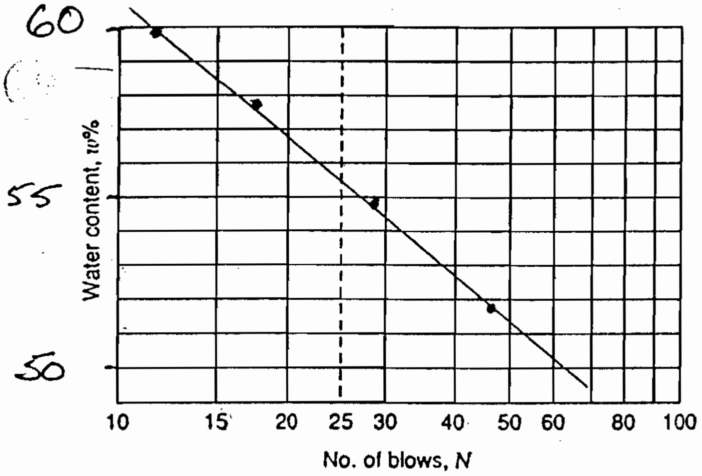
Location of Project Boring No. B-4 Sample No.

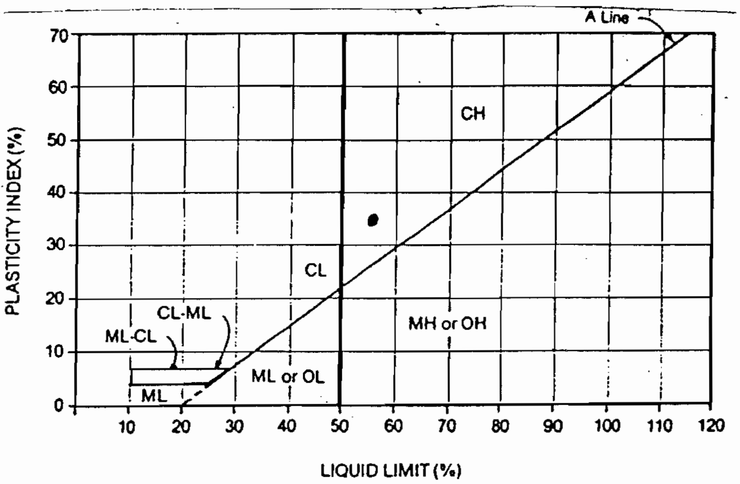
Description of Soil LT OLV BRN W/BRN YEL WEATHERED CLAYSTONE

Depth of Sample 17.5' Tested By RLF Date 2/15/01

Liquid Limit Determination

Can no.	F-47	F-107	F-104	F-43	
Mass of wet soil + can	38.6	34.8	34.0	40.1	
Mass of dry soil + can	28.1	25.2	24.4	28.0	
Mass of can	7.8	7.7	7.8	7.8	
Mass of dry soil	20.3	17.5	16.6	20.2	
Mass of moisture	10.5	9.6	9.6	12.1	
Water content, w%	51.7	54.9	57.8	59.9	
No. of blows N	47	28	17	12	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-109		
Mass of wet soil + can	34.4		
Mass of dry soil + can	29.8		
Mass of can	7.7		
Mass of dry soil	22.1		
Mass of moisture	4.6		
Water content, $w\% = w_P$	20.8		

Flow index F_i =

Liquid limit = 56

Plastic limit = 21

Plasticity index I_P = 35

F-81

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

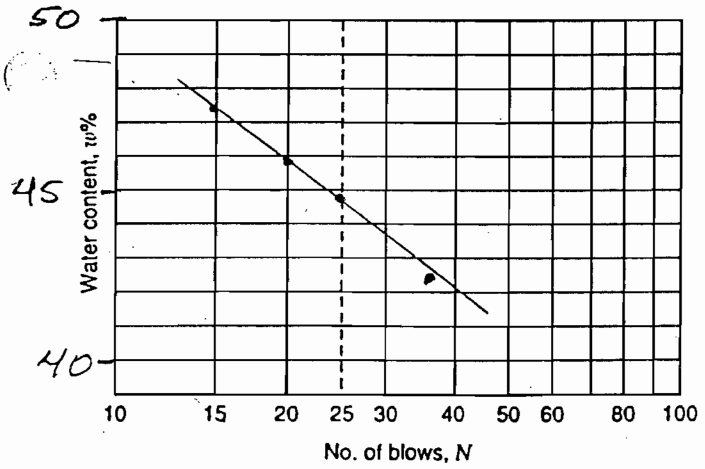
Location of Project ____ Boring No. B-4 Sample No. ____

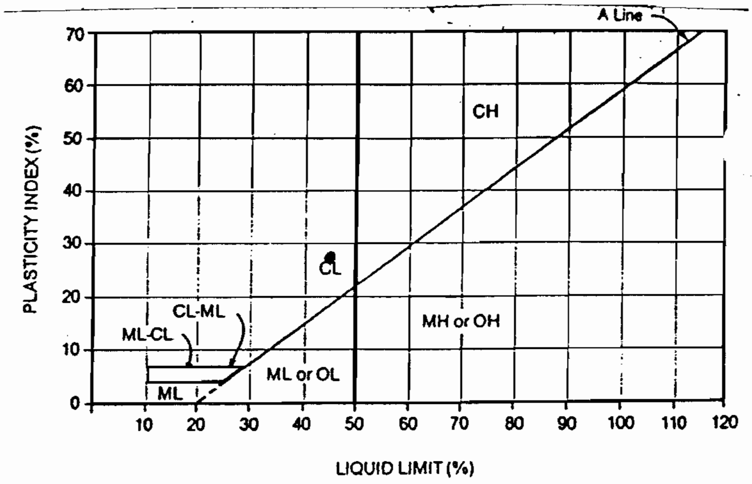
Description of Soil OLV BRN W/YEL BRN CLAYSTONE W/TR VFG SAND

Depth of Sample 30.0' Tested By RLF Date 2/15/01

Liquid Limit Determination

Can no.	F-51	F-5	F-50	F-48	
Mass of wet soil + can	38.8	44.1	40.0	42.3	
Mass of dry soil + can	29.6	32.9	29.9	31.2	
Mass of can	7.9	7.9	7.9	7.8	
Mass of dry soil	21.7	25.0	22.0	23.4	
Mass of moisture	9.2	11.2	10.1	11.1	
Water content, w%	42.4	44.8	45.9	47.4	
No. of blows N	37	25	20	15	
Penetration D, mm		24.2			





Plastic Limit Determination

Can no.	F-45		
Mass of wet soil + can	35.3		
Mass of dry soil + can	31.2		
Mass of can	7.8		
Mass of dry soil	23.4		
Mass of moisture	4.1		
Water content, $w\% = w_P$	17.5		

Flow index F_i = ____

Liquid limit = 45

Plastic limit = 18

Plasticity index I_P = 27

F-68

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

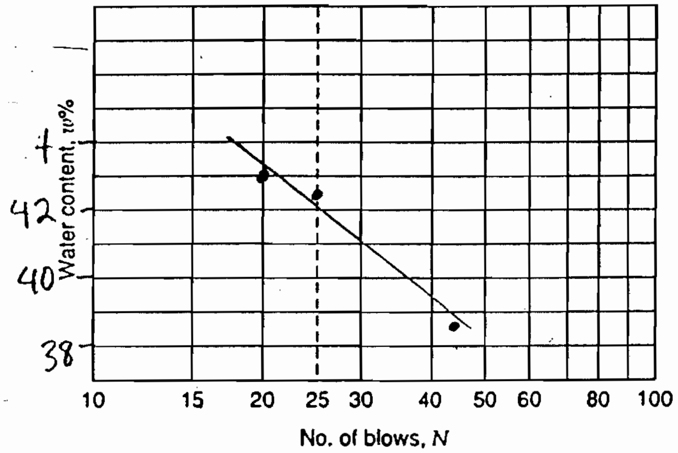
Location of Project Boring No. B-4 Sample No.

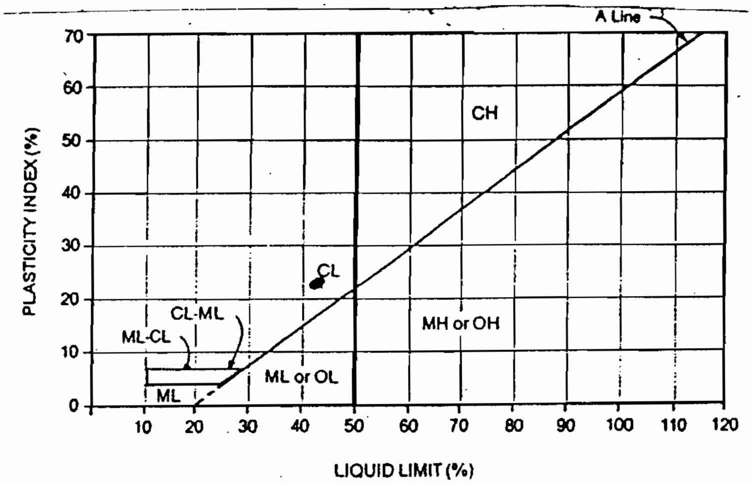
Description of Soil V DK GRY CLAYSTONE W/TR VFG SAND

Depth of Sample 44.0' Tested By RLF Date 2/15/01

Liquid Limit Determination

Can no.	F-102		F-106	F-54	
Mass of wet soil + can	41.4		36.9	38.8	
Mass of dry soil + can	32.0		28.2	29.5	
Mass of can	7.8		7.7	7.9	
Mass of dry soil	24.2		20.5	21.6	
Mass of moisture	9.4		8.7	9.3	
Water content, w%	38.8		42.4	43.0	
No. of blows N	44		25	20	
Penetration D, mm					





Plastic Limit Determination

Can no.	F-3		
Mass of wet soil + can	37.8		
Mass of dry soil + can	32.8		
Mass of can	7.8		
Mass of dry soil	25.0		
Mass of moisture	5.0		
Water content, $w\% = w_P$	20.0		

Flow index F_i =

Liquid limit = 42

Plastic limit = 20

Plasticity index I_P = 22

ATTERBERG LIMITS DETERMINATION

Project VASCO RD Job No. 001860

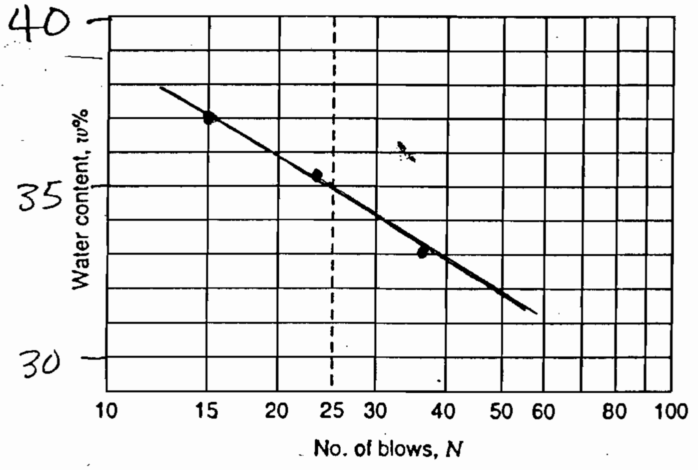
Location of Project Boring No. B-4 Sample No.

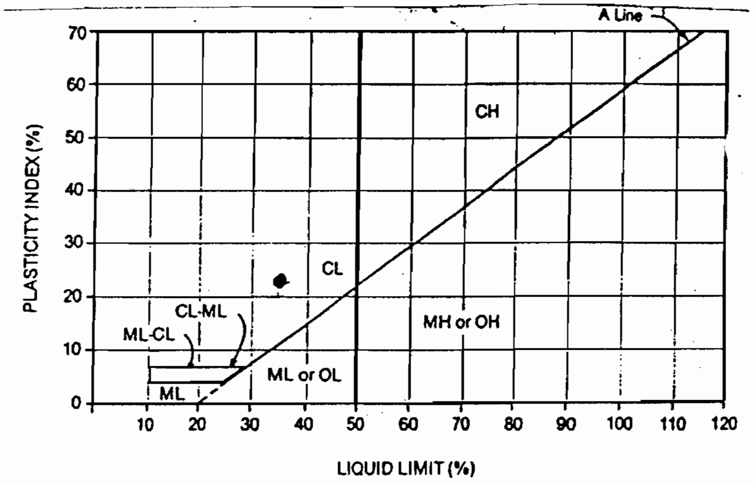
Description of Soil DK GRN GRY SANDY CLAYSTONE

Depth of Sample 70.5' Tested By RLF Date 2/15/01

Liquid Limit Determination

Can no.	F-42	F-4	F-41		
Mass of wet soil + can	44.2	44.4	40.4		
Mass of dry soil + can	35.2	34.9	31.6		
Mass of can	7.9	7.9	7.8		
Mass of dry soil	27.3	27.0	23.8		
Mass of moisture	9.0	9.5	8.8		
Water content, *w*%	33.0	35.2	37.0		
No. of blows *N*	36	23	15		
Penetration *D*, mm					





Plastic Limit Determination

Can no.	F-101		
Mass of wet soil + can	32.5		
Mass of dry soil + can	29.8		
Mass of can	7.9		
Mass of dry soil	21.9		
Mass of moisture	2.7		
Water content, $w\% = w_P$	12.3		

Flow index F_i =

Liquid limit = 35

Plastic limit = 12

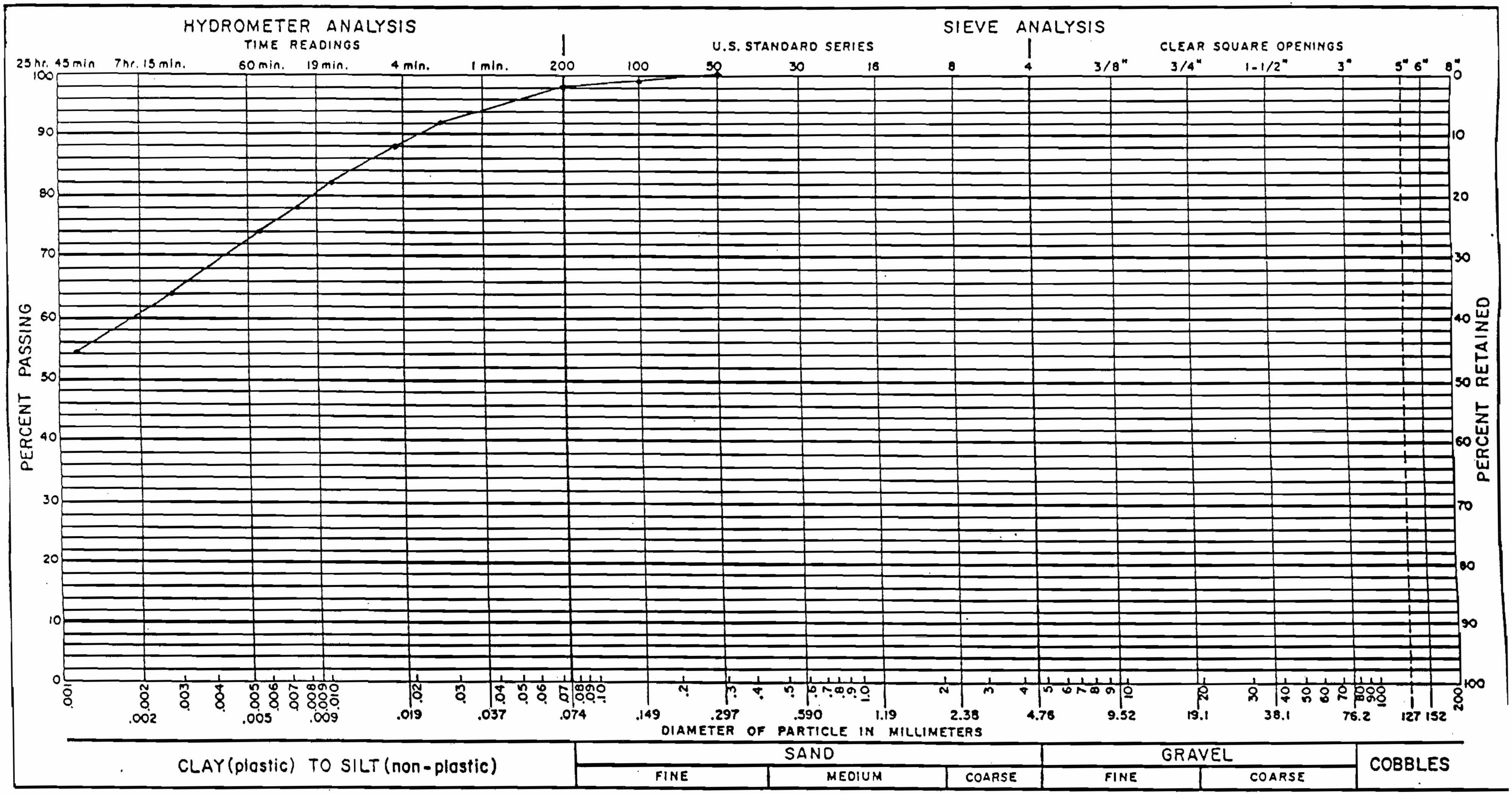
Plasticity index I_P = 23

GF ION TEST RESULTS

PROJECT VASCO ROAD PROJECT NO. 001860

SAMPLE NO. BORING B-3 DEPTH 46.5'

SAMPLE DESCRIPTION DK OLV GRY W/YEL BRN CLAYSTONE



F-67

Job No. 001860

Job Name VASCO RD

Boring No. B-3 Depth 46.5'

Date 2/24/01 Tested by RLF

Sample Description DK OLV GRY W/YEL BRN CLAYSTONE

WHOLE SAMPLE

Air Dry Sample Wt. = ______ (A1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0g (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ______ (B1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0g (B3) = W

Air Dry Wt. of Hydrometer Sample = ______ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ______ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100 \times B5}$ x B6 = ______

HPF, Hydrometer Percentage Factor = $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6}$ = ______

Specific Gravity, G = 2.65

DRY SIEVE						
Original Dry Sample Wt. (A3) = 1.0 gm						
U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#16–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"						
3/4"						
3/8"						
#4						
#8						
#10						100 ← B6
#16						100
#30						100
#40						100
#50						100
#100		0.5		0.5	1.0	99
#200		0.5		1.0	2.0	98

21.5°

Hydrometer Correction

clear water reading 2.0 (C1) TOP

water + disp (top) 7.0 (C2) 21.5°

water + disp (bottom) 7.5 (C3)

Hyd Corr −1x(2xC2−C1−C3) = −4.5

START 10^{26} Am 2/24/01

$P = \frac{R\alpha}{W} \times 100$

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF·(R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) D=K√L/T
3/24 10^{28} Am	2	51	−4.5	46.5	18°	92.07	0.01378	7.9	0.0274
3/24 10^{31} Am	5	49	−4.5	44.5		88.11	0.01378	8.3	0.0178
3/24 10^{41} Am	15	46	−4.5	41.5	↓	82.17	0.01378	8.8	0.0106
3/24 10^{56} Am	30	44	−4.5	39.5		78.21	0.01378	9.1	0.0076
3/24 11^{26} Am	60	42	−4.5	37.5	↓	74.25	0.01378	9.4	0.0055
2 pm 3/24 2^{26} pm	240 (4h)	37	−4.5	32.5	20°	64.35	0.01344	10.2	0.0028
3/24 10^{26} Am	1440 (24h)	32	−4.5	27.5	18°	54.45	0.01378	11.1	0.0012

$\alpha = 0.99$

F-3 #200 WASH

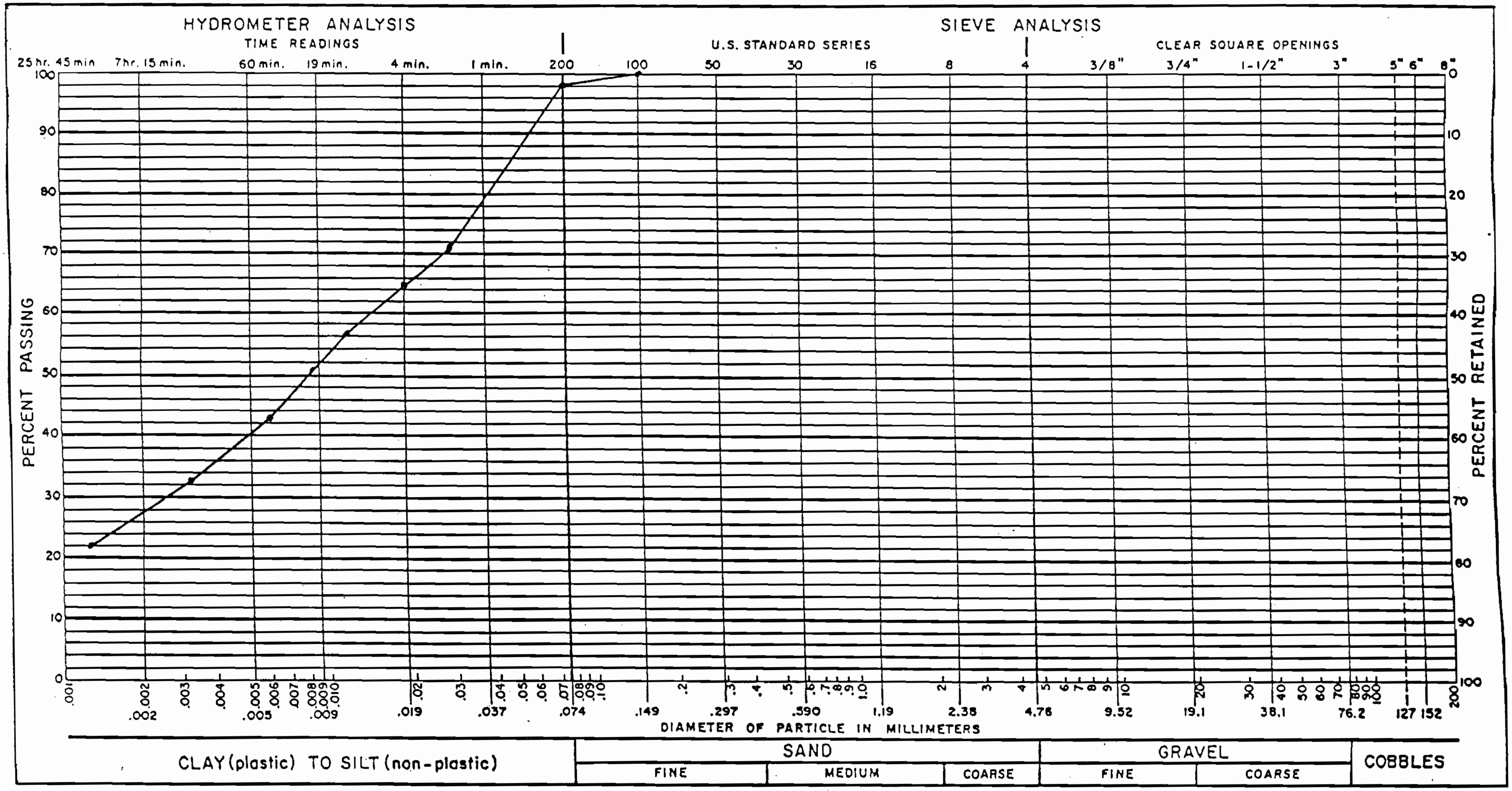
ASSUMED $G_s = 2.70$

GRADATION TEST RESULTS

PROJECT VASCO RD. PROJECT NO. 001860

SAMPLE NO. BORING B-3 DEPTH 62.0'

SAMPLE DESCRIPTION DK GRN GRY AND DK GRY CLAYSTONE



HYDROMETER ANALYSIS

Sample No. F-67

Job No. 001860

Job Name VASCO RD

Boring No. B-3 Depth 62.0

Date 2/26/01 Tested by RLF

Sample Description ______

WHOLE SAMPLE

Air Dry Sample Wt. = ______ (A1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0g (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ______ (B1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0g (B3) = W

Air Dry Wt. of Hydrometer Sample = ______ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ______ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100 \times B5} \times B6 =$ ______

HPF, Hydrometer Percentage Factor = $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6} =$ ______

Specific Gravity, G = 2.65

DRY SIEVE

Original Dry Sample Wt. (A3) = 0.9 gm

U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#18–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"			☒			
3/4"			☒			
3/8"			☒			
#4			☒			
#8			☒			
#10			☒			100 ← B6
#16						
#30						
#40						
#50						
#100						100
#200				0.9	1.8	98.2

Hydrometer Correction

clear water reading 2.0 (C1) TOP

water + disp (top) 7.0 (C2)

water + disp (bottom) 7.5 (C3) 21.5°

Hyd Corr −1x(2xC2−C1−C3) = −4.5

2/26/01 6^{36}pm START

$P = \frac{R\alpha}{W} \times 100$

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF·(R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) D=K√L/T
2/26 6^{38}pm	2	40.5	−4.5	36.0	20	71.28	0.01344	9.65	0.0295
6^{41}	5	37.5	−4.5	33.0	20	65.34		10.15	0.0192
6^{51}	15	33.0	−4.5	28.5	20	56.43		10.9	0.0115
7^{06}	30	30.0	−4.5	25.5	20	50.49		11.4	0.0083
7^{36}	60	26.0	−4.5	21.5	20	42.57		12.0	0.0060
10^{36}pm	240 (4h)	21.0	−4.5	16.5	20	32.67		12.9	0.0031
2/27 6^{36}pm	1440 (24h)	15.5	−4.5	11.0	20.5	21.78	0.01336	13.75	0.0013

200 WASH F-40

SAND IS GRAY TO LT GRY

$\alpha = 0.99$

ASSUMED

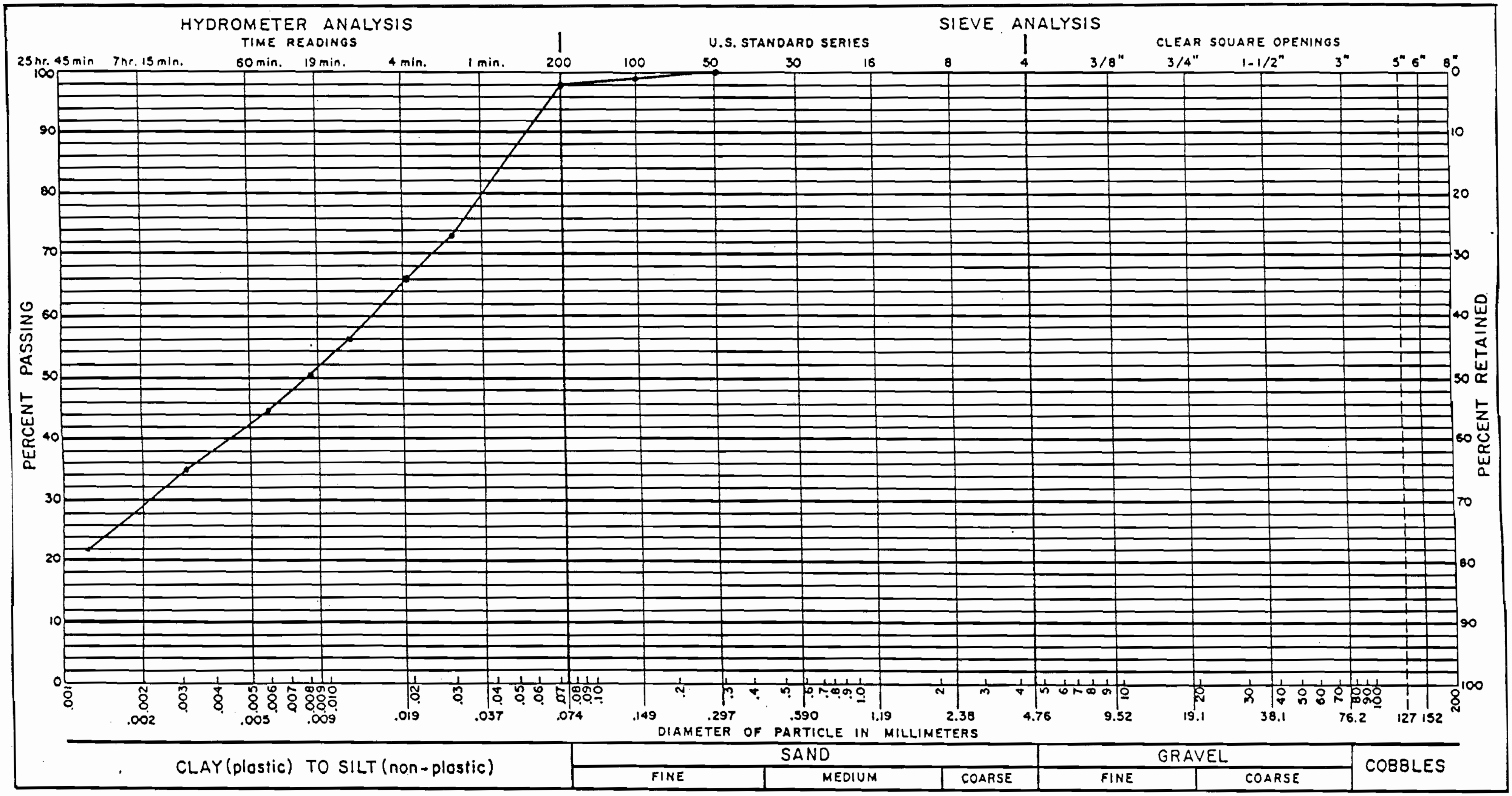
$G_s = 2.70$

GRADATION TEST RESULTS

PROJECT VASCO RD. PROJECT NO. 001860

SAMPLE NO. BORING B-4 DEPTH 17.5'

SAMPLE DESCRIPTION LT OLV BRN W/YEL BRN WEATH. CLAYSTONE



HYDROMETER ANALYSIS

Sample No. F-95

Job No. 001860

Job Name NASCO RD

Boring No. B-4 Depth 17.5'

Date 2/25/01 Tested by RLF

Sample Description ______

WHOLE SAMPLE

Air Dry Sample Wt. = ______ (A1)

Air Dry Water Content

Can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0g (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ______ (B1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0g (B3) = W

Air Dry Wt. of Hydrometer Sample = ______ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ______ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100 \times B5}$ x B6= ______

HPF, Hydrometer Percentage Factor = $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6}$ = ______

Specific Gravity, G = 2.65

DRY SIEVE

Original Dry Sample Wt. (A3) = [illegible] gm

U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#16–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"						
3/4"						
3/8"						
#4						
#8						
#10						100 ← B6
#16						
#30						
#40						
#50						100
#100				0.5	1.0	99
#200				0.6	2.2	97.8

Hydrometer Correction Top

clear water reading 2.0 (C1)

water + disp (top) 7.0 (C2)

water + disp (bottom) 7.5 (C3) 21.5°

Hyd Corr −1x(2xC2−C1−C3) = −4.5

2/25/01 3²² pm START

$P = \frac{Ra}{W} \times 100$

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF·(R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) D=K√L/T
2/25 3²⁴ pm	2	41.5	−4.5	37.0	18°	73.26	0.01378	9.5	0.0300
3²⁷ pm	5	38	−4.5	33.5	↓	66.33	↓	10.1	0.0196
3³⁷ pm	15	33	−4.5	28.5	↓	56.43	↓	10.9	0.0118
3⁵² pm	30	30	−4.5	25.5	↓	50.49	↓	11.4	0.0085
4²² pm	60	27	−4.5	22.5	19	44.55	0.01361	11.9	0.0061
7²² pm	240 (4h)	22	−4.5	17.5	↓	34.65	0.01361	12.7	0.0031
2/26 3²² pm	1440 (24h)	15/15.5	−4.5	11.0	20.5	21.78	0.01336	13.75	0.0013

200 WASH F-47

SAND IS PALE BRN + DK YEL BRN

$\alpha = 0.99$

ASSUMED

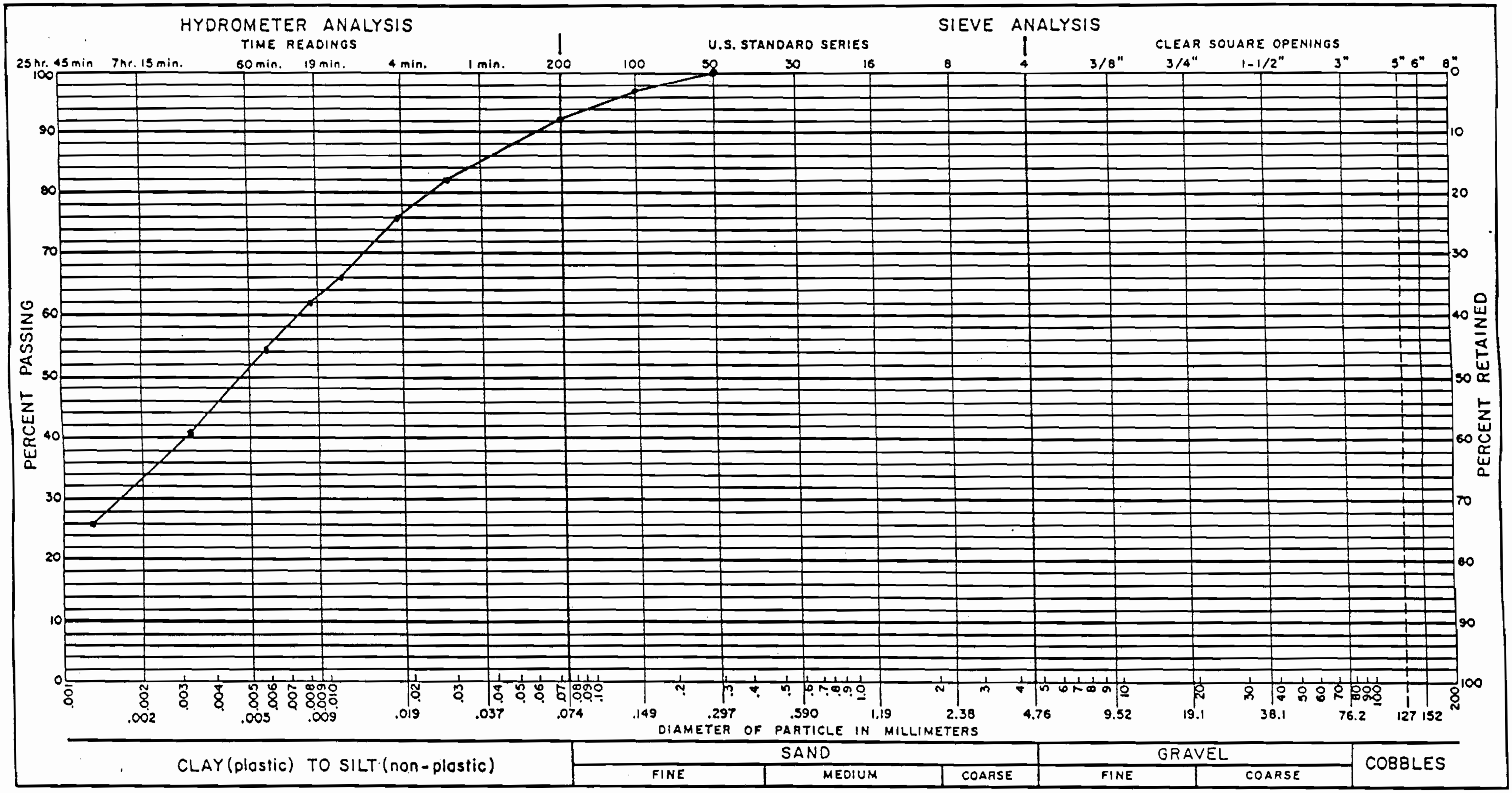
$G_s = 2.70$

GRADATION TEST RESULTS

PROJECT VASCO RD PROJECT NO. 001860

SAMPLE NO. BORING B-4 DEPTH 30.0'

SAMPLE DESCRIPTION OLV BRN W/YEL BRN CLAYSTONE



HYDROMETER ANALYSIS

Sample No. F-81

Job No. 001860

Job Name VASCO RD

Boring No. B-4 Depth 30.0'

Date 2/25/01 Tested by RLF

Sample Description

WHOLE SAMPLE

Air Dry Sample Wt. = ______ (A1)

Air Dry Water Content

Can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0g (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ______ (B1)

Air Dry Water Content

can no. ______

wet + can ______

dry + can ______

can wt. ______

w.c. (dec) ______ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0g (B3) = W

Air Dry Wt. of Hydrometer Sample = ______ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ______ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100 \times B5} \times B6$ = ______

HPF, Hydrometer Percentage Factor = $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6}$ = ______

Specific Gravity, G = 2.65

11.7 - 7.9 10.3-7.9

DRY SIEVE

Original Dry Sample Wt. (A3) = 3.8 gm

U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#18–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"						
3/4"						
3/8"						
#4						
#8						
#10						100 ← B6
#16						
#30						
#40						
#50						100
#100				1.4	2.8	97.2
#200				2.4	7.6	92.4

Hydrometer Correction

clear water reading 2.0 (C1) TOP

water + disp (top) 7.0 (C2)

water + disp (bottom) 7.5 (C3) 21.5

Hyd Corr −1x(2xC2−C1−C3) = −4.5

$P = \frac{R\alpha}{W} \times 100$

5/01 $3^{34\,13}$ pm START

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF·(R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) $D = K\sqrt{L/T}$
3^{36}	2	46	−4.5	41.5	18°	82.17	0.01378	8.8	0.0289
3^{39}	5	43	−4.5	38.5	↓	76.23	0.01378	9.2	0.0187
3^{49}	15	38	−4.5	33.5	↓	66.33	0.01378	10.1	0.0113
4^{03}	30	36	−4.5	31.5	19°	62.37	0.01361	10.4	0.0080
4^{34}	60	32	−4.5	27.5	↓	54.45	0.01361	11.1	0.0059
7^{34}	240 (4h)	25	−4.5	20.5	19.5	40.59	0.01353	12.2	0.0031
3^{34} pm	1440 (24h)	17.5	−4.5	13.0	20.5	25.74	0.01336	13.4	0.0013

25

43 pm

200 WASH F-51

SAND IS LT + DK YEL BRN

$\alpha = 0.99$

ASSUMED

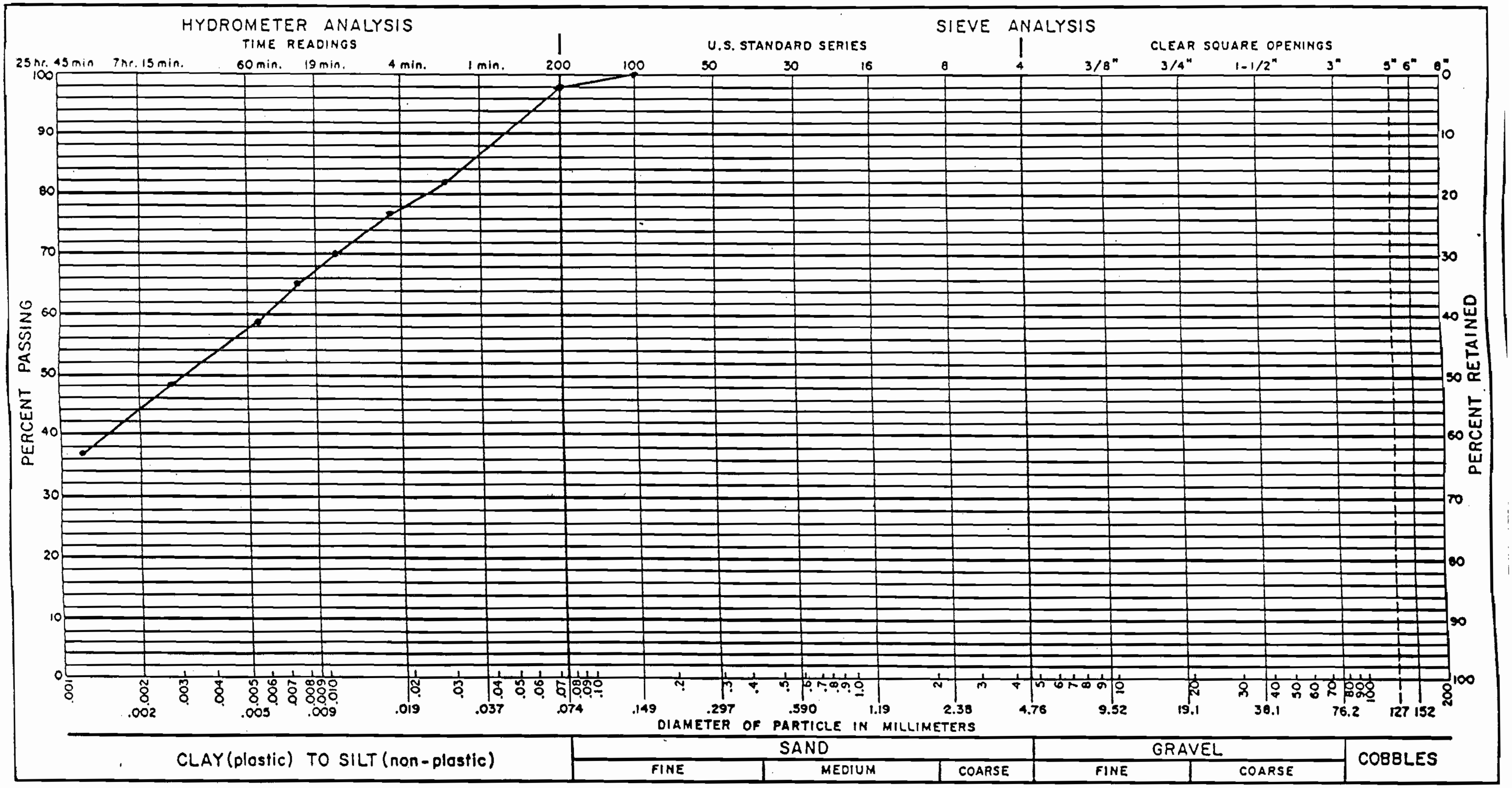
$G_s = 2.70$

GRADATION TEST RESULTS

PROJECT VASCO RD. PROJECT NO. 001860

SAMPLE NO. BORING B-4 DEPTH 44.0'

SAMPLE DESCRIPTION V DK. GRY CLAYSTONE



HYDROMETER ANALYSIS

Sample No. F-68

Job No. 001860

Job Name VASCO RD

Boring No. B-4 Depth 44.0'

Date 2/26/01 Tested by RLF

Sample Description ____

WHOLE SAMPLE

Air Dry Sample Wt. = ____ (A1)

Air Dry Water Content

can no. ____

wet + can ____

dry + can ____

can wt. ____

w.c. (dec) ____ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0g (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ____ (B1)

Air Dry Water Content

can no. ____

wet + can ____

dry + can ____

can wt. ____

w.c. (dec) ____ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0g (B3) = W

Air Dry Wt. of Hydrometer Sample = ____ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ____ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100 \times B5}$ x B6= ____

HPF, Hydrometer Percentage Factor= $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6}$ = ____

Specific Gravity, G = 2.65

DRY SIEVE

Original Dry Sample Wt. (A3) = 0.9 gm

U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#16–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"			☒			
3/4"			☒			
3/8"			☒			
#4			☒			
#8			☒			
#10			☒			100 ← B6
#16						
#30						
#40						
#50						
#100						100
#200				0.9	1.8	98.2

Hydrometer Correction

clear water reading 2.0 (C1) TOP

water + disp (top) 7.0 (C2)

water + disp (bottom) 7.5 (C3) 21.5°

$P = \frac{R\alpha}{W} \times 100$ Hyd Corr −1x(2xC2−C1−C3) = −4.5

START 6^{32} pm 2/26/01

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF · (R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) $D = K\sqrt{L/T}$
2/26 6^{34} PM	2	46	−4.5	41.5	20	82.17	0.01344	8.8	0.0282
6^{37}	5	43.5	−4.5	39.0	20	77.22		9.15	0.0182
6^{47}	15	40.0	−4.5	35.5	20	70.29		9.7	0.0108
7^{02}	30	37.5	−4.5	33.0	20	65.34		10.15	0.0078
7^{32}	60	34.5	−4.5	30.0	20	59.40		10.65	0.0057
10^{32} pm	240 (4h)	29.0	−4.5	24.5	20	48.51		11.5	0.0029
2/27 6^{32} pm	1440 (24h)	23.0	−4.5	18.5	20.5	36.63	0.01336	12.5	0.0012

200 WASH F-54

SAND IS WT + GRY

$\alpha = 0.99$

ASSUMED

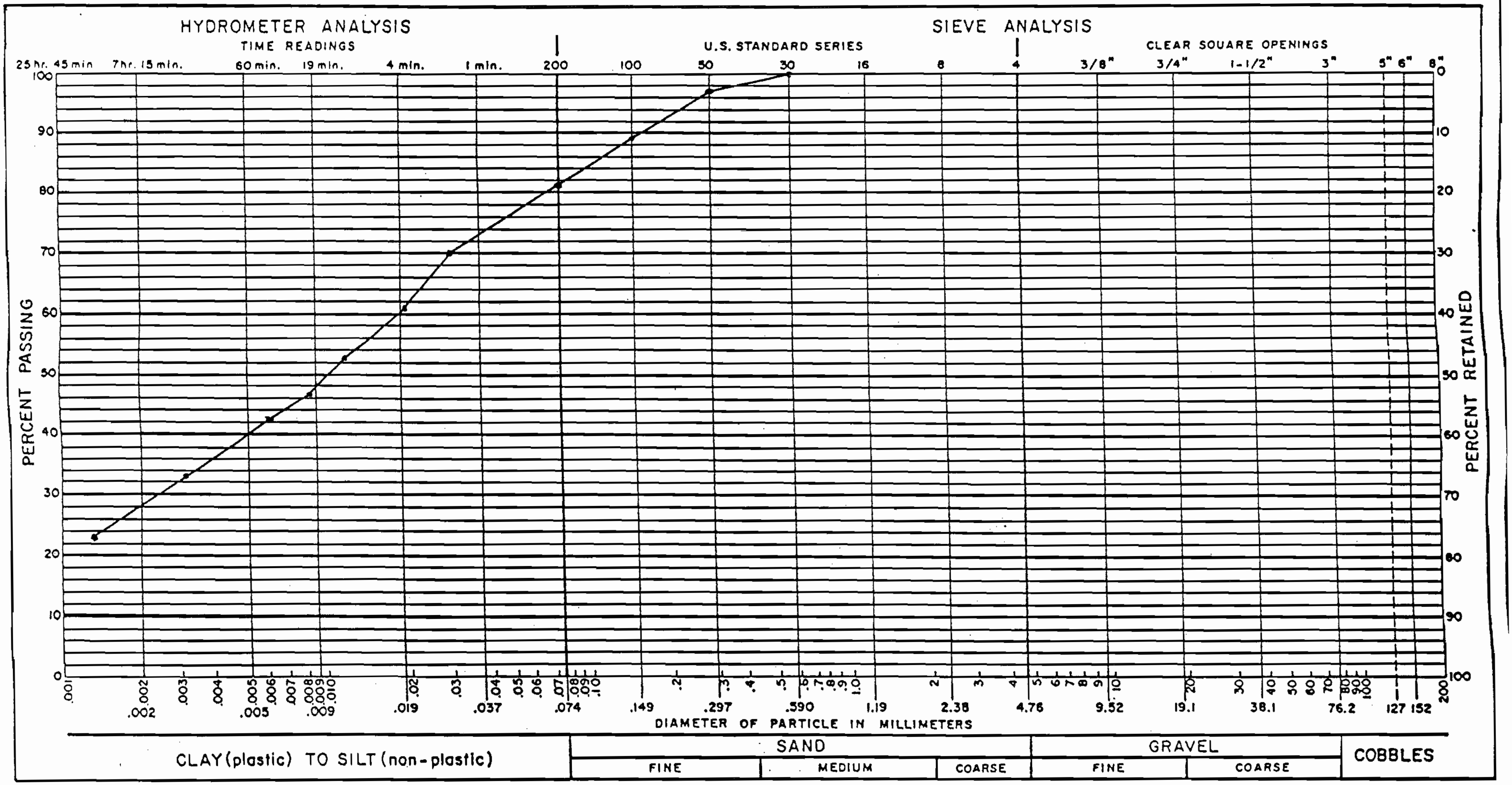
$G_s = 2.70$

GRADATION TEST RESULTS

PROJECT VASCO RD. PROJECT NO. 001860

SAMPLE NO. BORING B-4 DEPTH 70.5'

SAMPLE DESCRIPTION DK GRN GRY SANDY CLAYSTONE



HYDROMETER ANALYSIS

Sample No. F-20

Job No. 001860

Job Name VASCO RD

Boring No. B-4 Depth 70.5'

Date 2/28/01 Tested by RLF

Sample Description ____

WHOLE SAMPLE

Air Dry Sample Wt. = ____ (A1)

Air Dry Water Content

Can no. ____

wet + can ____

dry + can ____

can wt. ____

w.c. (dec) ____ (A2)

Oven Dry Sample Wt. = $\frac{A1}{1+A2}$ = 50.0 (A3)

<NO. 10 PORTION

Air Dry Wt. Passing No. 10 = ____ (B1)

Air Dry Water Content

can no. ____

wet + can ____

dry + can ____

can wt. ____

w.c. (dec) ____ (B2)

Oven Dry Wt. Passing No. 10 = $\frac{B1}{1+B2}$ = 50.0 (B3) = W

Air Dry Wt. of Hydrometer Sample = ____ (B4)

Oven Dry Wt. of Hydrometer Sample = $\frac{B4}{1+B2}$ = ____ (B5)

SCF, Sieve Correction Factor = $\frac{A3}{100\text{x}B5}$ x B6 = ____

HPF, Hydrometer Percentage Factor = $\frac{1000}{B5/B6} \cdot \frac{G}{G-1} = \frac{1606}{B5/B6}$ = ____

Specific Gravity, G = 2.65

DRY SIEVE						
Original Dry Sample Wt. (A3) = 9.4 gm						
U.S. Standard Sieve Size	Can No.	Sample Wt. (SW)	Corrected Sample Wt. = SW·SCF (#16–#200 only)	Cumulative Wt. Retained	Cumulative % Retained	% Passing
1"						
3/4"						
3/8"						
#4						
#8						
#10						← B6
#16						
#30						
#40						100
#50		1.5		1.5	3.0	97.0
#100		3.8		5.3	10.6	89.4
#200		4.1		9.4	18.8	81.2

Hydrometer Correction

clear water reading 2.0 (C1) TOP

water + disp (top) 7.0 (C2)

water + disp (bottom) 7.5 (C3) 21.50

$P = \frac{Ra}{W} \times 100$ Hyd Corr −1x(2xC2−C1−C3) = −4.5

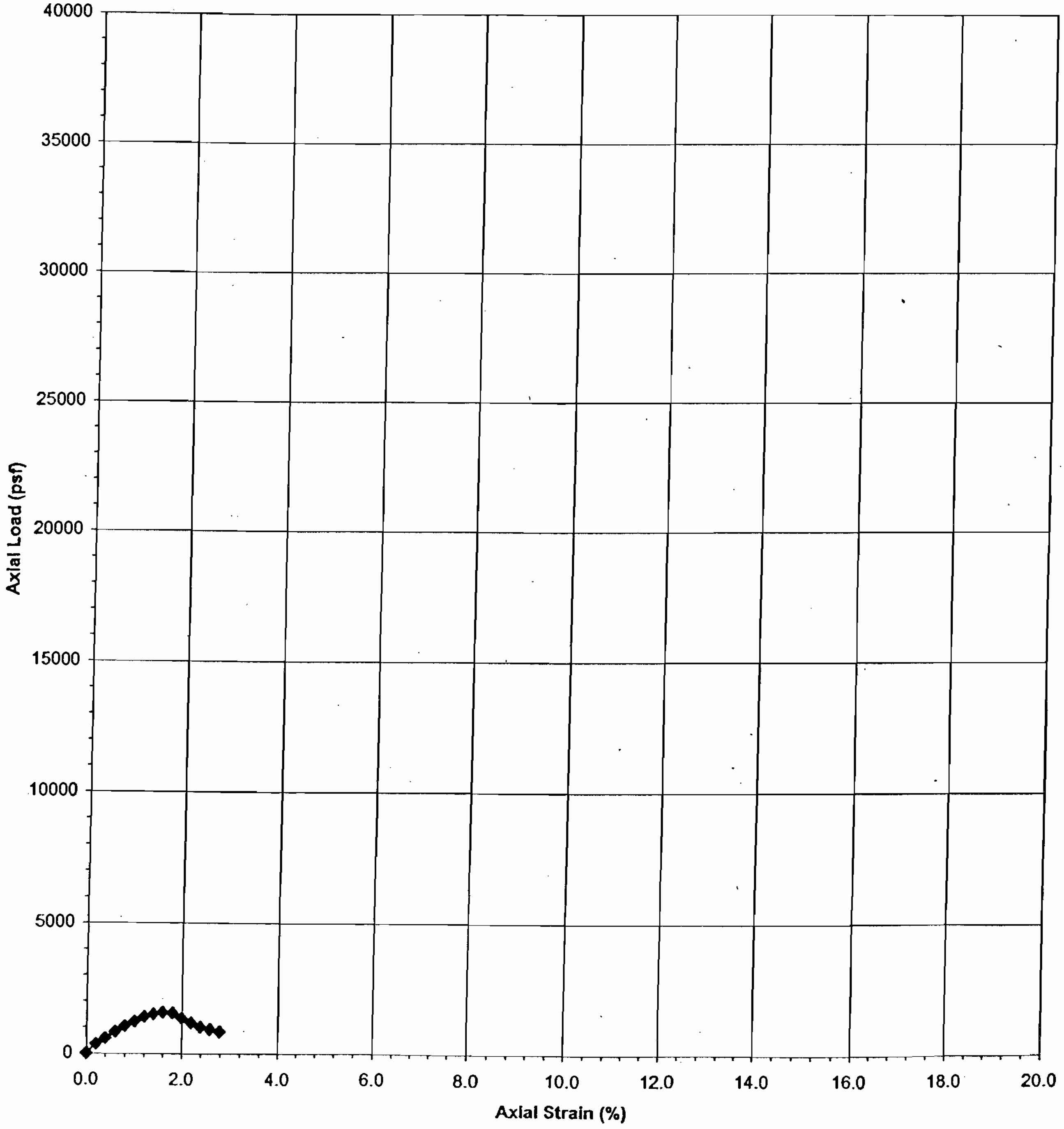
START 4^{46} pm 2/28/01

Date / Time	T Elapsed Time	Hydrometer Reading	Hydrometer Correction	R Corrected Reading	Temp. (C)	P HPF·(R−1)	K Table 3, pg. 93	L Table 2, pg. 92	D (mm) $D=K\sqrt{L/T}$
3/28 4^{48} pm	2	40	−4.5	35.5	19	70.29	0.01361	9.7	0.0300
4^{51}	5	35.5	−4.5	31.0	19	61.38	↓	10.5	0.0197
5^{01}	15	31	−4.5	26.5	19	52.47		11.2	0.0118
5^{16}	30	28	−4.5	23.5	19	46.53		11.7	0.0085
5^{46}	60	26	−4.5	21.5	19	42.57		12.0	0.0061
8^{46} pm	240 (4h)	21	−4.5	16.5	19.5	32.67	0.01353	12.9	0.0031
3/1 4^{46} pm	1440 (24h)	16	−4.5	11.5	19	22.77	0.01361	13.7	0.0013

α=0.99
FOR ASSUMED
G_s = 2.70

DK GR + LT GRY SAND

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-1 @ 5.5'
Lt Olv Brn Silty Sandstone / Sandy Siltstone (VFG)



Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

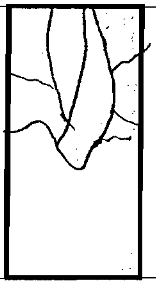
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-1
DEPTH: 5.5'

Sample Diameter: 2.40
Sample Length: 5.03
Wet Wt./Dry Wt.:
Description: LT OLV BRN SILTY SANDSTONE / VFG SANDY SILTSTONE

F-25

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	16	0.26	
0.02	26	0.27	
0.03	37	0.28	
0.04	47	0.29	
0.05	55	0.30	
0.06	63	0.31	
0.07	68	0.32	
0.08	71	0.33	
0.09	70	0.34	
0.10	61	0.35	
0.11	53	0.36	
0.12	46	0.37	
0.13	42	0.38	
0.14	38	0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



BEDDING NOT APPARENT
NO POLISHING ON SHEAR SURF

Comments: LT OLV BRN 2.5Y 5/4

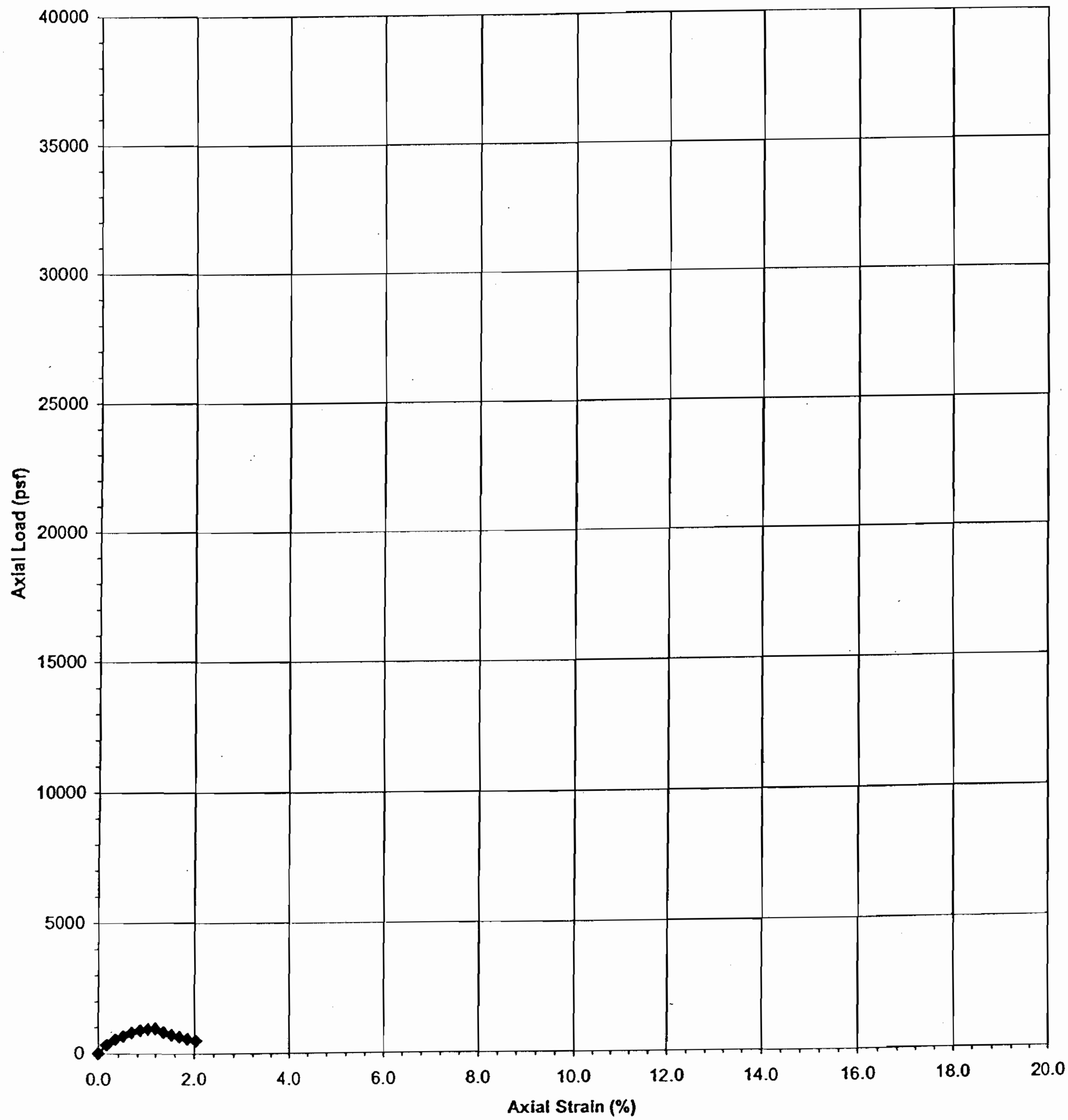
UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/19/2001
BORING: B-1
DEPTH: 5.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.03	0.00	0	0.00	0	0.0	0
2.40	5.03	0.01	16	11.13	354	0.2	354
2.40	5.03	0.02	26	18.08	576	0.4	576
2.40	5.03	0.03	37	25.73	819	0.6	819
2.40	5.03	0.04	47	32.68	1040	0.8	1040
2.40	5.03	0.05	55	38.25	1217	1.0	1217
2.40	5.03	0.06	63	43.81	1395	1.2	1395
2.40	5.03	0.07	68	47.29	1505	1.4	1505
2.40	5.03	0.08	71	49.37	1572	1.6	1572
2.40	5.03	0.09	70	48.68	1549	1.8	1549
2.40	5.03	0.10	61	42.42	1350	2.0	1350
2.40	5.03	0.11	53	36.86	1173	2.2	1173
2.40	5.03	0.12	46	31.99	1018	2.4	1018
2.40	5.03	0.13	42	29.21	930	2.6	930
2.40	5.03	0.14	38	26.43	841	2.8	841
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-1 @ 13.5'
Gry Brn and Lt Olv Brn w/ Yel Brn Sandy Siltstone / Silty Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-1			Ring Constant = 0.6954 lb/div			
DEPTH:	13.5						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	5.91	0.00	0	0.00	0	0.0	0
2.41	5.91	0.01	15	10.43	329	0.2	329
2.41	5.91	0.02	24	16.69	527	0.3	527
2.41	5.91	0.03	30	20.86	659	0.5	659
2.41	5.91	0.04	36	25.03	790	0.7	790
2.41	5.91	0.05	40	27.82	878	0.8	878
2.41	5.91	0.06	42	29.21	922	1.0	922
2.41	5.91	0.07	43	29.90	944	1.2	944
2.41	5.91	0.08	37	25.73	812	1.4	812
2.41	5.91	0.09	32	22.25	702	1.5	702
2.41	5.91	0.10	29	20.17	637	1.7	637
2.41	5.91	0.11	25	17.39	549	1.9	549
2.41	5.91	0.12	22	15.30	483	2.0	483
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

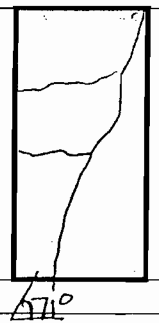
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-1
DEPTH: 13.5

Sample Diameter: 2.41
Sample Length: 5.91
Wet Wt./Dry Wt.:
Description: GRY BRN + LT OLV BRN W/YEL BRN SANDY SILTSTONE/SILTY SANDSTONE

I-31

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	15	0.26	
0.02	24	0.27	
0.03	30	0.28	
0.04	36	0.29	
0.05	40	0.30	
0.06	42	0.31	
0.07	43	0.32	
0.08	37	0.33	
0.09	32	0.34	
0.10	29	0.35	
0.11	25	0.36	
0.12	22	0.37	
0.13		0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

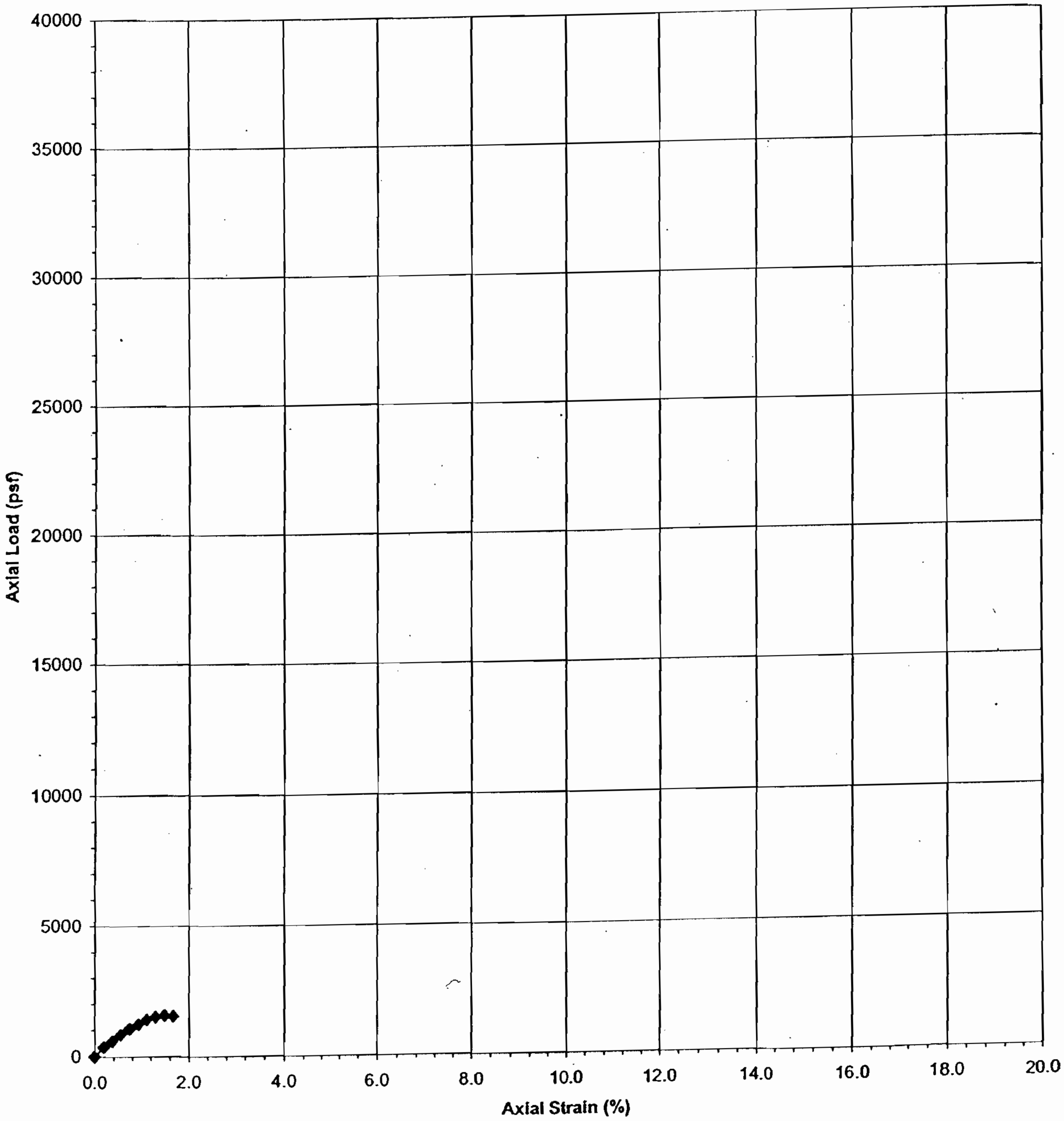
Sketch of Sample After Test:



SL POLISHED SHEAR SURFACE

Comments: 2.5Y 5/2 5/3 GRY BRN + LT OLV BRN
10YR 5/8 YEL BRN Fe STAIN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-1 @ 29.5'
Olv Brn and Brn Yel Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-1			Ring Constant = 0.6954 lb/div			
DEPTH:	29.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.41	0.00	0	0.00	0	0.0	0
2.40	5.41	0.01	16	11.13	354	0.2	354
2.40	5.41	0.02	26	18.08	576	0.4	576
2.40	5.41	0.03	37	25.73	819	0.6	819
2.40	5.41	0.04	47	32.68	1040	0.7	1040
2.40	5.41	0.05	55	38.25	1217	0.9	1217
2.40	5.41	0.06	63	43.81	1395	1.1	1395
2.40	5.41	0.07	68	47.29	1505	1.3	1505
2.40	5.41	0.08	71	49.37	1572	1.5	1572
2.40	5.41	0.09	70	48.68	1549	1.7	1549
		0.10		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.11		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.12		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

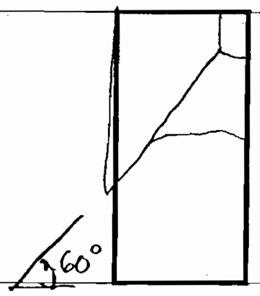
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-1
DEPTH: 29.5

Sample Diameter: 2.40
Sample Length: 5.41
Wet Wt./Dry Wt.:
Description: LT OLV BRN + BRNYLW CLAYSTONE

F-60

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	18	0.26	
0.02	21	0.27	
0.03	18	0.28	
0.04	16	0.29	
0.05	14	0.30	
0.06	12	0.31	
0.07	11	0.32	
0.08	11	0.33	
0.09	10	0.34	
0.10		0.35	
0.11		0.36	
0.12		0.37	
0.13		0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:

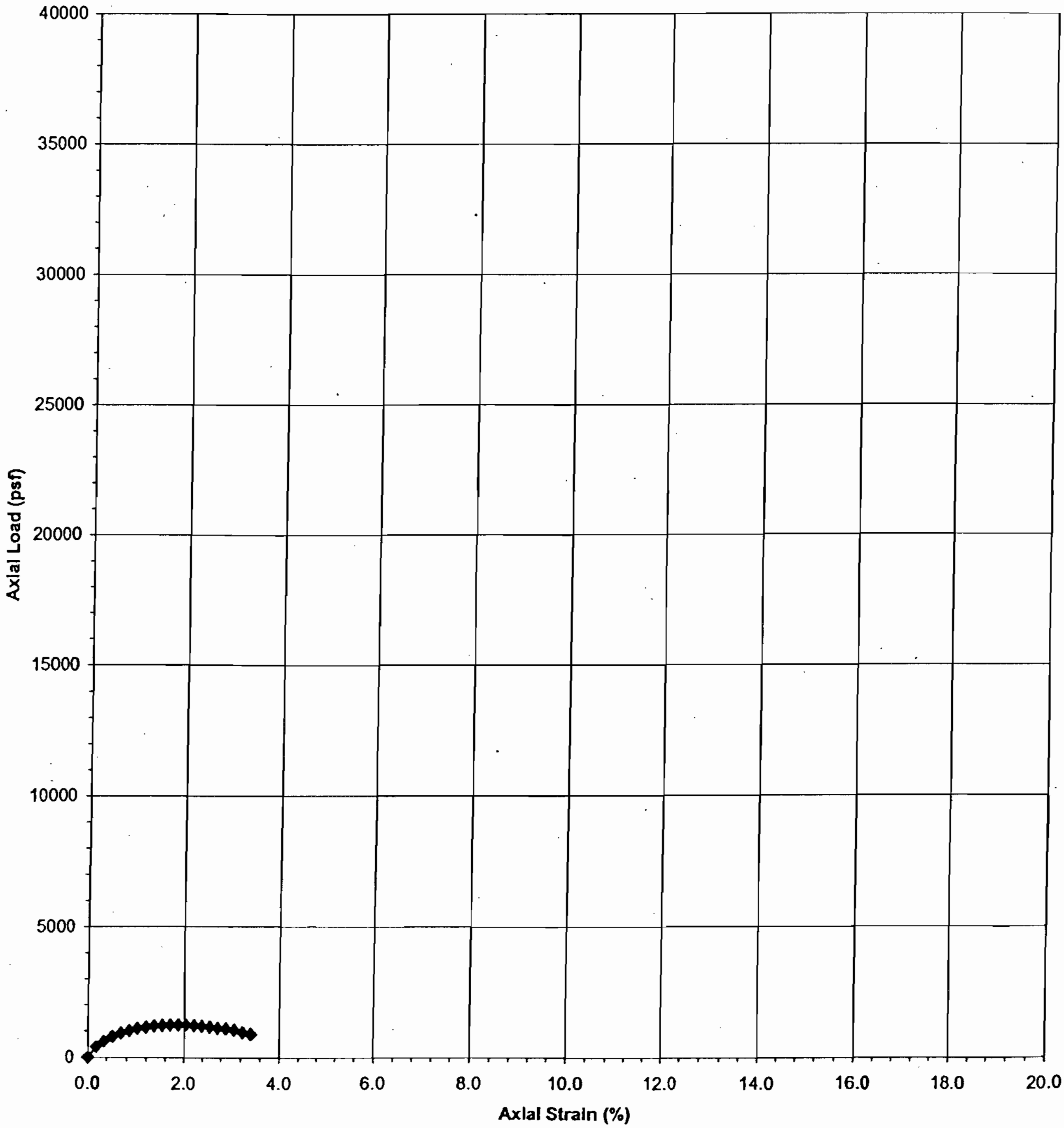


BEDDING NOT APPARENT

HIGHLY POLISHED SHEAR SURFACE
PREEXISTING? VERY PLANAR

Comments: 2.5Y 5/4 LT OLV BRN + BRN YLW 10YR 6/8

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 17.5'
Lt Olv Brn w/ Yel Brn Sandy Siltstone / Silty and Clayey Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-2			Ring Constant = 0.6954 lb/div			
DEPTH:	17.5'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.87	0.00	0	0.00	0	0.0	0
2.39	5.87	0.01	18	12.52	402	0.2	402
2.39	5.87	0.02	27	18.78	603	0.3	603
2.39	5.87	0.03	35	24.34	781	0.5	781
2.39	5.87	0.04	41	28.51	915	0.7	915
2.39	5.87	0.05	45	31.29	1004	0.9	1004
2.39	5.87	0.06	49	34.07	1094	1.0	1094
2.39	5.87	0.07	51	35.47	1138	1.2	1138
2.39	5.87	0.08	53	36.86	1183	1.4	1183
2.39	5.87	0.09	54	37.55	1205	1.5	1205
2.39	5.87	0.10	55	38.25	1228	1.7	1228
2.39	5.87	0.11	55	38.25	1228	1.9	1228
2.39	5.87	0.12	55	38.25	1228	2.0	1228
2.39	5.87	0.13	54	37.55	1205	2.2	1205
2.39	5.87	0.14	53	36.86	1183	2.4	1183
2.39	5.87	0.15	52	36.16	1161	2.6	1161
2.39	5.87	0.16	50	34.77	1116	2.7	1116
2.39	5.87	0.17	49	34.07	1094	2.9	1094
2.39	5.87	0.18	47	32.68	1049	3.1	1049
2.39	5.87	0.19	43	29.90	960	3.2	960
2.39	5.87	0.20	40	27.82	893	3.4	893
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

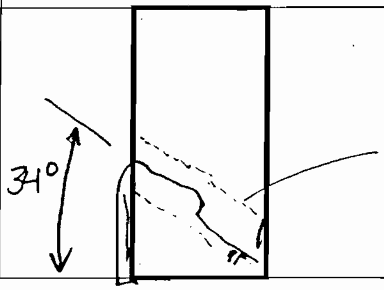
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 17,5

Sample Diameter: 2,39
Sample Length: 5,87
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/YELBRN SANDY SILTSTONE, SILTY + CLAYEY SANDSTONE VFG

F-90

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	18	0.26	
0.02	27	0.27	
0.03	35	0.28	
0.04	41	0.29	
0.05	45	0.30	
0.06	49	0.31	
0.07	51	0.32	
0.08	53	0.33	
0.09	54	0.34	
0.10	55	0.35	
0.11	55	0.36	
0.12	55	0.37	
0.13	54	0.38	
0.14	53	0.39	
0.15	52	0.40	
0.16	50	0.41	
0.17	49	0.42	
0.18	47	0.43	
0.19	43	0.44	
0.20	40	0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



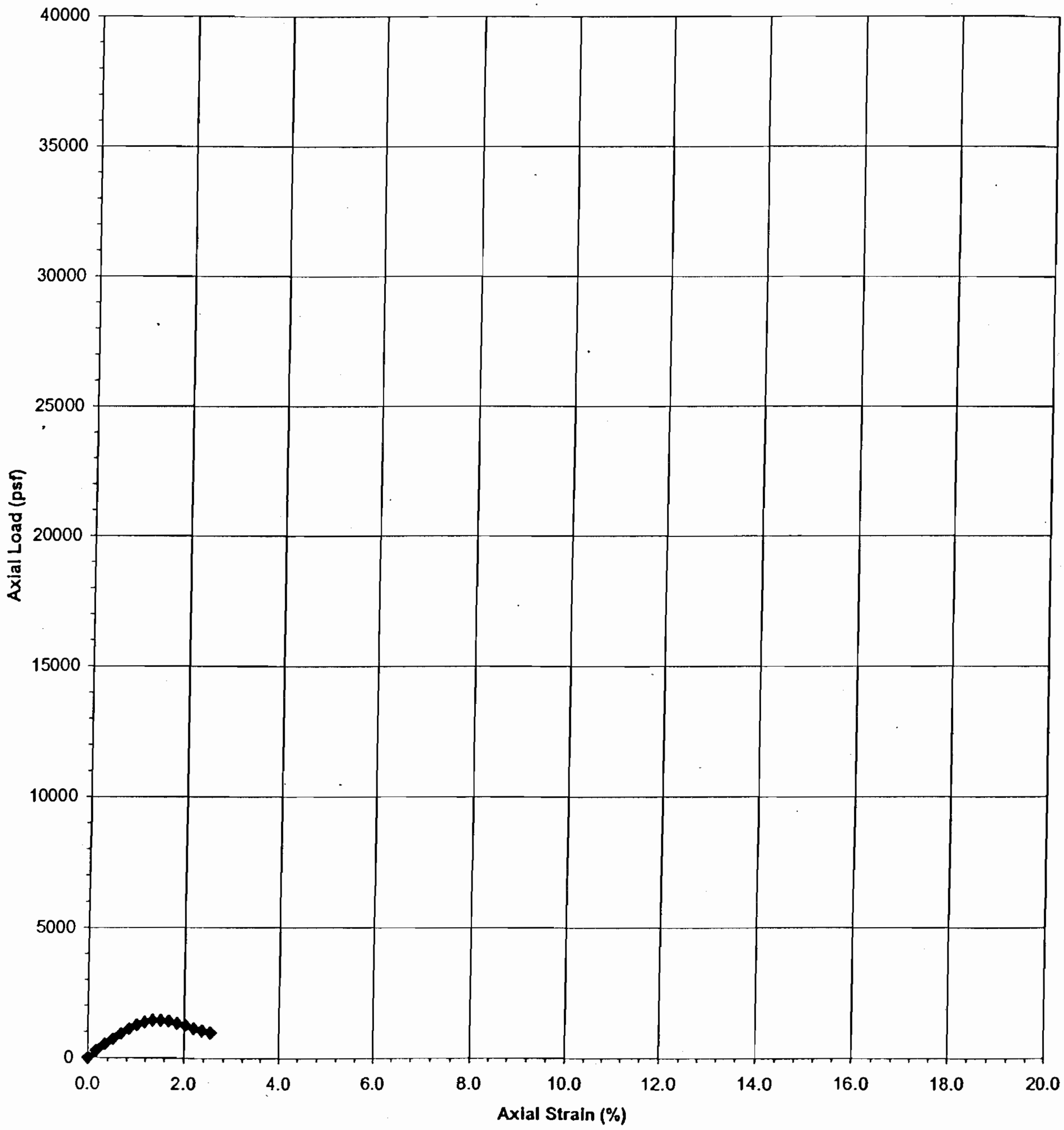
BEDDING NOT APPARENT

YEL BRN ZONE W/PREEXIST? SHEARS
AT SAME ANGLE

POLISHED SHEAR SURFACE

Comments: 2,5Y 5/3 5/4 LT OLV BRN W/ 10YR 5/8 YEL BRN MOT
V MOIST

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 19.0'
Lt Olv Brn w/ Yel Brn Claystone w/ Sand Pockets / Laminations



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-2			Ring Constant = 0.6954 lb/div			
DEPTH:	19.0'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.41	5.93	0.00	0	0.00	0	0.0	0
2.41	5.93	0.01	13	9.04	285	0.2	285
2.41	5.93	0.02	24	16.69	527	0.3	527
2.41	5.93	0.03	33	22.95	724	0.5	724
2.41	5.93	0.04	42	29.21	922	0.7	922
2.41	5.93	0.05	50	34.77	1098	0.8	1098
2.41	5.93	0.06	57	39.64	1251	1.0	1251
2.41	5.93	0.07	62	43.11	1361	1.2	1361
2.41	5.93	0.08	65	45.20	1427	1.3	1427
2.41	5.93	0.09	65	45.20	1427	1.5	1427
2.41	5.93	0.10	64	44.51	1405	1.7	1405
2.41	5.93	0.11	60	41.72	1317	1.9	1317
2.41	5.93	0.12	56	38.94	1229	2.0	1229
2.41	5.93	0.13	51	35.47	1120	2.2	1120
2.41	5.93	0.14	47	32.68	1032	2.4	1032
2.41	5.93	0.15	44	30.60	966	2.5	966
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 19.0'

Sample Diameter: 2.41
Sample Length: 5.93
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/YEL BRN CLAY STONE W/SAND POCKETS/LAM.

F-104

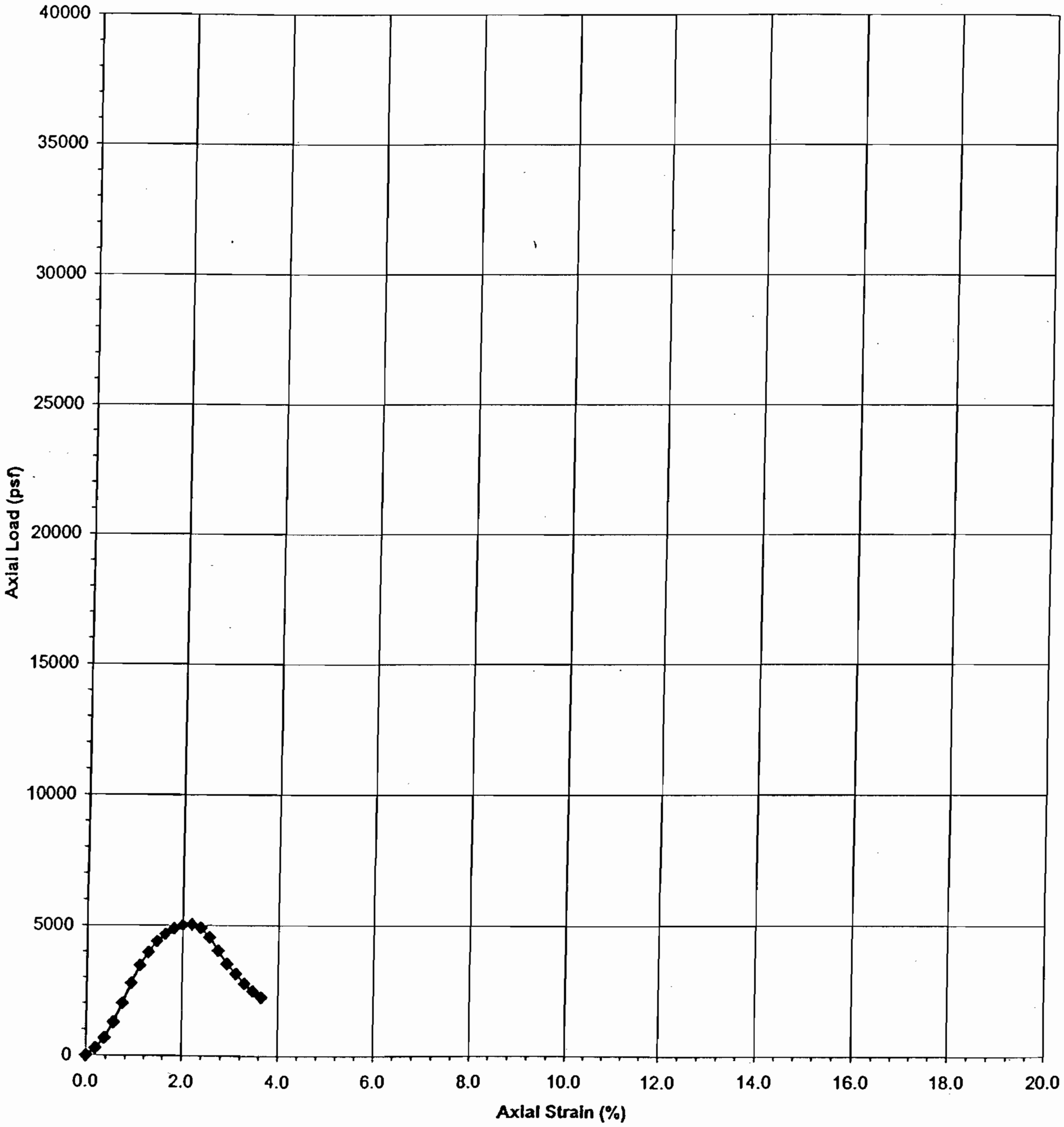
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	13	0.26	
0.02	24	0.27	
0.03	33	0.28	
0.04	42	0.29	
0.05	50	0.30	
0.06	57	0.31	
0.07	62	0.32	
0.08	65	0.33	
0.09	65 5	0.34	
0.10	64	0.35	
0.11	60	0.36	
0.12	56	0.37	
0.13	51	0.38	
0.14	47	0.39	
0.15	44	0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:

BEDDING NOT OBVIOUS

Comments: 2.5Y 5/3 5/4 LT OLV BRN POLISHED SHEAR SURFACE
w 10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 26.5'
Lt Olv Brn w/ Yel Brn Claystone w/ Sand Pockets / Laminations



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-2			Ring Constant = 0.6954 lb/div			
DEPTH:	26.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.40	5.49	0.00	0	0.00	0	0.0	0
2.40	5.49	0.01	13	9.04	288	0.2	288
2.40	5.49	0.02	30	20.86	664	0.4	664
2.40	5.49	0.03	57	39.64	1262	0.5	1262
2.40	5.49	0.04	90	62.59	1992	0.7	1992
2.40	5.49	0.05	125	86.93	2767	0.9	2767
2.40	5.49	0.06	156	108.48	3453	1.1	3453
2.40	5.49	0.07	179	124.48	3962	1.3	3962
2.40	5.49	0.08	198	137.69	4383	1.5	4383
2.40	5.49	0.09	211	146.73	4671	1.6	4671
2.40	5.49	0.10	220	152.99	4870	1.8	4870
2.40	5.49	0.11	226	157.16	5003	2.0	5003
2.40	5.49	0.12	227	157.86	5025	2.2	5025
2.40	5.49	0.13	221	153.68	4892	2.4	4892
2.40	5.49	0.14	205	142.56	4538	2.6	4538
2.40	5.49	0.15	182	126.56	4029	2.7	4029
2.40	5.49	0.16	159	110.57	3519	2.9	3519
2.40	5.49	0.17	142	98.75	3143	3.1	3143
2.40	5.49	0.18	125	86.93	2767	3.3	2767
2.40	5.49	0.19	112	77.88	2479	3.5	2479
2.40	5.49	0.20	101	70.24	2236	3.6	2236
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

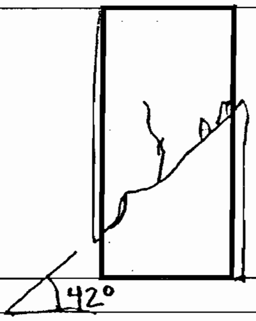
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 26.5'

Sample Diameter: 2.40
Sample Length: 5.49
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/YEL BRN CLAYSTONE W/SANDY INCLUSIONS

F-61

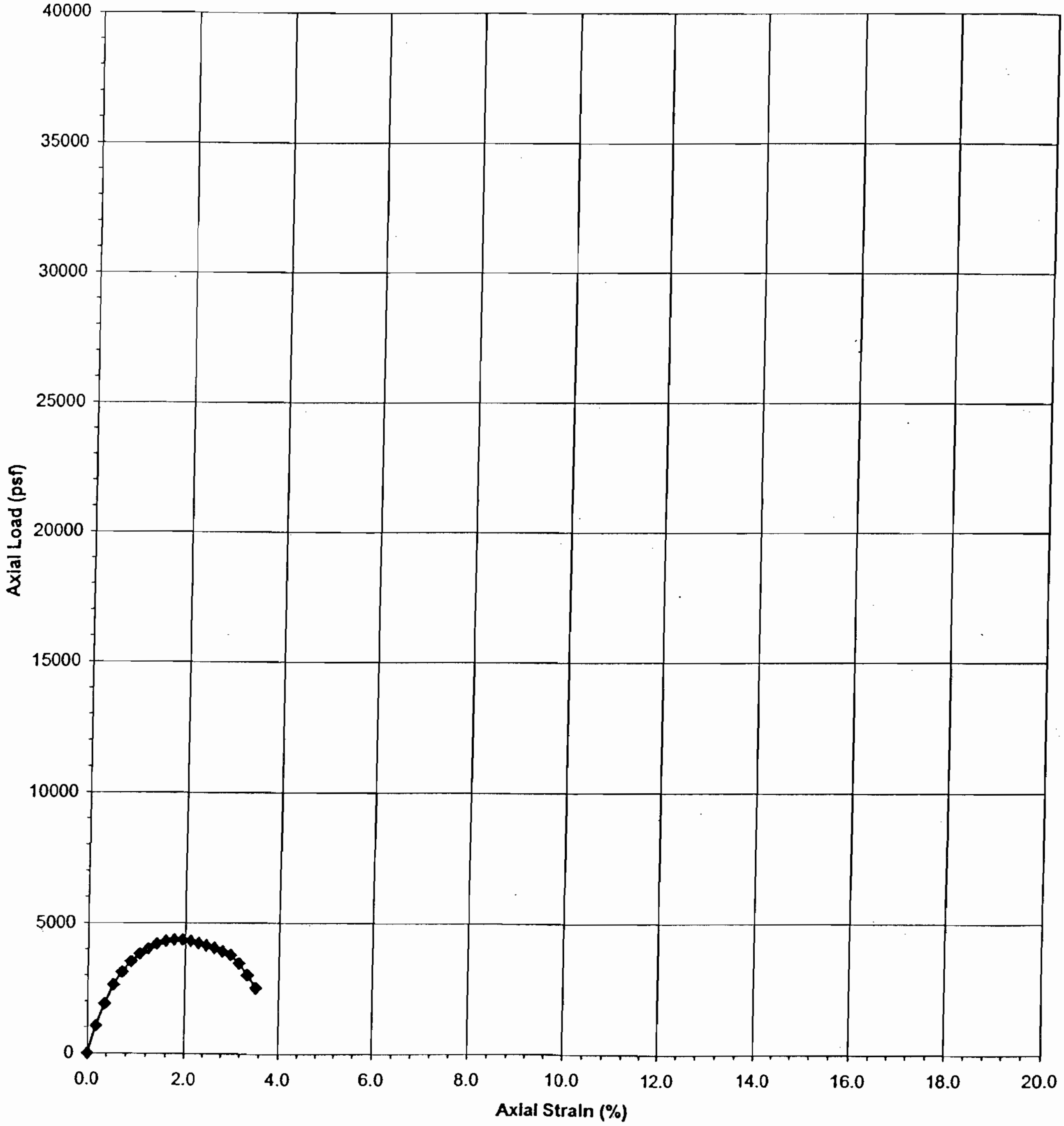
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	13	0.26	
0.02	30	0.27	
0.03	57	0.28	
0.04	90	0.29	
0.05	125	0.30	
0.06	156	0.31	
0.07	179	0.32	
0.08	198	0.33	
0.09	211	0.34	
0.10	220	0.35	
0.11	226	0.36	
0.12	227	0.37	
0.13	221	0.38	
0.14	205	0.39	
0.15	182	0.40	
0.16	159	0.41	
0.17	142	0.42	
0.18	125	0.43	
0.19	112	0.44	
0.20	101	0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED SHEAR SURFACE
LT OLV BRN 2.5Y 5/3 5/4 W/ 10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 35.0'
Olv Brn w/ Yel Brn Claystone w/ Gypsum



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/19/2001
BORING: B-2
DEPTH: 35.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.68	0.00	0	0.00	0	0.0	0
2.39	5.68	0.01	47	32.68	1049	0.2	1049
2.39	5.68	0.02	85	59.11	1897	0.4	1897
2.39	5.68	0.03	118	82.06	2634	0.5	2634
2.39	5.68	0.04	140	97.36	3125	0.7	3125
2.39	5.68	0.05	158	109.87	3527	0.9	3527
2.39	5.68	0.06	171	118.91	3817	1.1	3817
2.39	5.68	0.07	180	125.17	4018	1.2	4018
2.39	5.68	0.08	188	130.74	4196	1.4	4196
2.39	5.68	0.09	193	134.21	4308	1.6	4308
2.39	5.68	0.10	195	135.60	4353	1.8	4353
2.39	5.68	0.11	195	135.60	4353	1.9	4353
2.39	5.68	0.12	193	134.21	4308	2.1	4308
2.39	5.68	0.13	189	131.43	4219	2.3	4219
2.39	5.68	0.14	185	128.65	4129	2.5	4129
2.39	5.68	0.15	181	125.87	4040	2.6	4040
2.39	5.68	0.16	175	121.70	3906	2.8	3906
2.39	5.68	0.17	169	117.52	3772	3.0	3772
2.39	5.68	0.18	155	107.79	3460	3.2	3460
2.39	5.68	0.19	135	93.88	3013	3.3	3013
2.39	5.68	0.20	113	78.58	2522	3.5	2522
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

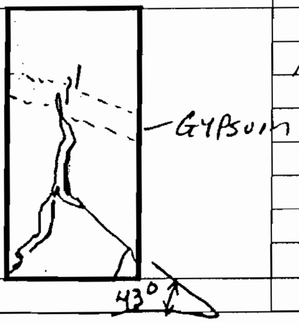
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 35.0

Sample Diameter: 2.39
Sample Length: 5.68
Wet Wt./Dry Wt.:
Description: OLV BRN W/YEL BRN CLAYSTONE (W/GYPSUM)

E103

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	47		0.26	
0.02	85		0.27	
0.03	118		0.28	
0.04	140		0.29	
0.05	158		0.30	
0.06	171		0.31	
0.07	180		0.32	
0.08	188		0.33	
0.09	193		0.34	
0.10	195	←	0.35	
0.11	195		0.36	
0.12	193		0.37	
0.13	189		0.38	
0.14	185		0.39	
0.15	181		0.40	
0.16	175		0.41	
0.17	169		0.42	
0.18	155		0.43	
0.19	135		0.44	
0.20	113		0.45	
0.21			0.46	
0.22			0.47	
0.23			0.48	
0.24			0.49	
0.25			0.50	

Sketch of Sample After Test:

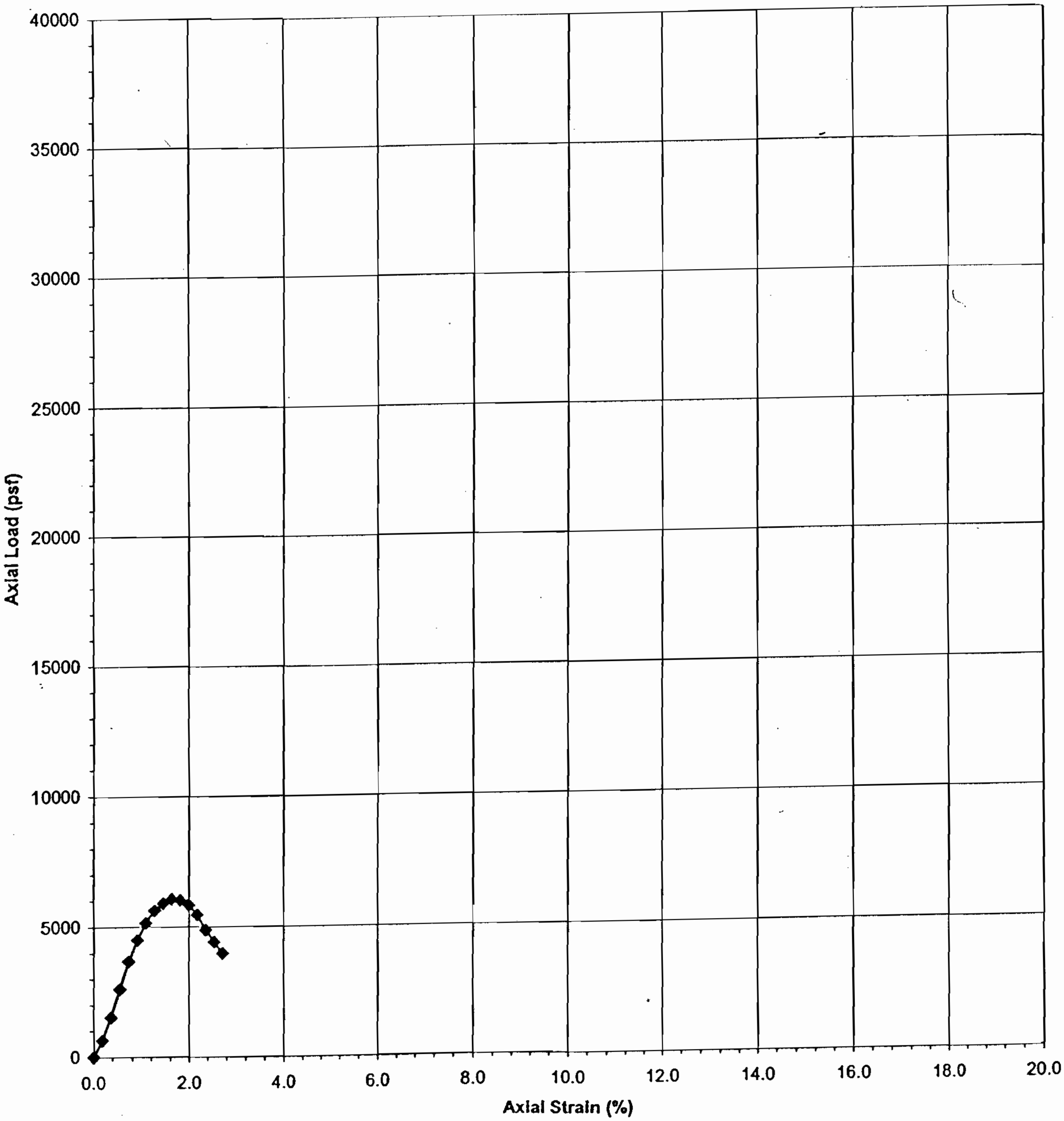


APPARENT BEDDING @ 16° DIP
ORTH TO FAILURE PLANE
WITH GYPSUM LAYER @
~ 16° DIP

43

Comments:
2.5Y 4/3 OLV BRN W/ 10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 39.5'
Blk / V Dk Gry Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/19/2001
BORING: B-2
DEPTH: 39.5'

Ring Constant = 0.6954 lb/div

SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.37	5.52	0.00	0	0.00	0	0.0	0
2.37	5.52	0.01	28	19.47	636	0.2	636
2.37	5.52	0.02	67	46.59	1521	0.4	1521
2.37	5.52	0.03	115	79.97	2610	0.5	2610
2.37	5.52	0.04	162	112.65	3677	0.7	3677
2.37	5.52	0.05	198	137.69	4494	0.9	4494
2.37	5.52	0.06	227	157.86	5153	1.1	5153
2.37	5.52	0.07	248	172.46	5629	1.3	5629
2.37	5.52	0.08	260	180.80	5902	1.4	5902
2.37	5.52	0.09	267	185.67	6061	1.6	6061
2.37	5.52	0.10	265	184.28	6015	1.8	6015
2.37	5.52	0.11	257	178.72	5834	2.0	5834
2.37	5.52	0.12	240	166.90	5448	2.2	5448
2.37	5.52	0.13	214	148.82	4858	2.4	4858
2.37	5.52	0.14	194	134.91	4404	2.5	4404
2.37	5.52	0.15	175	121.70	3972	2.7	3972
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

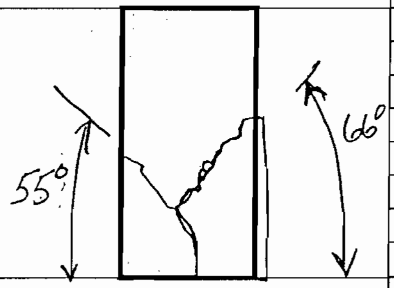
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 39.5'

Sample Diameter: 2.37
Sample Length: 5.52
Wet Wt./Dry Wt.:
Description: BLK CLAYSTONE (V DK GRY)

F-33

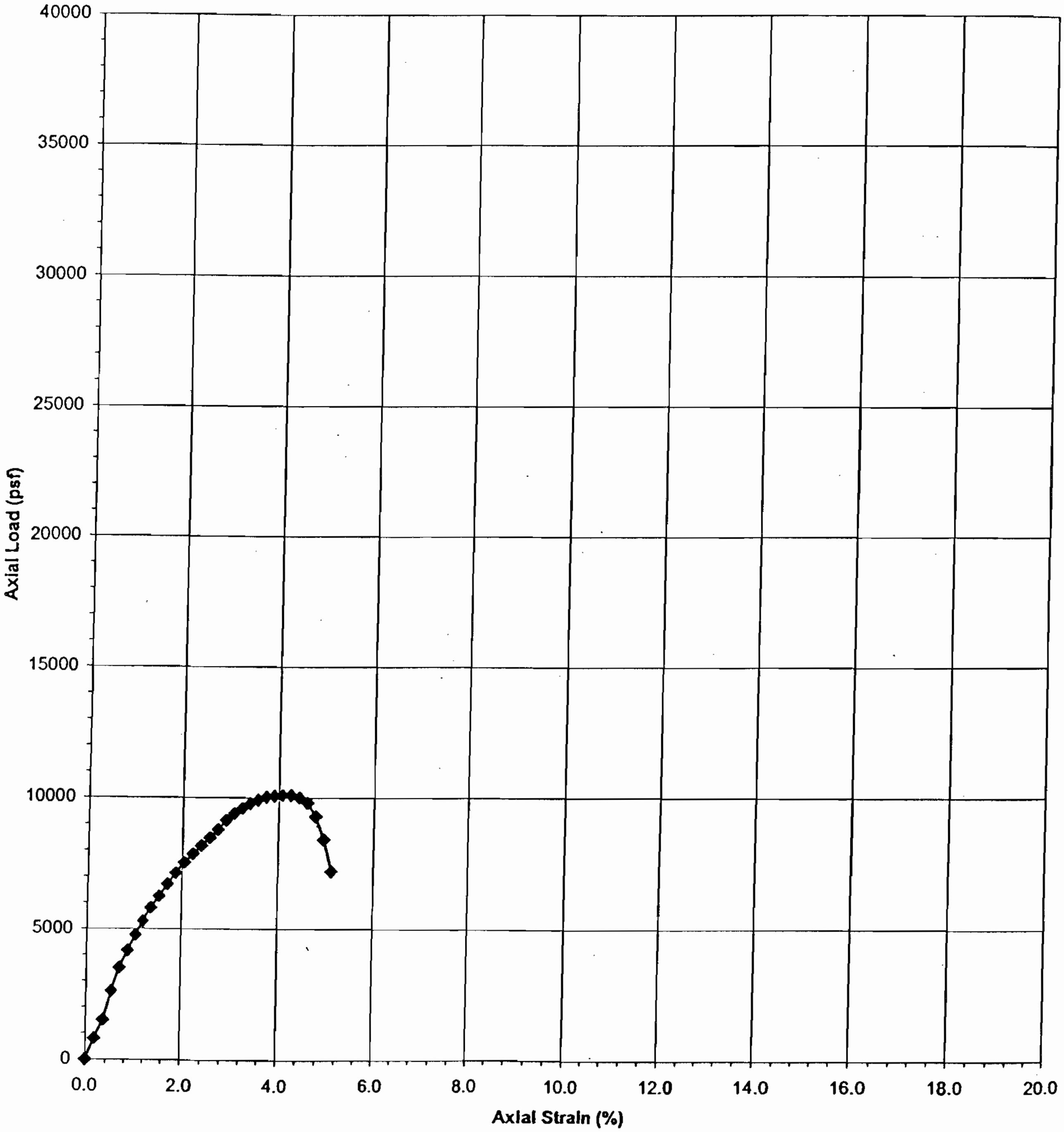
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	28	0.26	
0.02	67	0.27	
0.03	115	0.28	
0.04	162	0.29	
0.05	198	0.30	
0.06	227	0.31	
0.07	248	0.32	
0.08	260	0.33	
0.09	267	0.34	
0.10	265	0.35	
0.11	257	0.36	
0.12	240	0.37	
0.13	214	0.38	
0.14	194	0.39	
0.15	175	0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 2.59 2.57 |

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 48.5'
Blk and V Dk Gry Sandy Claystone / Clayey Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/19/2001
BORING: B-2
DEPTH: 48.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.89	0.00	0	0.00	0	0.0	0
2.40	5.89	0.01	36	25.03	797	0.2	797
2.40	5.89	0.02	68	47.29	1505	0.3	1505
2.40	5.89	0.03	118	82.06	2612	0.5	2612
2.40	5.89	0.04	158	109.87	3497	0.7	3497
2.40	5.89	0.05	188	130.74	4161	0.8	4161
2.40	5.89	0.06	215	149.51	4759	1.0	4759
2.40	5.89	0.07	239	166.20	5290	1.2	5290
2.40	5.89	0.08	262	182.19	5799	1.4	5799
2.40	5.89	0.09	282	196.10	6242	1.5	6242
2.40	5.89	0.10	303	210.71	6707	1.7	6707
2.40	5.89	0.11	322	223.92	7128	1.9	7128
2.40	5.89	0.12	340	236.44	7526	2.0	7526
2.40	5.89	0.13	355	246.87	7858	2.2	7858
2.40	5.89	0.14	369	256.60	8168	2.4	8168
2.40	5.89	0.15	383	266.34	8478	2.5	8478
2.40	5.89	0.16	397	276.07	8788	2.7	8788
2.40	5.89	0.17	413	287.20	9142	2.9	9142
2.40	5.89	0.18	425	295.55	9407	3.1	9407
2.40	5.89	0.19	434	301.80	9607	3.2	9607
2.40	5.89	0.20	442	307.37	9784	3.4	9784
2.40	5.89	0.21	448	311.54	9917	3.6	9917
2.40	5.89	0.22	453	315.02	10027	3.7	10027
2.40	5.89	0.23	455	316.41	10072	3.9	10072
2.40	5.89	0.24	456	317.10	10094	4.1	10094
2.40	5.89	0.25	456	317.10	10094	4.2	10094
2.40	5.89	0.26	452	314.32	10005	4.4	10005
2.40	5.89	0.27	443	308.06	9806	4.6	9806
2.40	5.89	0.28	420	292.07	9297	4.8	9297
2.40	5.89	0.29	380	264.25	8411	4.9	8411
2.40	5.89	0.30	325	226.01	7194	5.1	7194
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

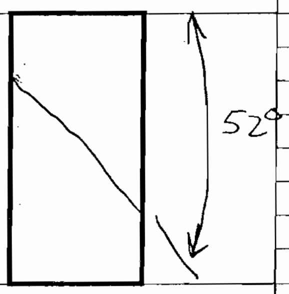
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 48.5

Sample Diameter: 2.40
Sample Length: 5,89
Wet Wt./Dry Wt.:
Description: BLK & VDKY GRY SANDY CLAYSTONE/CLAYEY SANDSTONE, VFG

F-21

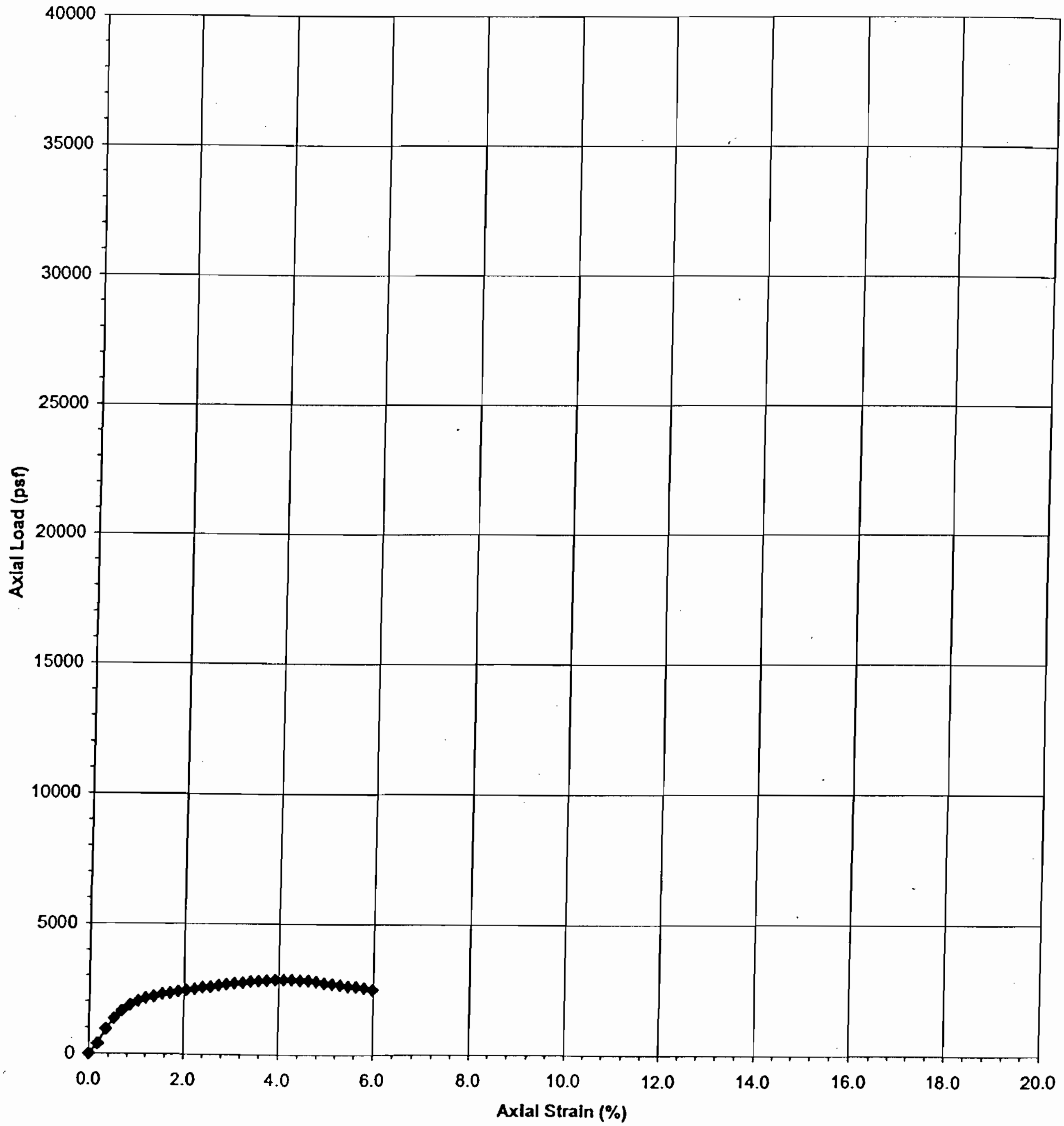
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	36		0.26	452
0.02	68		0.27	443
0.03	118		0.28	420
0.04	158		0.29	380
0.05	188		0.30	325
0.06	215		0.31	
0.07	239		0.32	
0.08	262		0.33	
0.09	282		0.34	
0.10	303		0.35	
0.11	322		0.36	
0.12	340		0.37	
0.13	355		0.38	
0.14	369		0.39	
0.15	383		0.40	
0.16	397		0.41	
0.17	413		0.42	
0.18	425		0.43	
0.19	434		0.44	
0.20	442		0.45	
0.21	448		0.46	
0.22	453		0.47	
0.23	455		0.48	
0.24	456	Σ	0.49	
0.25	456		0.50	

Sketch of Sample After Test:



Comments: 2,5Y 2,5/1 BLK NO POLISHING ON SHEAR SURF

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 55.0'
Blk Claystone w/ Trace Pebbles



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-2			Ring Constant = 0.6954 lb/div			
DEPTH:	55.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.86	0.00	0	0.00	0	0.0	0
2.39	5.86	0.01	17	11.82	379	0.2	379
2.39	5.86	0.02	42	29.21	937	0.3	937
2.39	5.86	0.03	60	41.72	1339	0.5	1339
2.39	5.86	0.04	73	50.76	1629	0.7	1629
2.39	5.86	0.05	83	57.72	1853	0.9	1853
2.39	5.86	0.06	90	62.59	2009	1.0	2009
2.39	5.86	0.07	95	66.06	2120	1.2	2120
2.39	5.86	0.08	98	68.15	2187	1.4	2187
2.39	5.86	0.09	102	70.93	2277	1.5	2277
2.39	5.86	0.10	104	72.32	2321	1.7	2321
2.39	5.86	0.11	107	74.41	2388	1.9	2388
2.39	5.86	0.12	109	75.80	2433	2.0	2433
2.39	5.86	0.13	111	77.19	2478	2.2	2478
2.39	5.86	0.14	114	79.28	2545	2.4	2545
2.39	5.86	0.15	115	79.97	2567	2.6	2567
2.39	5.86	0.16	118	82.06	2634	2.7	2634
2.39	5.86	0.17	120	83.45	2679	2.9	2679
2.39	5.86	0.18	122	84.84	2723	3.1	2723
2.39	5.86	0.19	123	85.53	2745	3.2	2745
2.39	5.86	0.20	125	86.93	2790	3.4	2790
2.39	5.86	0.21	126	87.62	2812	3.6	2812
2.39	5.86	0.22	127	88.32	2835	3.8	2835
2.39	5.86	0.23	128	89.01	2857	3.9	2857
2.39	5.86	0.24	128	89.01	2857	4.1	2857
2.39	5.86	0.25	128	89.01	2857	4.3	2857
2.39	5.86	0.26	127	88.32	2835	4.4	2835
2.39	5.86	0.27	127	88.32	2835	4.6	2835
2.39	5.86	0.28	125	86.93	2790	4.8	2790
2.39	5.86	0.29	122	84.84	2723	4.9	2723
2.39	5.86	0.30	121	84.14	2701	5.1	2701
2.39	5.86	0.31	119	82.75	2656	5.3	2656
2.39	5.86	0.32	117	81.36	2612	5.5	2612
2.39	5.86	0.33	116	80.67	2589	5.6	2589
2.39	5.86	0.34	114	79.28	2545	5.8	2545
2.39	5.86	0.35	111	77.19	2478	6.0	2478
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

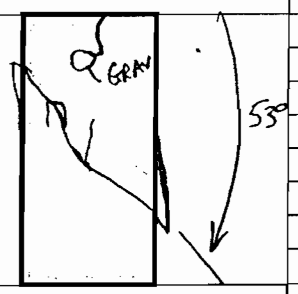
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 55.0'

Sample Diameter: 2.39
Sample Length: 5.86
Wet Wt./Dry Wt.:
Description: BLK CLAYSTONE W/TR PEBBLES

F-101

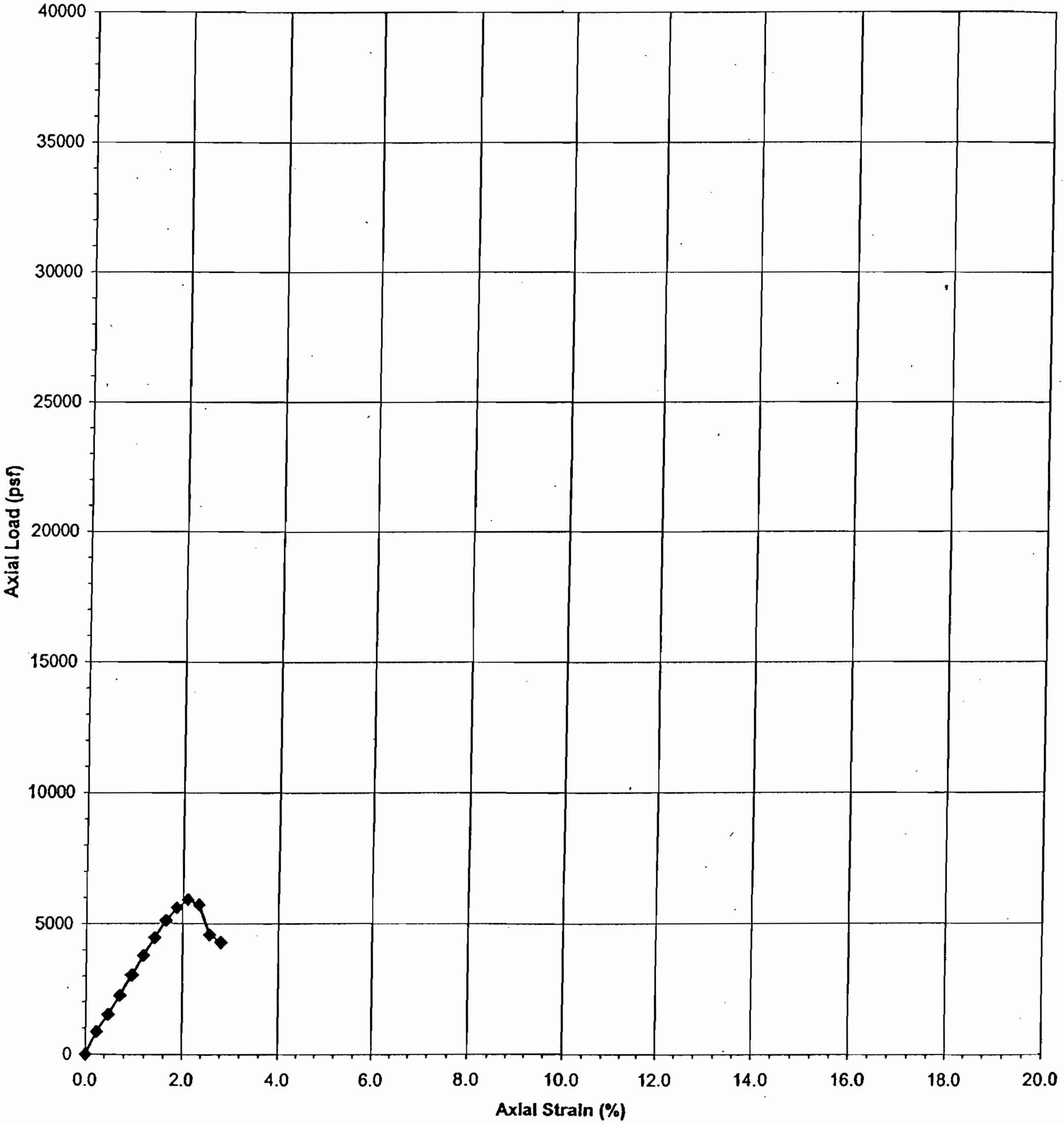
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	17	0.26	127
0.02	42	0.27	127
0.03	60	0.28	125
0.04	73	0.29	122
0.05	83	0.30	121
0.06	90	0.31	119
0.07	95	0.32	117
0.08	98	0.33	116
0.09	102	0.34	114
0.10	104	0.35	111
0.11	107	0.36	
0.12	109	0.37	
0.13	111	0.38	
0.14	114	0.39	
0.15	115	0.40	
0.16	118	0.41	
0.17	120	0.42	
0.18	122	0.43	
0.19	123	0.44	
0.20	125	0.45	
0.21	126	0.46	
0.22	127	0.47	
0.23	128	0.48	
0.24	128	0.49	
0.25	128	0.50	

Sketch of Sample After Test:



Comments: 2.5Y 2.5/1 BLK POLISHED SHEAR SURF

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-2 @ 69.0'
Gry and Dk Gry Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/19/2001						
BORING:	B-2			Ring Constant = 0.6954 lb/div			
DEPTH:	69.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	4.27	0.00	0	0.00	0	0.0	0
2.41	4.27	0.01	39	27.12	856	0.2	856
2.41	4.27	0.02	69	47.98	1515	0.5	1515
2.41	4.27	0.03	102	70.93	2239	0.7	2239
2.41	4.27	0.04	138	95.97	3029	0.9	3029
2.41	4.27	0.05	172	119.61	3776	1.2	3776
2.41	4.27	0.06	203	141.17	4456	1.4	4456
2.41	4.27	0.07	233	162.03	5115	1.6	5115
2.41	4.27	0.08	255	177.33	5598	1.9	5598
2.41	4.27	0.09	269	187.06	5905	2.1	5905
2.41	4.27	0.10	260	180.80	5707	2.3	5707
2.41	4.27	0.11	208	144.64	4566	2.6	4566
2.41	4.27	0.12	195	135.60	4281	2.8	4281
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

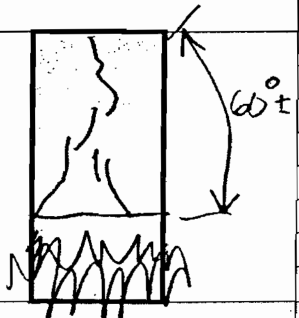
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/19/01
BORING: B-2
DEPTH: 69.0'

Sample Diameter: 2.41
Sample Length: 4.27
Wet Wt./Dry Wt.:
Description: GRY + DK GRY SANDSTONE VFG

F-24

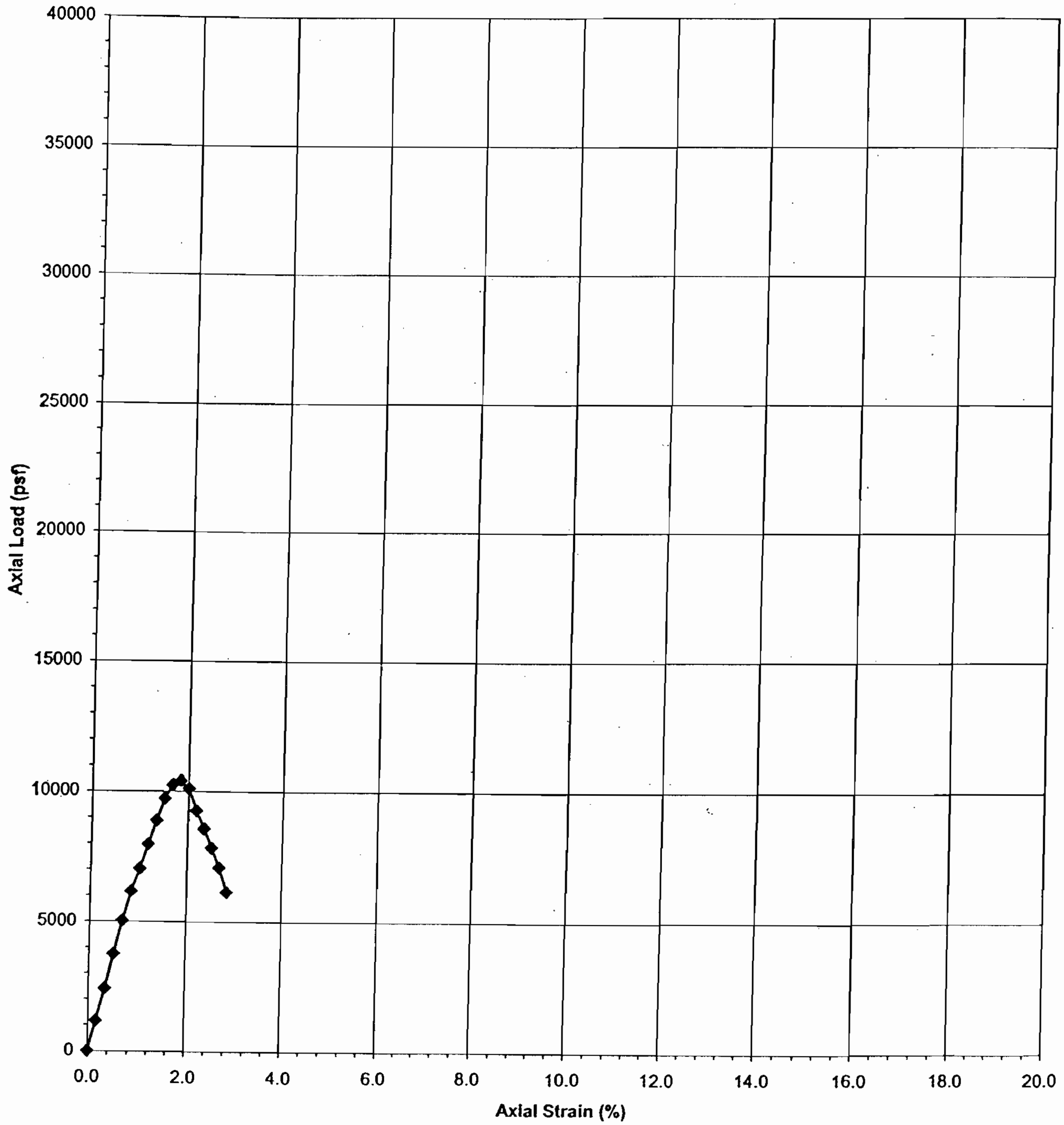
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	39		0.26	
0.02	69		0.27	
0.03	102		0.28	
0.04	138		0.29	
0.05	172		0.30	
0.06	203		0.31	
0.07	233		0.32	
0.08	255		0.33	
0.09	269		0.34	
0.10	260	271	0.35	
0.11	208		0.36	
0.12	195		0.37	
0.13			0.38	
0.14			0.39	
0.15			0.40	
0.16			0.41	
0.17			0.42	
0.18			0.43	
0.19			0.44	
0.20			0.45	
0.21			0.46	
0.22			0.47	
0.23			0.48	
0.24			0.49	
0.25			0.50	

Sketch of Sample After Test:



Comments: 2.5Y 4/1 DK GRY NO POLISHING ON SHEAR SURFACE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 8.5'
Brn Claystone / Sandy Clay Residual Soil



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	8.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.99	0.00	0	0.00	0	0.0	0
2.39	5.99	0.01	52	36.16	1161	0.2	1161
2.39	5.99	0.02	108	75.10	2411	0.3	2411
2.39	5.99	0.03	168	116.83	3750	0.5	3750
2.39	5.99	0.04	225	156.47	5022	0.7	5022
2.39	5.99	0.05	276	191.93	6161	0.8	6161
2.39	5.99	0.06	315	219.05	7031	1.0	7031
2.39	5.99	0.07	357	248.26	7969	1.2	7969
2.39	5.99	0.08	398	276.77	8884	1.3	8884
2.39	5.99	0.09	436	303.19	9732	1.5	9732
2.39	5.99	0.10	459	319.19	10245	1.7	10245
2.39	5.99	0.11	466	324.06	10402	1.8	10402
2.39	5.99	0.12	453	315.02	10111	2.0	10111
2.39	5.99	0.13	415	288.59	9263	2.2	9263
2.39	5.99	0.14	384	267.03	8571	2.3	8571
2.39	5.99	0.15	351	244.09	7835	2.5	7835
2.39	5.99	0.16	317	220.44	7076	2.7	7076
2.39	5.99	0.17	275	191.24	6138	2.8	6138
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

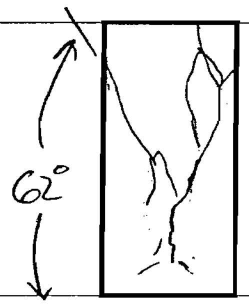
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 8.5

Sample Diameter: 2.39
Sample Length: 5.99
Wet Wt./Dry Wt.:
Description: BRN CLAYSTONE/ SANDY CLAY RESID. SOIL W/WHITE PRECIP.

F-85

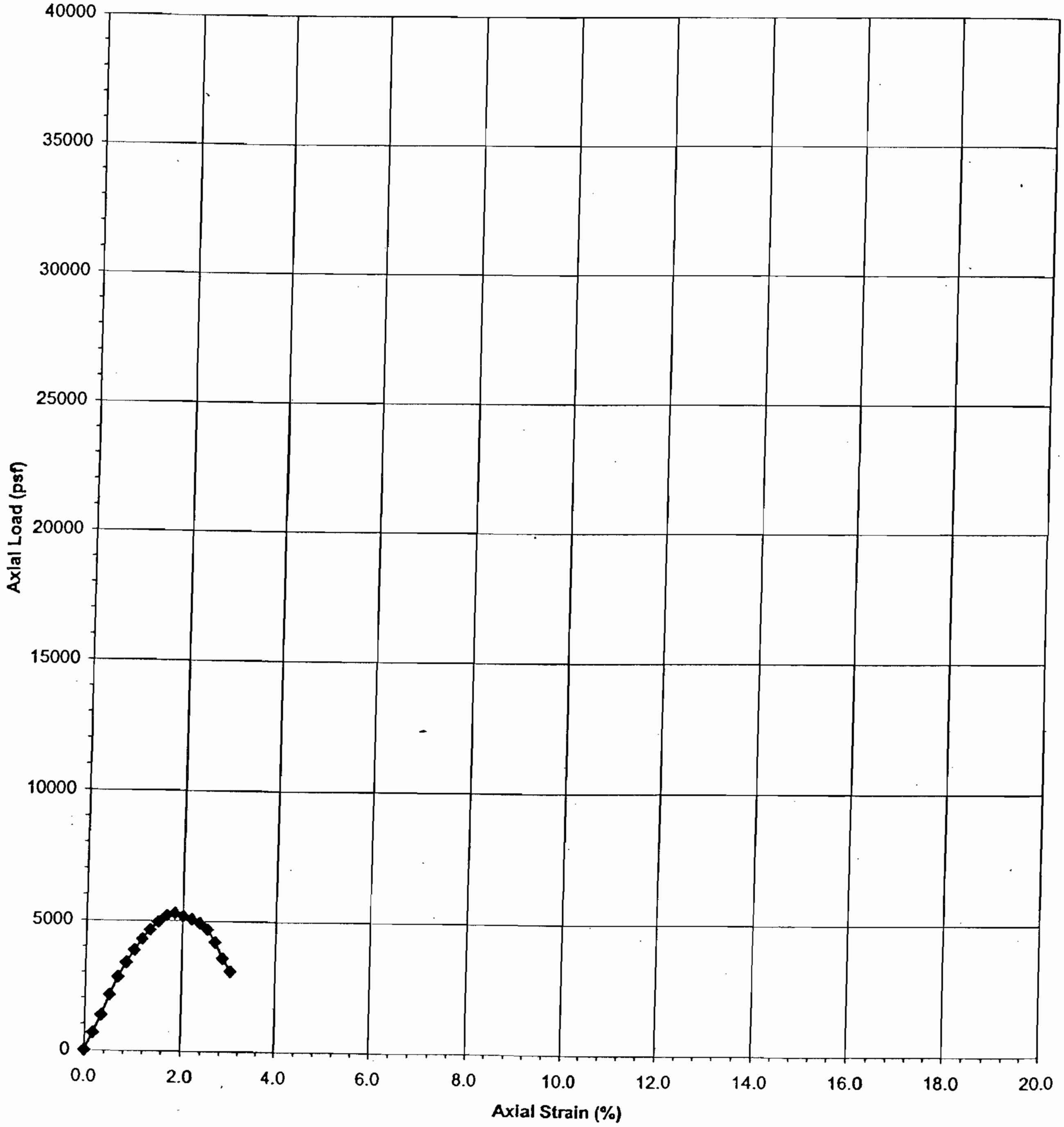
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	52	0.26	
0.02	108	0.27	
0.03	168	0.28	
0.04	225	0.29	
0.05	276	0.30	
0.06	315	0.31	
0.07	357	0.32	
0.08	398	0.33	
0.09	436	0.34	
0.10	459	0.35	
0.11	466	0.36	
0.12	453	0.37	
0.13	415	0.38	
0.14	384	0.39	
0.15	351	0.40	
0.16	317	0.41	
0.17	275	0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 10 YR 4/3 BRN W/WT PRECIP IN FINE VEINS

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 14.0'
Lt Olv Brn w/ Yel Brn Clayey Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	14.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.98	0.00	0	0.00	0	0.0	0
2.39	5.98	0.01	30	20.86	670	0.2	670
2.39	5.98	0.02	60	41.72	1339	0.3	1339
2.39	5.98	0.03	95	66.06	2120	0.5	2120
2.39	5.98	0.04	126	87.62	2812	0.7	2812
2.39	5.98	0.05	151	105.01	3370	0.8	3370
2.39	5.98	0.06	173	120.30	3862	1.0	3862
2.39	5.98	0.07	192	133.52	4286	1.2	4286
2.39	5.98	0.08	208	144.64	4643	1.3	4643
2.39	5.98	0.09	222	154.38	4955	1.5	4955
2.39	5.98	0.10	233	162.03	5201	1.7	5201
2.39	5.98	0.11	237	164.81	5290	1.8	5290
2.39	5.98	0.12	232	161.33	5178	2.0	5178
2.39	5.98	0.13	227	157.86	5067	2.2	5067
2.39	5.98	0.14	220	152.99	4911	2.3	4911
2.39	5.98	0.15	210	146.03	4687	2.5	4687
2.39	5.98	0.16	188	130.74	4196	2.7	4196
2.39	5.98	0.17	160	111.26	3571	2.8	3571
2.39	5.98	0.18	138	95.97	3080	3.0	3080
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

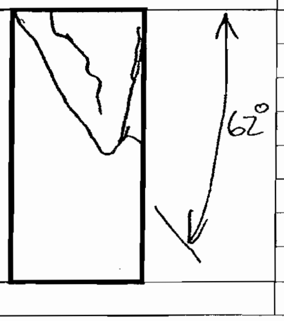
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 14.0

Sample Diameter: 2,39
Sample Length: 5,98
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/ YEL BRN CLAYEY SANDSTONE

F-105

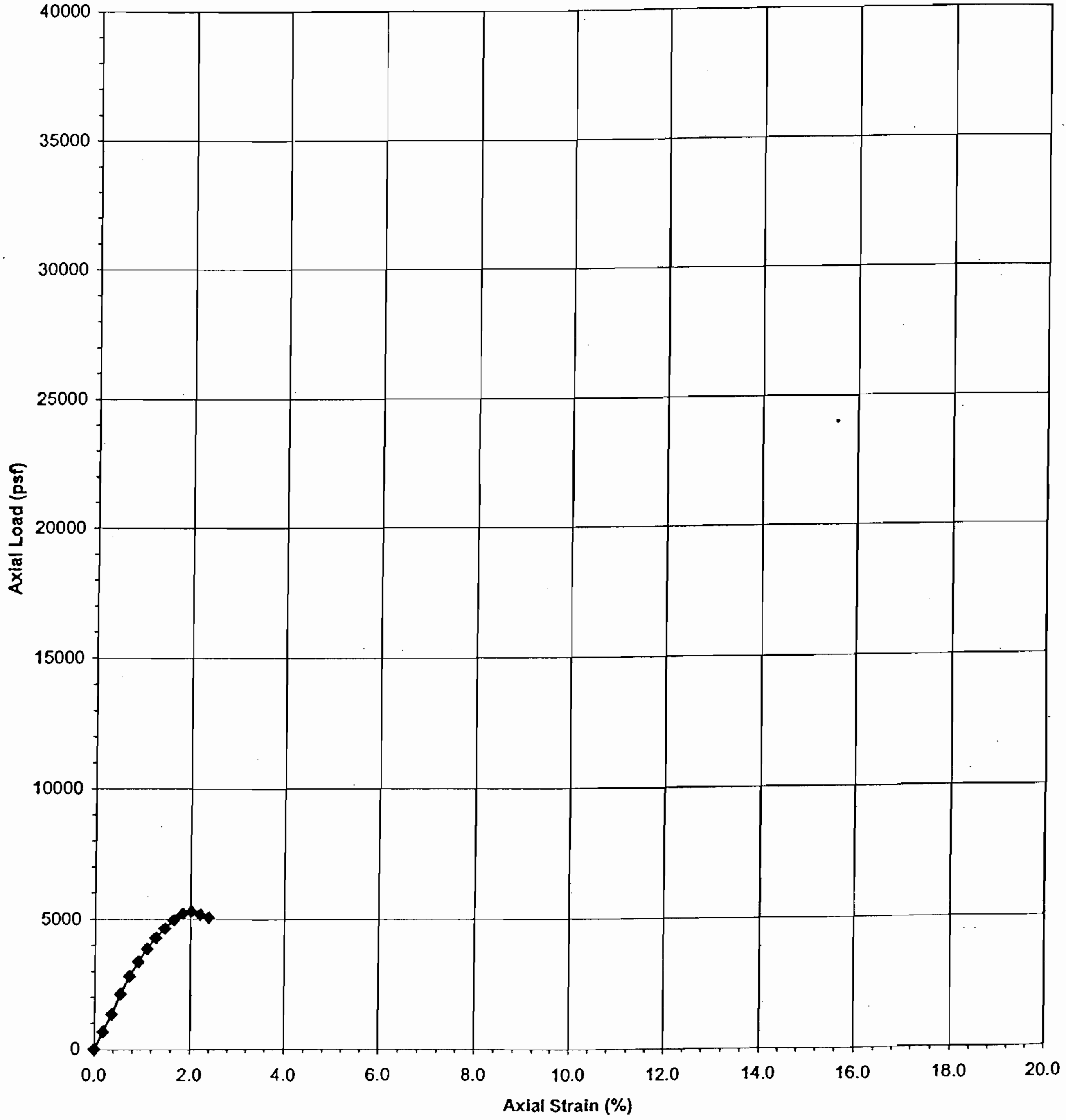
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	30	0.26	
0.02	60	0.27	
0.03	95	0.28	
0.04	126	0.29	
0.05	151	0.30	
0.06	173	0.31	
0.07	192	0.32	
0.08	208	0.33	
0.09	222	0.34	
0.10	233	0.35	
0.11	237	0.36	
0.12	232	0.37	
0.13	227	0.38	
0.14	220	0.39	
0.15	210	0.40	
0.16	188	0.41	
0.17	160	0.42	
0.18	138	0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: SL. POLISHING ON SURFACE ODD ODOR (SL METALIC)
2,5Y 5/3 LT OLV BRN W/ 10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 21.5'
Lt Olv Brn and Lt Yel Brn Clayey Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/17/2001
BORING: B-3
DEPTH: 21.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.44	0.00	0	0.00	0	0.0	0
2.39	5.44	0.01	30	20.86	670	0.2	670
2.39	5.44	0.02	60	41.72	1339	0.4	1339
2.39	5.44	0.03	95	66.06	2120	0.6	2120
2.39	5.44	0.04	126	87.62	2812	0.7	2812
2.39	5.44	0.05	151	105.01	3370	0.9	3370
2.39	5.44	0.06	173	120.30	3862	1.1	3862
2.39	5.44	0.07	192	133.52	4286	1.3	4286
2.39	5.44	0.08	208	144.64	4643	1.5	4643
2.39	5.44	0.09	222	154.38	4955	1.7	4955
2.39	5.44	0.10	233	162.03	5201	1.8	5201
2.39	5.44	0.11	237	164.81	5290	2.0	5290
2.39	5.44	0.12	232	161.33	5178	2.2	5178
2.39	5.44	0.13	227	157.86	5067	2.4	5067
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

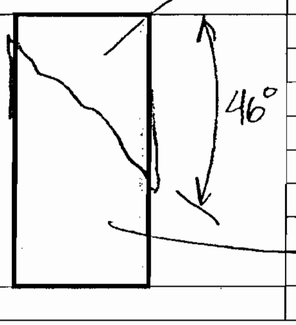
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 21.5

Sample Diameter: 2.39
Sample Length: 5.40
Wet Wt./Dry Wt.:
Description: LT OLV BRN + LT YEL BRN CLAYEY SANDSTONE

F-202

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	51	0.26	
0.02	93	0.27	
0.03	123	0.28	
0.04	146	0.29	
0.05	164	0.30	
0.06	177	0.31	
0.07	181	0.32	
0.08	171	0.33	
0.09	154	0.34	
0.10	131	0.35	
0.11	110	0.36	
0.12	88	0.37	
0.13	64	0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



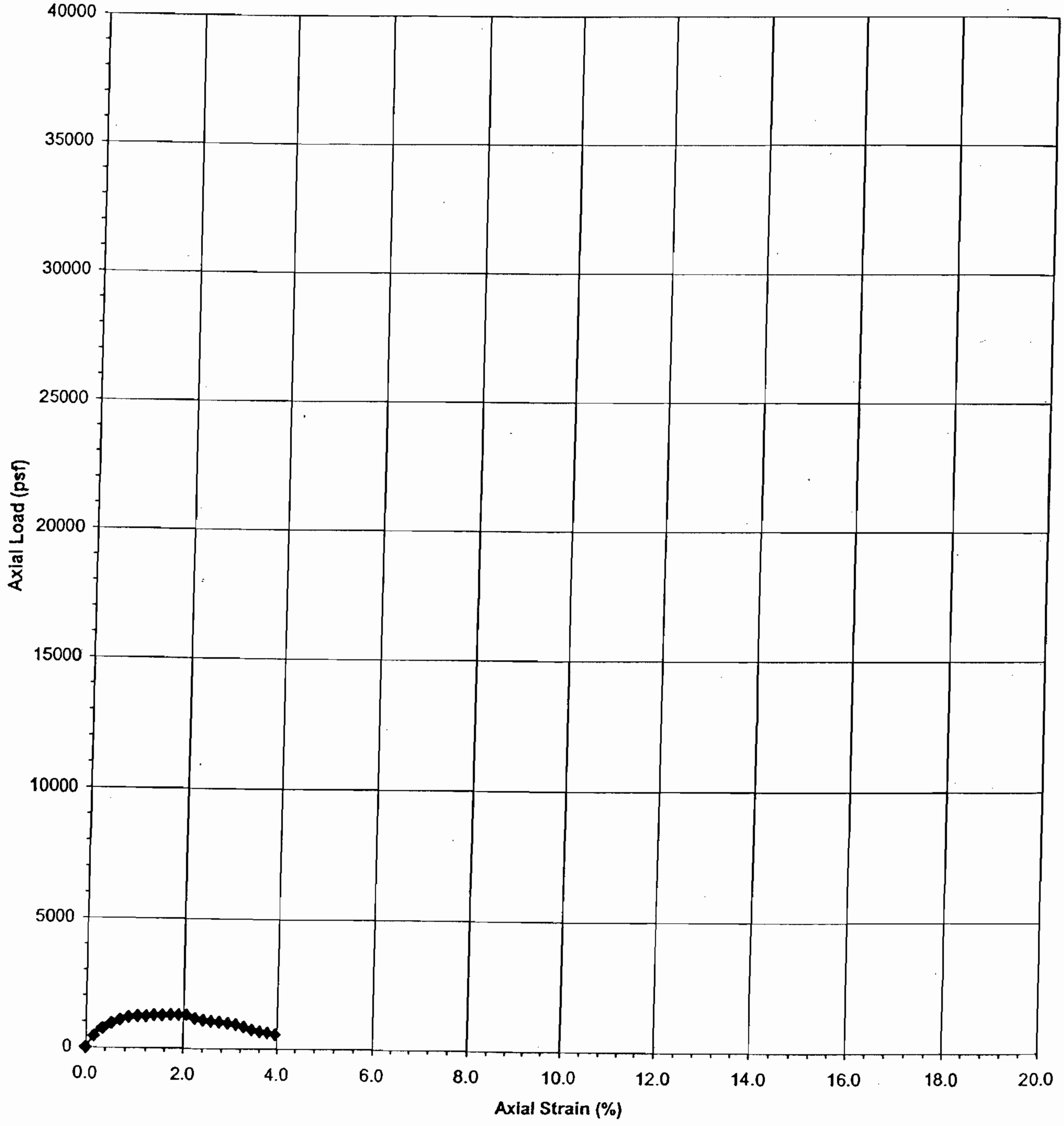
CLAYEY SANDSTONE / SANDY CLAYSTONE

IRREG BEDDING? AT SAME ANGLE ±

SANDSTONE, SL CLAYEY

Comments: POLISHED SHEAR SURFACE
2.5Y 6/4 LT YEL BRN 5/4 LT OLV BRN.

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 35.0'
Dk Grn Gry Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/17/2001
BORING: B-3
DEPTH: 35.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.82	0.00	0	0.00	0	0.0	0
2.40	5.82	0.01	20	13.91	443	0.2	443
2.40	5.82	0.02	33	22.95	730	0.3	730
2.40	5.82	0.03	42	29.21	930	0.5	930
2.40	5.82	0.04	48	33.38	1062	0.7	1062
2.40	5.82	0.05	53	36.86	1173	0.9	1173
2.40	5.82	0.06	55	38.25	1217	1.0	1217
2.40	5.82	0.07	55	38.25	1217	1.2	1217
2.40	5.82	0.08	57	39.64	1262	1.4	1262
2.40	5.82	0.09	57	39.64	1262	1.5	1262
2.40	5.82	0.10	58	40.33	1284	1.7	1284
2.40	5.82	0.11	58	40.33	1284	1.9	1284
2.40	5.82	0.12	58	40.33	1284	2.1	1284
2.40	5.82	0.13	52	36.16	1151	2.2	1151
2.40	5.82	0.14	49	34.07	1085	2.4	1085
2.40	5.82	0.15	47	32.68	1040	2.6	1040
2.40	5.82	0.16	46	31.99	1018	2.7	1018
2.40	5.82	0.17	44	30.60	974	2.9	974
2.40	5.82	0.18	42	29.21	930	3.1	930
2.40	5.82	0.19	38	26.43	841	3.3	841
2.40	5.82	0.20	33	22.95	730	3.4	730
2.40	5.82	0.21	30	20.86	664	3.6	664
2.40	5.82	0.22	28	19.47	620	3.8	620
2.40	5.82	0.23	25	17.39	553	4.0	553
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

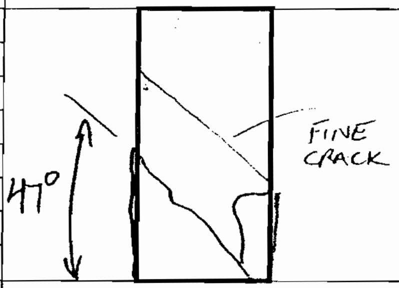
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 35.0

Sample Diameter: 2.40
Sample Length: 5.82
Wet Wt./Dry Wt.:
Description: DK GRN GRY CLAYSTONE

F-72

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	20		0.26	
0.02	33		0.27	
0.03	42		0.28	
0.04	48		0.29	
0.05	53		0.30	
0.06	55		0.31	
0.07	55		0.32	
0.08	57		0.33	
0.09	57		0.34	
0.10	58		0.35	
0.11	58	5	0.36	
0.12	58		0.37	
0.13	52		0.38	
0.14	49		0.39	
0.15	47		0.40	
0.16	46		0.41	
0.17	44		0.42	
0.18	42		0.43	
0.19	38		0.44	
0.20	33		0.45	
0.21	30		0.46	
0.22	28		0.47	
0.23	25		0.48	
0.24			0.49	
0.25			0.50	

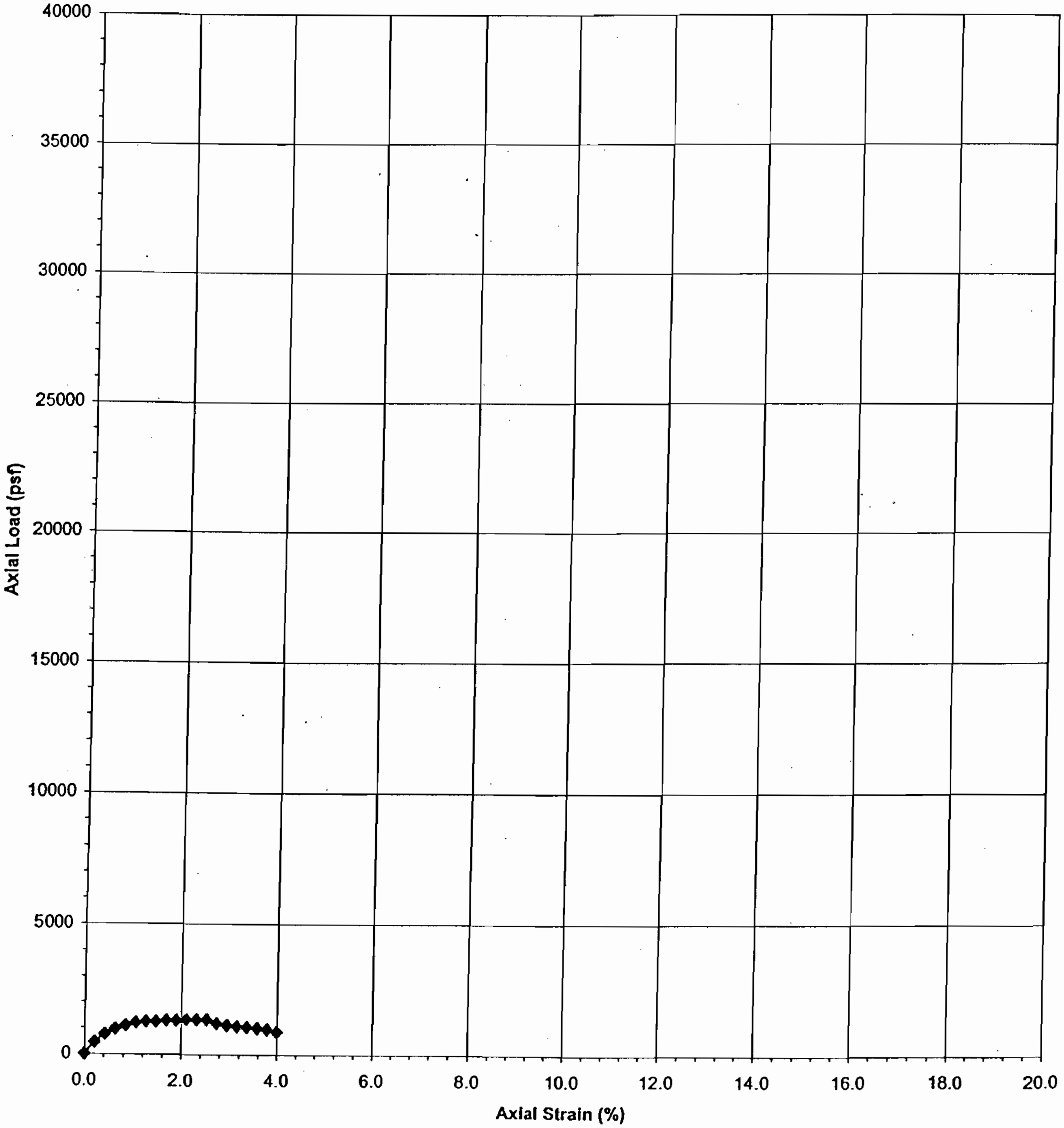
Sketch of Sample After Test:



BEDDING NOT OBVIOUS

Comments: V. POLISHED SURFACE 10Y 3/1 DK GRN GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 46.5'
Dk Olv Gry w/ Yel Brn Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology	
PROJECT	Vasco Road	
PROJ. # :	001860	
DATE:	02/17/2001	
BORING:	B-3	Ring Constant = 0.6954 lb/div
DEPTH:	46.5	

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.37	4.76	0.00	0	0.00	0	0.0	0
2.37	4.76	0.01	20	13.91	454	0.2	454
2.37	4.76	0.02	33	22.95	749	0.4	749
2.37	4.76	0.03	42	29.21	953	0.6	953
2.37	4.76	0.04	48	33.38	1090	0.8	1090
2.37	4.76	0.05	53	36.86	1203	1.1	1203
2.37	4.76	0.06	55	38.25	1248	1.3	1248
2.37	4.76	0.07	55	38.25	1248	1.5	1248
2.37	4.76	0.08	57	39.64	1294	1.7	1294
2.37	4.76	0.09	57	39.64	1294	1.9	1294
2.37	4.76	0.10	58	40.33	1317	2.1	1317
2.37	4.76	0.11	58	40.33	1317	2.3	1317
2.37	4.76	0.12	58	40.33	1317	2.5	1317
2.37	4.76	0.13	52	36.16	1180	2.7	1180
2.37	4.76	0.14	49	34.07	1112	2.9	1112
2.37	4.76	0.15	47	32.68	1067	3.2	1067
2.37	4.76	0.16	46	31.99	1044	3.4	1044
2.37	4.76	0.17	44	30.60	999	3.6	999
2.37	4.76	0.18	42	29.21	953	3.8	953
2.37	4.76	0.19	38	26.43	863	4.0	863
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

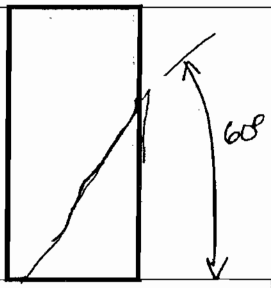
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 46.5

Sample Diameter: 2,37
Sample Length: 4.76
Wet Wt./Dry Wt.:
Description: DK OLV GRY W/YEL BRN CLAYSTONE

F-91

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	46	0.26	
0.02	69	0.27	
0.03	81	0.28	
0.04	90	0.29	
0.05	97	0.30	
0.06	97	0.31	
0.07	96	0.32	
0.08	95	0.33	
0.09	93	0.34	
0.10	90	0.35	
0.11	88	0.36	
0.12	86	0.37	
0.13	84	0.38	
0.14	82	0.39	
0.15	79	0.40	
0.16	76	0.41	
0.17	74	0.42	
0.18	72	0.43	
0.19	70	0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

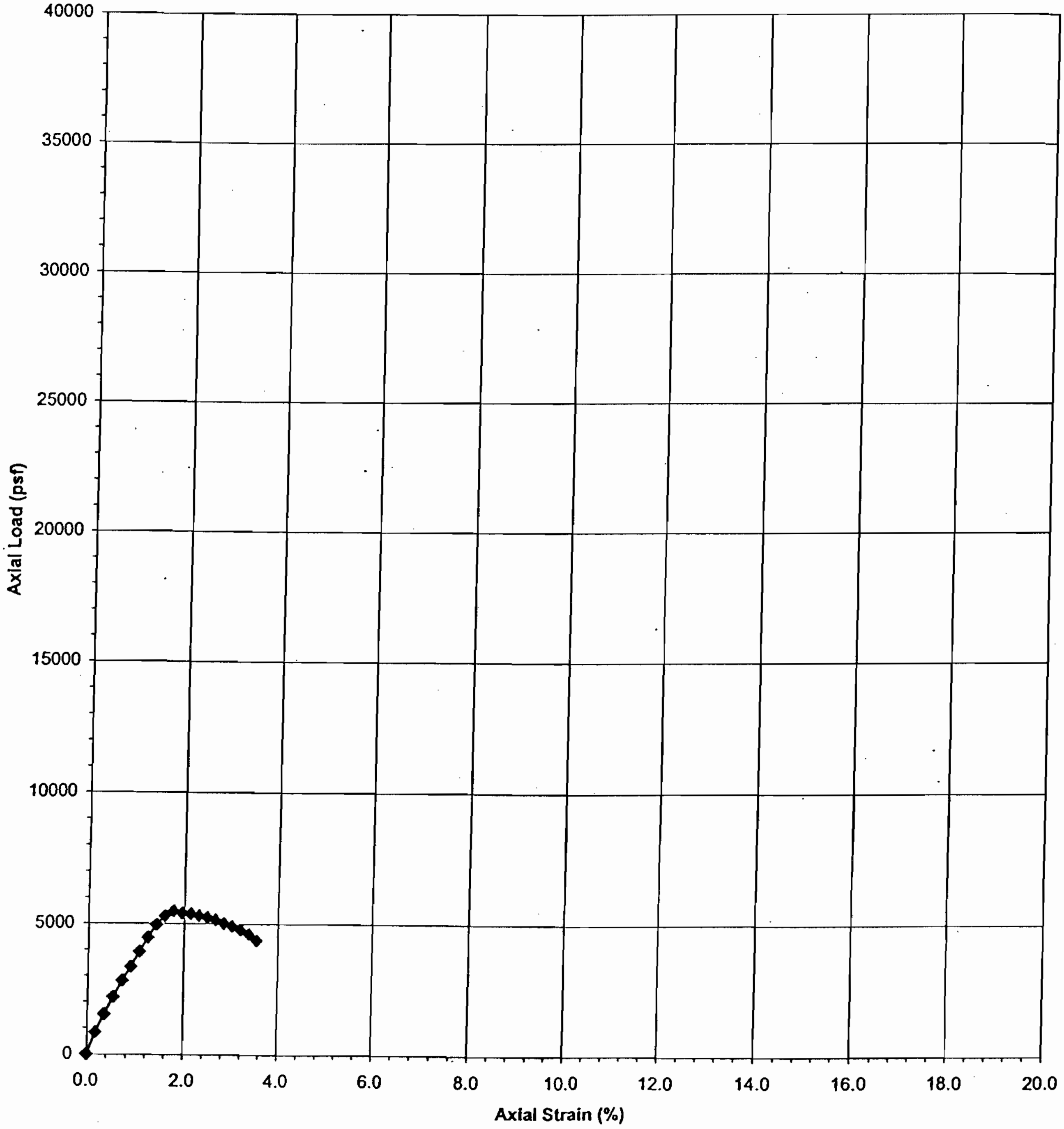
Sketch of Sample After Test:



5Y 3/2 DK OLV GRY
10YR 5/6 YEL BRN
V SOFT / PLASTIC

Comments: V POLISHED SHEAR SURFACE, V MOIST SURFACE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 58.0'
Blk and Dk Gry Claystone w/ Sandstone Laminations or Gravels



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	58.0'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.39	5.64	0.00	0	0.00	0	0.0	0
2.39	5.64	0.01	37	25.73	826	0.2	826
2.39	5.64	0.02	68	47.29	1518	0.4	1518
2.39	5.64	0.03	98	68.15	2187	0.5	2187
2.39	5.64	0.04	126	87.62	2812	0.7	2812
2.39	5.64	0.05	150	104.31	3348	0.9	3348
2.39	5.64	0.06	176	122.39	3928	1.1	3928
2.39	5.64	0.07	200	139.08	4464	1.2	4464
2.39	5.64	0.08	222	154.38	4955	1.4	4955
2.39	5.64	0.09	237	164.81	5290	1.6	5290
2.39	5.64	0.10	245	170.37	5469	1.8	5469
2.39	5.64	0.11	242	168.29	5402	2.0	5402
2.39	5.64	0.12	241	167.59	5379	2.1	5379
2.39	5.64	0.13	238	165.51	5312	2.3	5312
2.39	5.64	0.14	235	163.42	5245	2.5	5245
2.39	5.64	0.15	231	160.64	5156	2.7	5156
2.39	5.64	0.16	225	156.47	5022	2.8	5022
2.39	5.64	0.17	220	152.99	4911	3.0	4911
2.39	5.64	0.18	214	148.82	4777	3.2	4777
2.39	5.64	0.19	207	143.95	4620	3.4	4620
2.39	5.64	0.20	196	136.30	4375	3.5	4375
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology

PROJECT: Vasco Road

PROJ. # : 001860

DATE: 2/17/01

BORING: B-3

DEPTH: 58.0

Sample Diameter: 2.39

Sample Length: 5.64

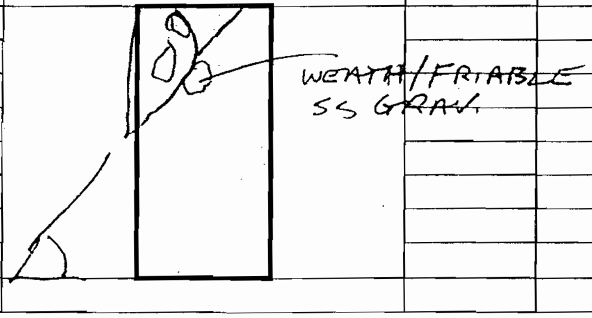
Wet Wt./Dry Wt.:

F-34

Description: BLK & DK GRY CLAYSTONE W/SS LAMINATIONS OR GRAVELS

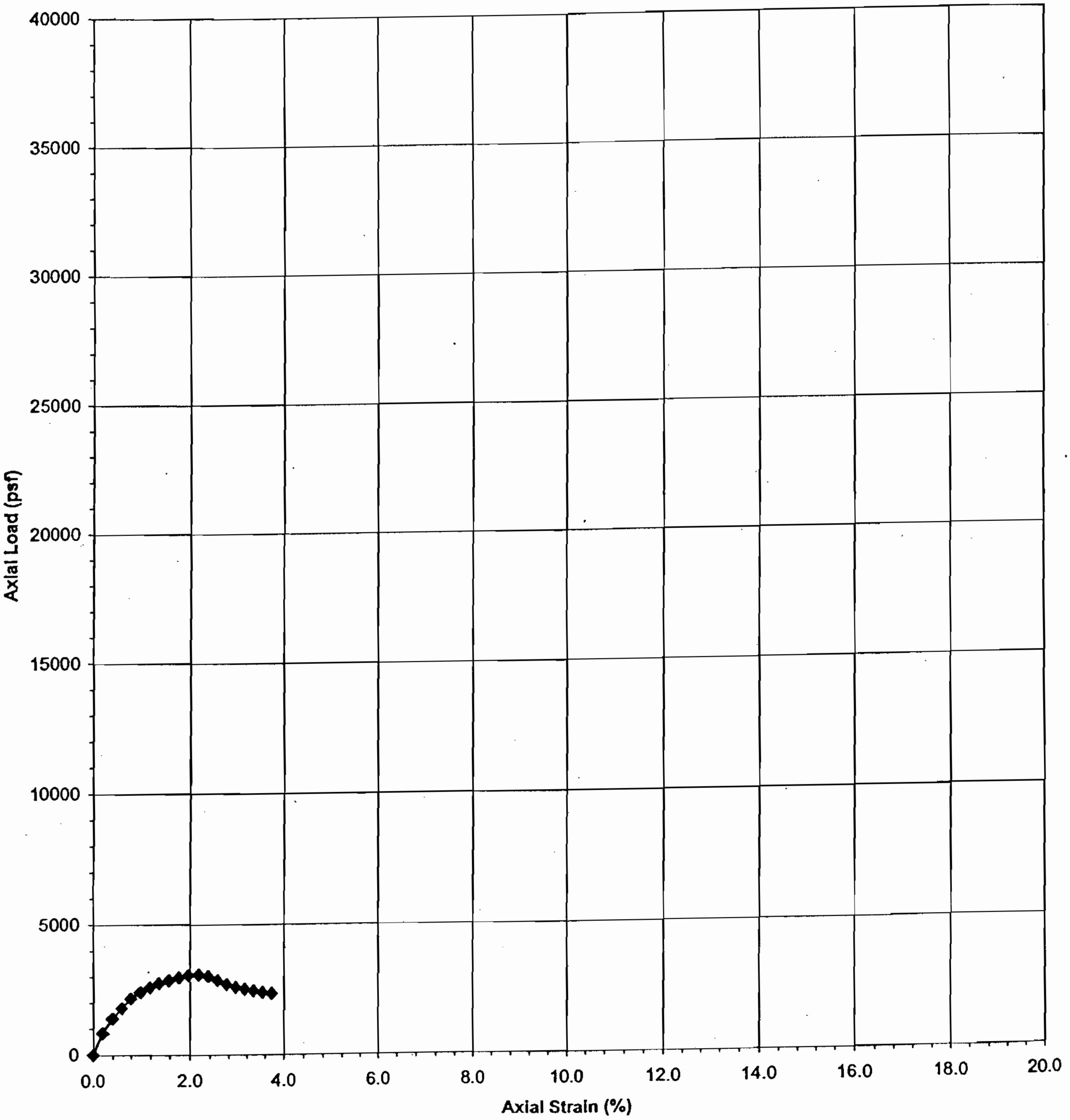
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	37	0.26	
0.02	68	0.27	
0.03	98	0.28	
0.04	126	0.29	
0.05	150	0.30	
0.06	176	0.31	
0.07	200	0.32	
0.08	222	0.33	
0.09	237	0.34	
0.10	245	0.35	
0.11	242	0.36	
0.12	241	0.37	
0.13	238	0.38	
0.14	235	0.39	
0.15	231	0.40	
0.16	225	0.41	
0.17	220	0.42	
0.18	214	0.43	
0.19	207	0.44	
0.20	196	0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED SHEAR SURFACE 2.5Y 2.5/1 BLK
4/1 DK GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 62.0'
Dk Grn Gry and Dk Gry Claystone w/ Trace VFG Sand



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	62.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.08	0.00	0	0.00	0	0.0	0
2.39	5.08	0.01	37	25.73	826	0.2	826
2.39	5.08	0.02	62	43.11	1384	0.4	1384
2.39	5.08	0.03	80	55.63	1786	0.6	1786
2.39	5.08	0.04	97	67.45	2165	0.8	2165
2.39	5.08	0.05	108	75.10	2411	1.0	2411
2.39	5.08	0.06	116	80.67	2589	1.2	2589
2.39	5.08	0.07	123	85.53	2745	1.4	2745
2.39	5.08	0.08	128	89.01	2857	1.6	2857
2.39	5.08	0.09	133	92.49	2969	1.8	2969
2.39	5.08	0.10	137	95.27	3058	2.0	3058
2.39	5.08	0.11	138	95.97	3080	2.2	3080
2.39	5.08	0.12	135	93.88	3013	2.4	3013
2.39	5.08	0.13	128	89.01	2857	2.6	2857
2.39	5.08	0.14	121	84.14	2701	2.8	2701
2.39	5.08	0.15	116	80.67	2589	3.0	2589
2.39	5.08	0.16	113	78.58	2522	3.1	2522
2.39	5.08	0.17	110	76.49	2455	3.3	2455
2.39	5.08	0.18	107	74.41	2388	3.5	2388
2.39	5.08	0.19	105	73.02	2344	3.7	2344
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

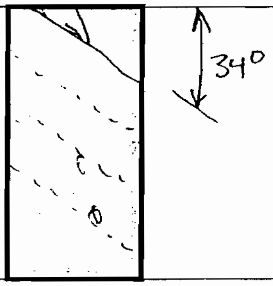
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 62.0

Sample Diameter: 2.39
Sample Length: 5.08
Wet Wt./Dry Wt.:
Description: DK GRN GRY + DK GRY CLAYSTONE TR VFG SAND + PEBBLES

F-67

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	37	0.26	
0.02	62	0.27	
0.03	80	0.28	
0.04	97	0.29	
0.05	108	0.30	
0.06	116	0.31	
0.07	123	0.32	
0.08	128	0.33	
0.09	133	0.34	
0.10	137	0.35	
0.11	138	0.36	
0.12	135	0.37	
0.13	128	0.38	
0.14	121	0.39	
0.15	116	0.40	
0.16	113	0.41	
0.17	110	0.42	
0.18	107	0.43	
0.19	105	0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:

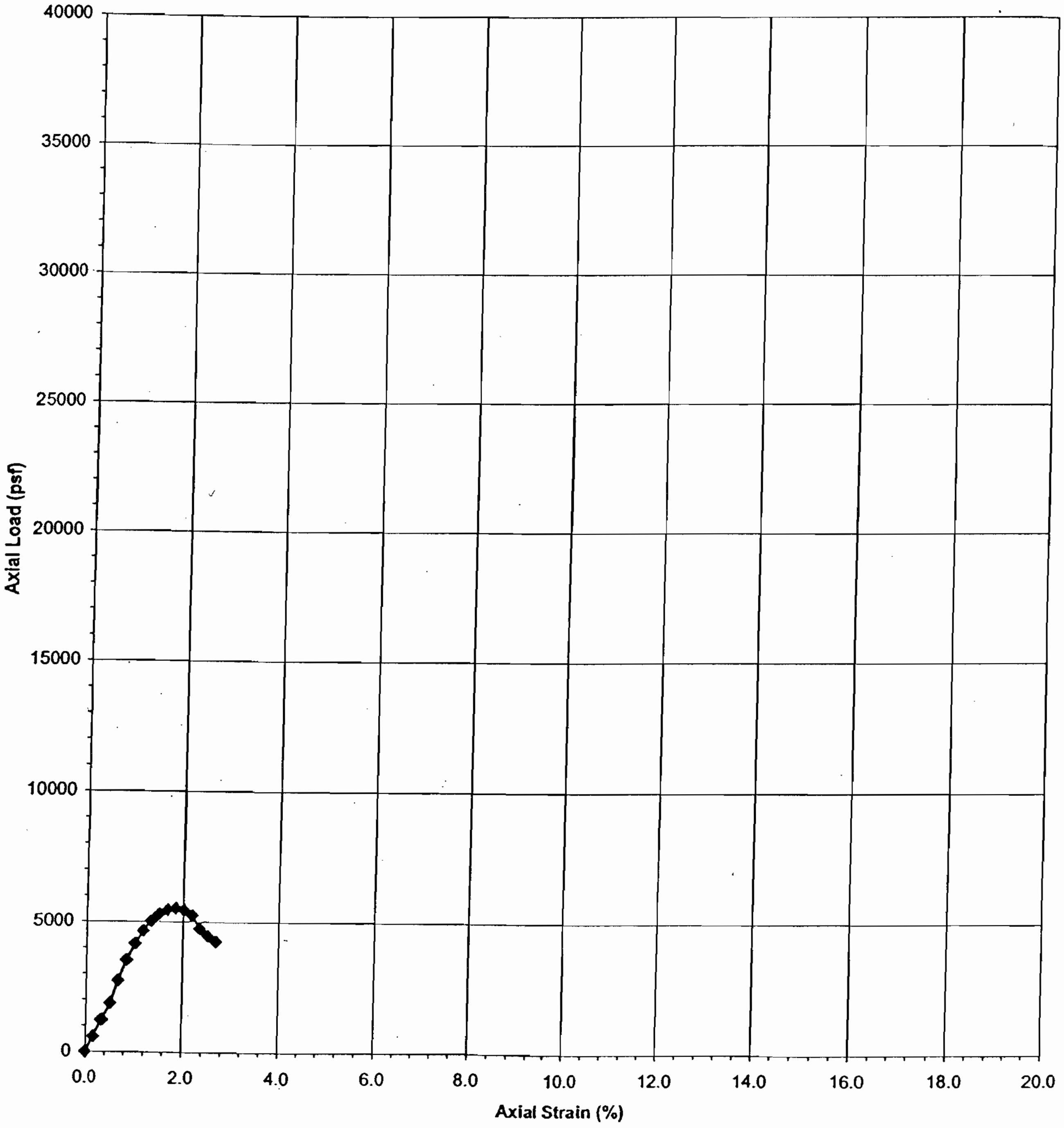


BEDDING @ SAME 34° ANGLE

ALT CLAYSTONE LAYERS SOME W/WEATH GRAV
N 4/ DK GRY
10Y 3/1 DK GRN GRY

Comments: V POLISHED SHEAR SURFACE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 71.5'
Dk Grn Gry Claystone w/ 1/4" Lt Gry Sandstone Laminations



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	71.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.96	0.00	0	0.00	0	0.0	0
2.40	5.96	0.01	26	18.08	576	0.2	576
2.40	5.96	0.02	55	38.25	1217	0.3	1217
2.40	5.96	0.03	84	58.41	1859	0.5	1859
2.40	5.96	0.04	123	85.53	2723	0.7	2723
2.40	5.96	0.05	159	110.57	3519	0.8	3519
2.40	5.96	0.06	188	130.74	4161	1.0	4161
2.40	5.96	0.07	210	146.03	4648	1.2	4648
2.40	5.96	0.08	227	157.86	5025	1.3	5025
2.40	5.96	0.09	239	166.20	5290	1.5	5290
2.40	5.96	0.10	246	171.07	5445	1.7	5445
2.40	5.96	0.11	249	173.15	5512	1.8	5512
2.40	5.96	0.12	246	171.07	5445	2.0	5445
2.40	5.96	0.13	237	164.81	5246	2.2	5246
2.40	5.96	0.14	214	148.82	4737	2.3	4737
2.40	5.96	0.15	202	140.47	4471	2.5	4471
2.40	5.96	0.16	192	133.52	4250	2.7	4250
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

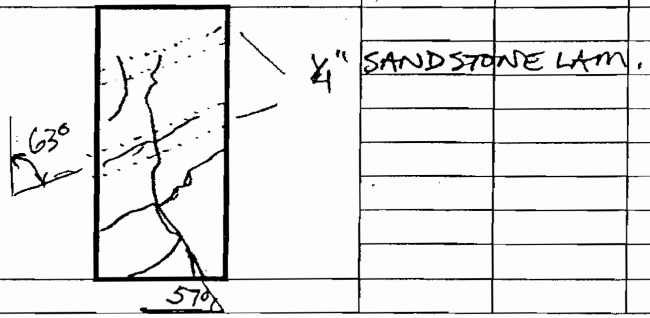
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 71.5'

Sample Diameter: 2.40
Sample Length: 5.96
Wet Wt./Dry Wt.:
Description: DK GRN GRY CLAYSTONE W/ 1/4" SANDSTONE LAMINATIONS (LT GRY)

F-82

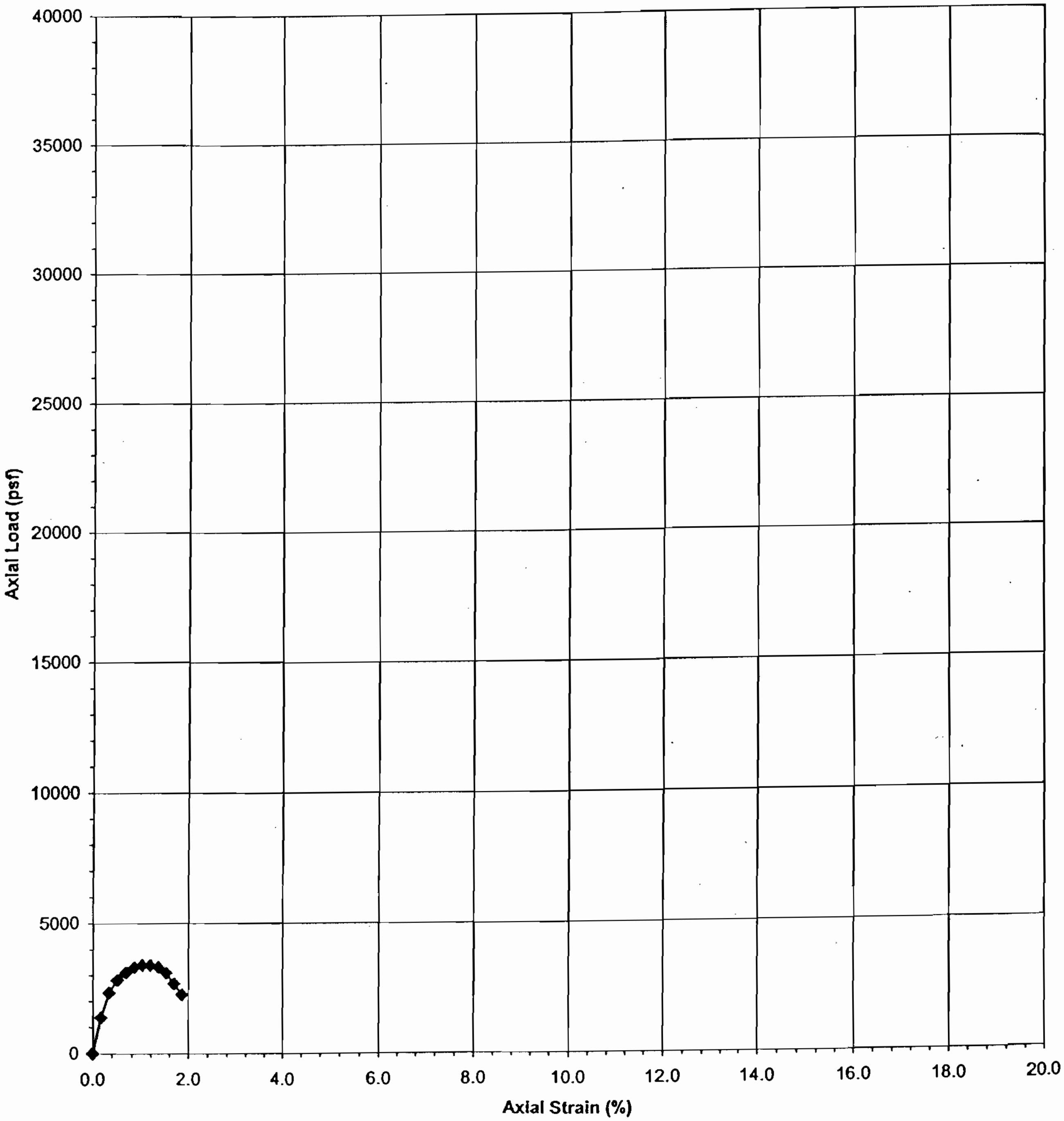
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	26	0.26	
0.02	55	0.27	
0.03	84	0.28	
0.04	123	0.29	
0.05	159	0.30	
0.06	188	0.31	
0.07	210	0.32	
0.08	227	0.33	
0.09	239	0.34	
0.10	246	0.35	
0.11	249	0.36	
0.12	246	0.37	
0.13	237	0.38	
0.14	214	0.39	
0.15	202	0.40	
0.16	192	0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 10Y 3/1 DK GRN GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-3 @ 82.0'
Dk Grn Gry w/ Dk Gry Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-3			Ring Constant = 0.6954 lb/div			
DEPTH:	82.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.92	0.00	0	0.00	0	0.0	0
2.40	5.92	0.01	62	43.11	1372	0.2	1372
2.40	5.92	0.02	105	73.02	2324	0.3	2324
2.40	5.92	0.03	127	88.32	2811	0.5	2811
2.40	5.92	0.04	140	97.36	3099	0.7	3099
2.40	5.92	0.05	149	103.61	3298	0.8	3298
2.40	5.92	0.06	153	106.40	3387	1.0	3387
2.40	5.92	0.07	153	106.40	3387	1.2	3387
2.40	5.92	0.08	150	104.31	3320	1.4	3320
2.40	5.92	0.09	140	97.36	3099	1.5	3099
2.40	5.92	0.10	121	84.14	2678	1.7	2678
2.40	5.92	0.11	102	70.93	2258	1.9	2258
		0.12		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

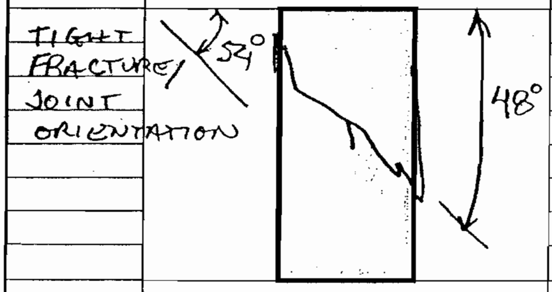
Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-3
DEPTH: 82.0'

Sample Diameter: 2.40
Sample Length: 5.92
Wet Wt./Dry Wt.:
Description: DK GRN GRY W/DK GRY: CLAYSTONE

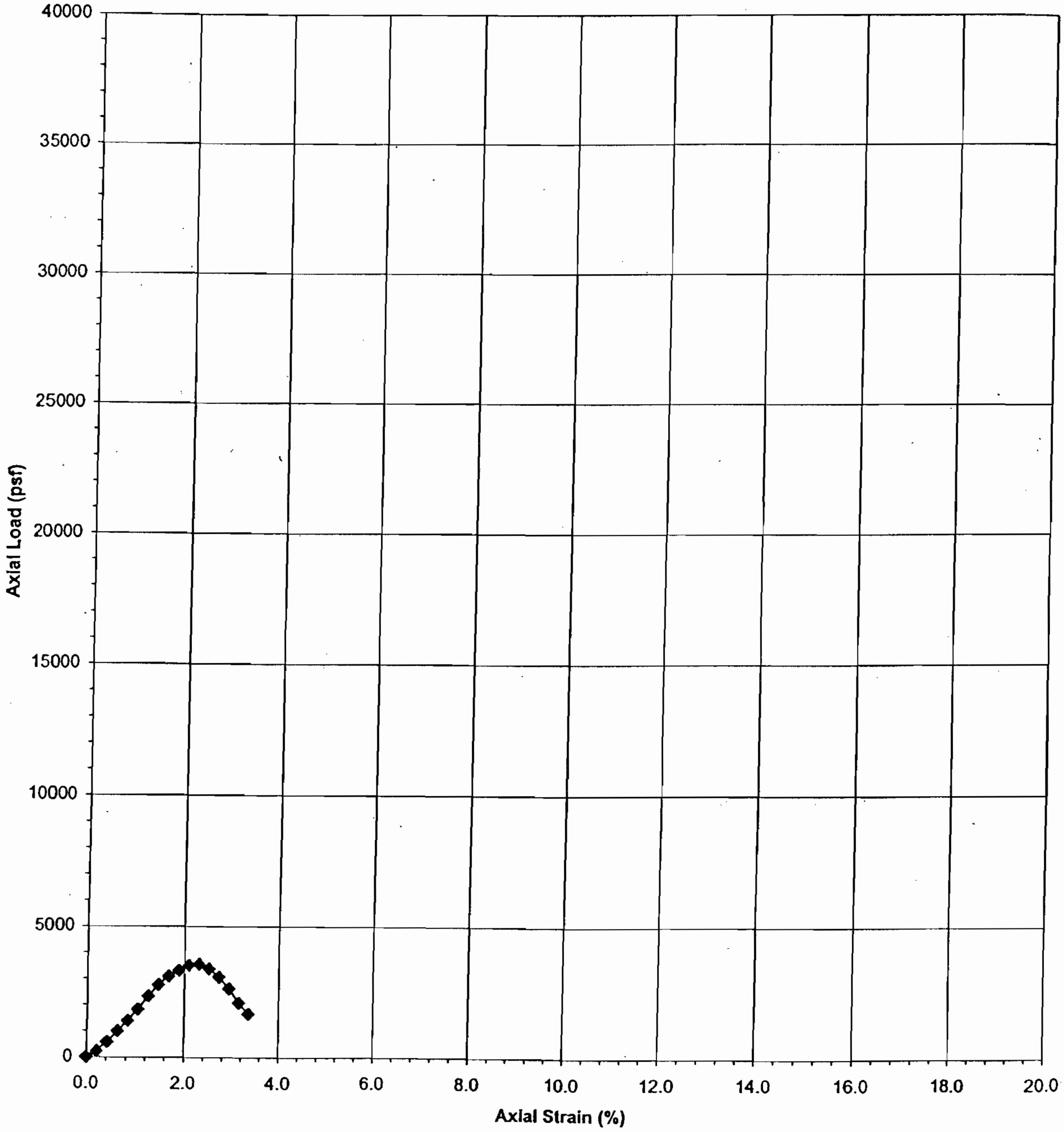
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	62	0.26	
0.02	105	0.27	
0.03	127	0.28	
0.04	140	0.29	
0.05	149	0.30	
0.06	153	0.31	
0.07	153	0.32	
0.08	150	0.33	
0.09	140	0.34	
0.10	121	0.35	
0.11	102	0.36	
0.12		0.37	
0.13		0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED SURFACE 10Y3/1 DK GRN GRY
N4/ DK GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 3.0'
Dk Yel Brn Weathered Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
Ring Constant = 0.6954 lb/div
DEPTH: 3.0'

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	4.77	0.00	0	0.00	0	0.0	0
2.41	4.77	0.01	10	6.95	220	0.2	220
2.41	4.77	0.02	26	18.08	571	0.4	571
2.41	4.77	0.03	45	31.29	988	0.6	988
2.41	4.77	0.04	63	43.81	1383	0.8	1383
2.41	4.77	0.05	83	57.72	1822	1.0	1822
2.41	4.77	0.06	106	73.71	2327	1.3	2327
2.41	4.77	0.07	126	87.62	2766	1.5	2766
2.41	4.77	0.08	141	98.05	3095	1.7	3095
2.41	4.77	0.09	151	105.01	3315	1.9	3315
2.41	4.77	0.10	160	111.26	3512	2.1	3512
2.41	4.77	0.11	162	112.65	3556	2.3	3556
2.41	4.77	0.12	154	107.09	3381	2.5	3381
2.41	4.77	0.13	140	97.36	3073	2.7	3073
2.41	4.77	0.14	120	83.45	2634	2.9	2634
2.41	4.77	0.15	95	66.06	2085	3.1	2085
2.41	4.77	0.16	76	52.85	1668	3.4	1668
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 3,0

Sample Diameter: 2.41
Sample Length: 4,77
Wet Wt./Dry Wt.:
Description: DK YELBRN WEATH SANDSTONE, FRIABLE TO WEAK, W/GRAV <½" SL CLAYEY

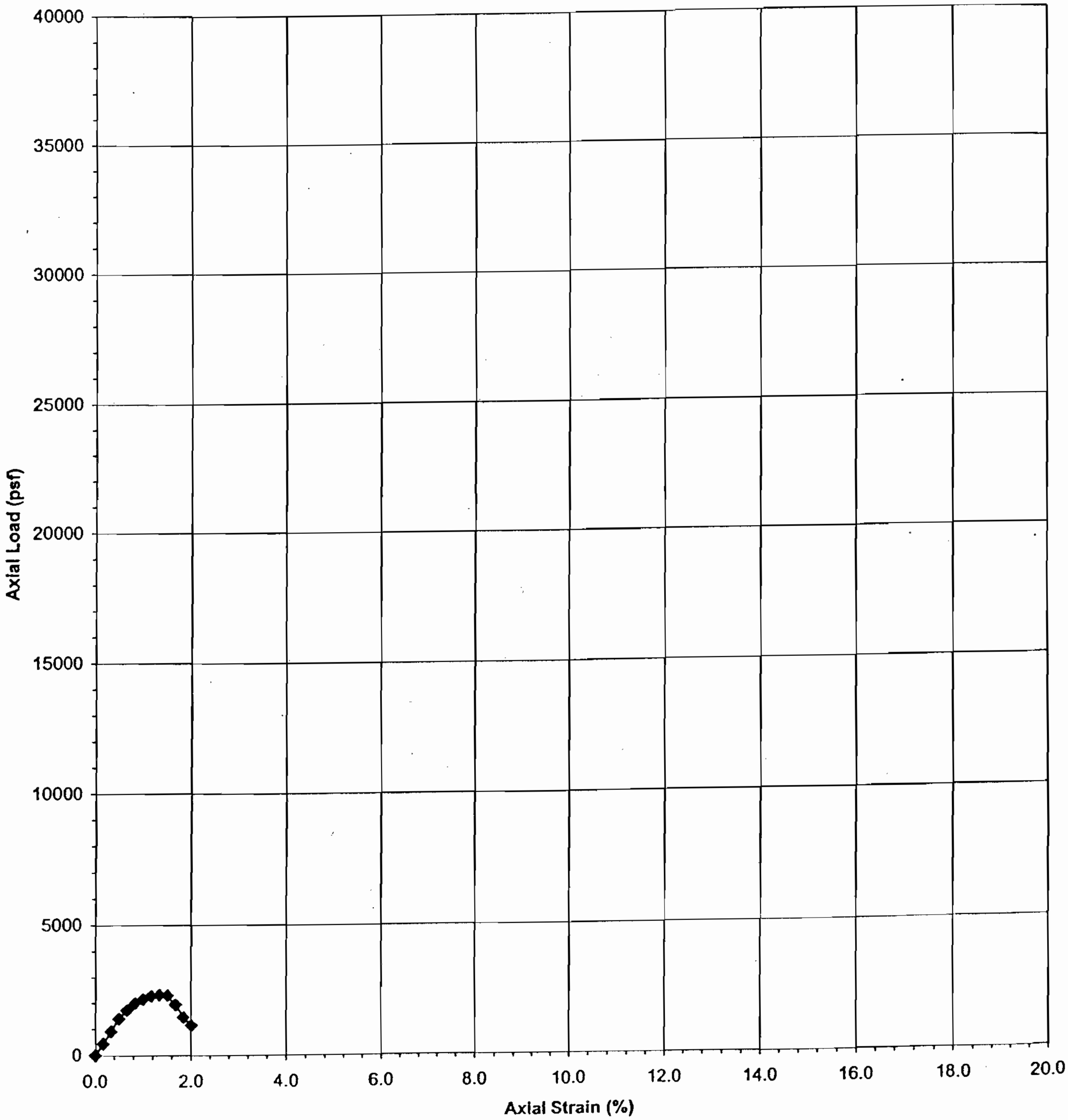
F-97

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	10	0.26	
0.02	26	0.27	
0.03	45	0.28	
0.04	63	0.29	
0.05	83	0.30	
0.06	106	0.31	
0.07	126	0.32	
0.08	141	0.33	
0.09	151	0.34	
0.10	160	0.35	
0.11	162	0.36	
0.12	154	0.37	
0.13	140	0.38	
0.14	120	0.39	
0.15	95	0.40	
0.16	76	0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:

Comments:
10YR 4/4

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 12.0'
Lt Olv Brn w/Orn Brn Weathered Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	12.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.99	0.00	0	0.00	0	0.0	0
2.40	5.99	0.01	20	13.91	443	0.2	443
2.40	5.99	0.02	41	28.51	908	0.3	908
2.40	5.99	0.03	63	43.81	1395	0.5	1395
2.40	5.99	0.04	78	54.24	1727	0.7	1727
2.40	5.99	0.05	90	62.59	1992	0.8	1992
2.40	5.99	0.06	97	67.45	2147	1.0	2147
2.40	5.99	0.07	103	71.63	2280	1.2	2280
2.40	5.99	0.08	105	73.02	2324	1.3	2324
2.40	5.99	0.09	104	72.32	2302	1.5	2302
2.40	5.99	0.10	88	61.20	1948	1.7	1948
2.40	5.99	0.11	66	45.90	1461	1.8	1461
2.40	5.99	0.12	52	36.16	1151	2.0	1151
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

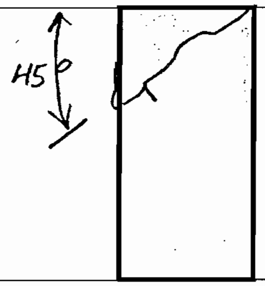
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 12.0

Sample Diameter: 2.40
Sample Length: 5.99
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/ OR BRN CLAYSTONE (WEATHERED)

F-69

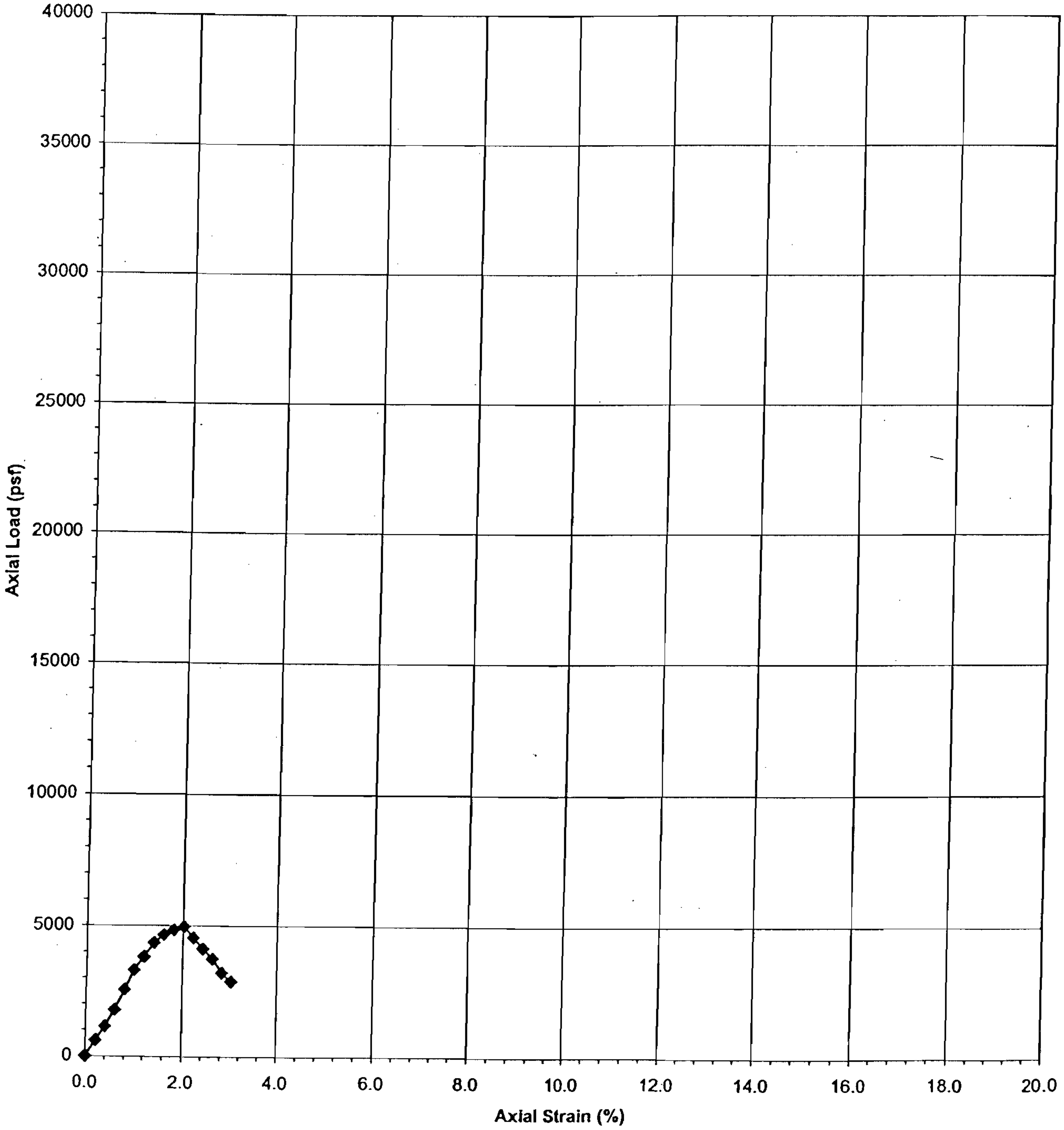
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	20	0.26	
0.02	41	0.27	
0.03	63	0.28	
0.04	78	0.29	
0.05	90	0.30	
0.06	97	0.31	
0.07	103	0.32	
0.08	105	0.33	
0.09	104	0.34	
0.10	88	0.35	
0.11	66	0.36	
0.12	52	0.37	
0.13		0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED SHEAR SURFACE
2.5Y 5/4 LT OLV BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 14.0'
Lt Yel Brn w/Yel Brn Weathered Sandstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology
PROJECT	Vasco Road
PROJ. # :	001860
DATE:	02/12/2001
BORING:	B-4
DEPTH:	14.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	4.95	0.00	0	0.00	0	0.0	0
2.40	4.95	0.01	27	18.78	598	0.2	598
2.40	4.95	0.02	51	35.47	1129	0.4	1129
2.40	4.95	0.03	80	55.63	1771	0.6	1771
2.40	4.95	0.04	115	79.97	2546	0.8	2546
2.40	4.95	0.05	149	103.61	3298	1.0	3298
2.40	4.95	0.06	172	119.61	3807	1.2	3807
2.40	4.95	0.07	196	136.30	4339	1.4	4339
2.40	4.95	0.08	210	146.03	4648	1.6	4648
2.40	4.95	0.09	218	151.60	4825	1.8	4825
2.40	4.95	0.10	224	155.77	4958	2.0	4958
2.40	4.95	0.11	205	142.56	4538	2.2	4538
2.40	4.95	0.12	186	129.34	4117	2.4	4117
2.40	4.95	0.13	169	117.52	3741	2.6	3741
2.40	4.95	0.14	145	100.83	3210	2.8	3210
2.40	4.95	0.15	130	90.40	2878	3.0	2878
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

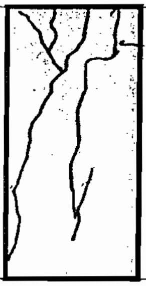
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 14.0'

Sample Diameter: 2.40
Sample Length: 4.95
Wet Wt./Dry Wt.:
Description: LT YEL BRN W/YEL BRN SANDSTONE, FRIABLE TO WEAK VFG

E-73

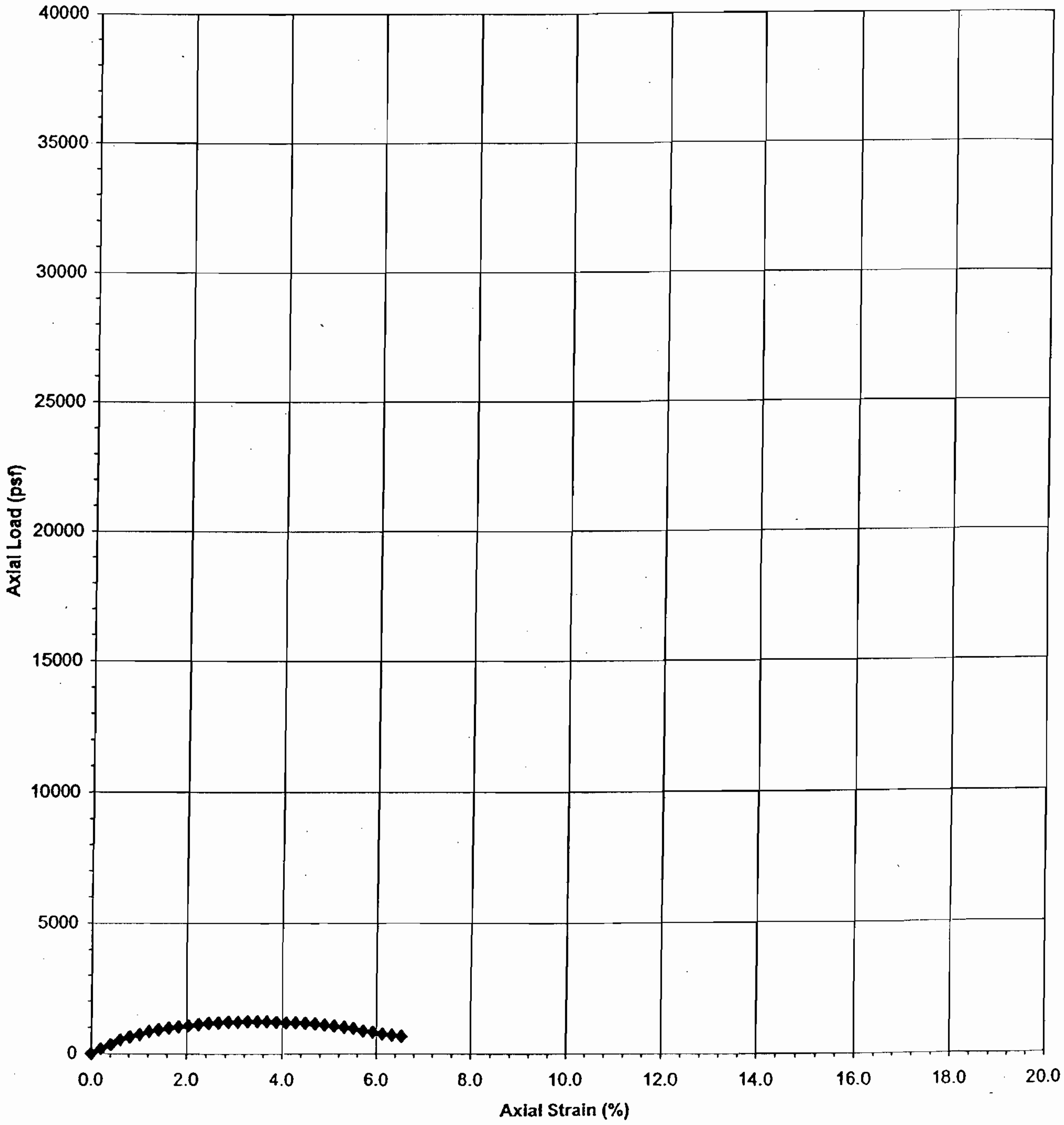
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	27	0.26	
0.02	51	0.27	
0.03	80	0.28	
0.04	115	0.29	
0.05	149	0.30	
0.06	172	0.31	
0.07	196	0.32	
0.08	210	0.33	
0.09	218	0.34	
0.10	224	0.35	
0.11	205	0.36	
0.12	186	0.37	
0.13	169	0.38	
0.14	145	0.39	
0.15	130	0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 2.5Y 6/3 W/ 10YR 5/6

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 17.5'
Lt Yel Brn w/Brn Yel Completely Weathered Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	17.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.37	4.90	0.00	0	0.00	0	0.0	0
2.37	4.90	0.01	8	5.56	182	0.2	182
2.37	4.90	0.02	15	10.43	340	0.4	340
2.37	4.90	0.03	23	15.99	522	0.6	522
2.37	4.90	0.04	28	19.47	636	0.8	636
2.37	4.90	0.05	32	22.25	726	1.0	726
2.37	4.90	0.06	37	25.73	840	1.2	840
2.37	4.90	0.07	40	27.82	908	1.4	908
2.37	4.90	0.08	43	29.90	976	1.6	976
2.37	4.90	0.09	45	31.29	1021	1.8	1021
2.37	4.90	0.10	47	32.68	1067	2.0	1067
2.37	4.90	0.11	49	34.07	1112	2.2	1112
2.37	4.90	0.12	51	35.47	1158	2.4	1158
2.37	4.90	0.13	52	36.16	1180	2.7	1180
2.37	4.90	0.14	53	36.86	1203	2.9	1203
2.37	4.90	0.15	53	36.86	1203	3.1	1203
2.37	4.90	0.16	54	37.55	1226	3.3	1226
2.37	4.90	0.17	54	37.55	1226	3.5	1226
2.37	4.90	0.18	54	37.55	1226	3.7	1226
2.37	4.90	0.19	53	36.86	1203	3.9	1203
2.37	4.90	0.20	52	36.16	1180	4.1	1180
2.37	4.90	0.21	52	36.16	1180	4.3	1180
2.37	4.90	0.22	51	35.47	1158	4.5	1158
2.37	4.90	0.23	50	34.77	1135	4.7	1135
2.37	4.90	0.24	48	33.38	1090	4.9	1090
2.37	4.90	0.25	46	31.99	1044	5.1	1044
2.37	4.90	0.26	44	30.60	999	5.3	999
2.37	4.90	0.27	42	29.21	953	5.5	953
2.37	4.90	0.28	38	26.43	863	5.7	863
2.37	4.90	0.29	36	25.03	817	5.9	817
2.37	4.90	0.30	33	22.95	749	6.1	749
2.37	4.90	0.31	31	21.56	704	6.3	704
2.37	4.90	0.32	29	20.17	658	6.5	658
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

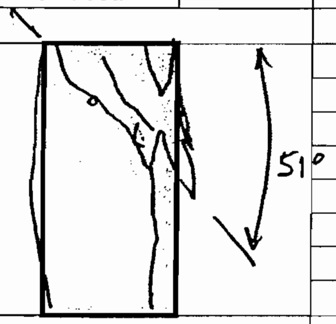
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 17.5'

Sample Diameter: 2.37
Sample Length: 4.90
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/ BRN YEL WEATH CLAYSTONE (ALMOST RESID SOIL) V SILTY

F-95

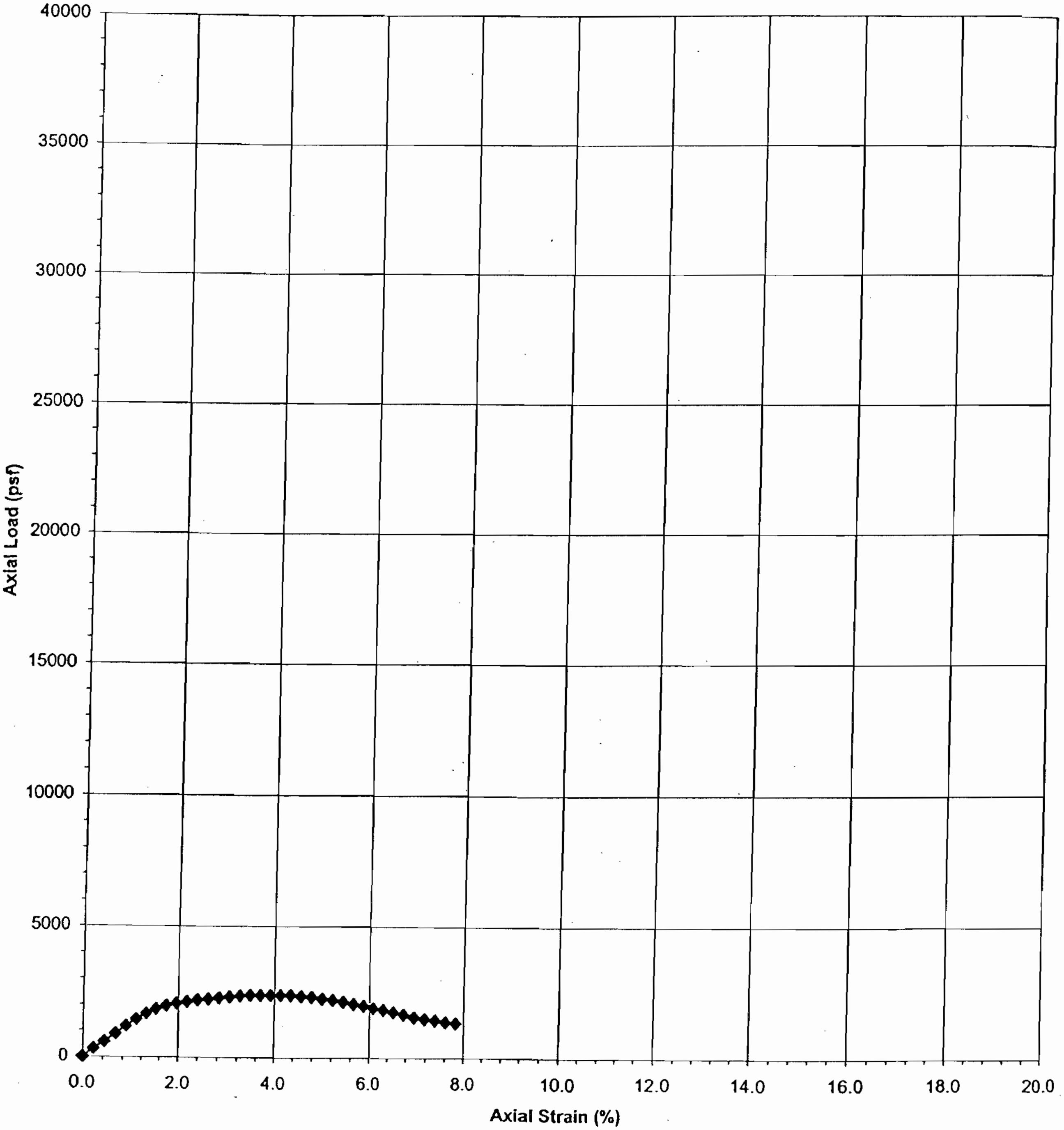
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	8	0.26	44
0.02	15	0.27	42
0.03	23	0.28	38
0.04	28	0.29	36
0.05	32	0.30	33
0.06	37	0.31	31
0.07	40	0.32	29
0.08	43	0.33	
0.09	45	0.34	
0.10	47	0.35	
0.11	49	0.36	
0.12	51	0.37	
0.13	52	0.38	
0.14	53	0.39	
0.15	53	0.40	
0.16	54	0.41	
0.17	54	0.42	
0.18	54	0.43	
0.19	53	0.44	
0.20	52	0.45	
0.21	52	0.46	
0.22	51	0.47	
0.23	50	0.48	
0.24	48	0.49	
0.25	46	0.50	

Sketch of Sample After Test:



Comments: 2.5Y 5/4 LT OLV BRN W/ 10YR 6/8
PARTIAL POLISHED SHEAR SURF

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 27.0'
Lt Yel Brn w/Brn Yel Weathered Sandy Claystone/Siltstone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 27.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	4.60	0.00	0	0.00	0	0.0	0
2.41	4.60	0.01	14	9.74	307	0.2	307
2.41	4.60	0.02	26	18.08	571	0.4	571
2.41	4.60	0.03	40	27.82	878	0.7	878
2.41	4.60	0.04	53	36.86	1163	0.9	1163
2.41	4.60	0.05	65	45.20	1427	1.1	1427
2.41	4.60	0.06	75	52.16	1646	1.3	1646
2.41	4.60	0.07	83	57.72	1822	1.5	1822
2.41	4.60	0.08	89	61.89	1954	1.7	1954
2.41	4.60	0.09	93	64.67	2042	2.0	2042
2.41	4.60	0.10	96	66.76	2107	2.2	2107
2.41	4.60	0.11	99	68.84	2173	2.4	2173
2.41	4.60	0.12	101	70.24	2217	2.6	2217
2.41	4.60	0.13	103	71.63	2261	2.8	2261
2.41	4.60	0.14	105	73.02	2305	3.0	2305
2.41	4.60	0.15	107	74.41	2349	3.3	2349
2.41	4.60	0.16	108	75.10	2371	3.5	2371
2.41	4.60	0.17	108	75.10	2371	3.7	2371
2.41	4.60	0.18	108	75.10	2371	3.9	2371
2.41	4.60	0.19	108	75.10	2371	4.1	2371
2.41	4.60	0.20	108	75.10	2371	4.3	2371
2.41	4.60	0.21	106	73.71	2327	4.6	2327
2.41	4.60	0.22	105	73.02	2305	4.8	2305
2.41	4.60	0.23	102	70.93	2239	5.0	2239
2.41	4.60	0.24	100	69.54	2195	5.2	2195
2.41	4.60	0.25	97	67.45	2129	5.4	2129
2.41	4.60	0.26	93	64.67	2042	5.7	2042
2.41	4.60	0.27	90	62.59	1976	5.9	1976
2.41	4.60	0.28	86	59.80	1888	6.1	1888
2.41	4.60	0.29	83	57.72	1822	6.3	1822
2.41	4.60	0.30	79	54.94	1734	6.5	1734
2.41	4.60	0.31	75	52.16	1646	6.7	1646
2.41	4.60	0.32	70	48.68	1537	7.0	1537
2.41	4.60	0.33	67	46.59	1471	7.2	1471
2.41	4.60	0.34	65	45.20	1427	7.4	1427
2.41	4.60	0.35	62	43.11	1361	7.6	1361
2.41	4.60	0.36	60	41.72	1317	7.8	1317
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

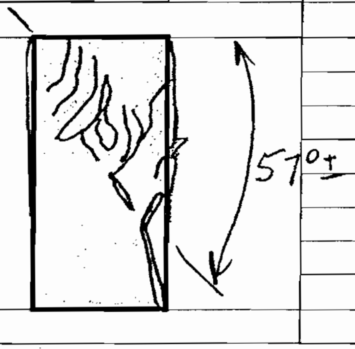
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 27.0'

Sample Diameter: 2.41
Sample Length: 4.60
Wet Wt./Dry Wt.:
Description: LT YEL BRN W/BRN YEL SANDY CLAYSTONE/SILTSTONE, VFG, WEAK

F-98

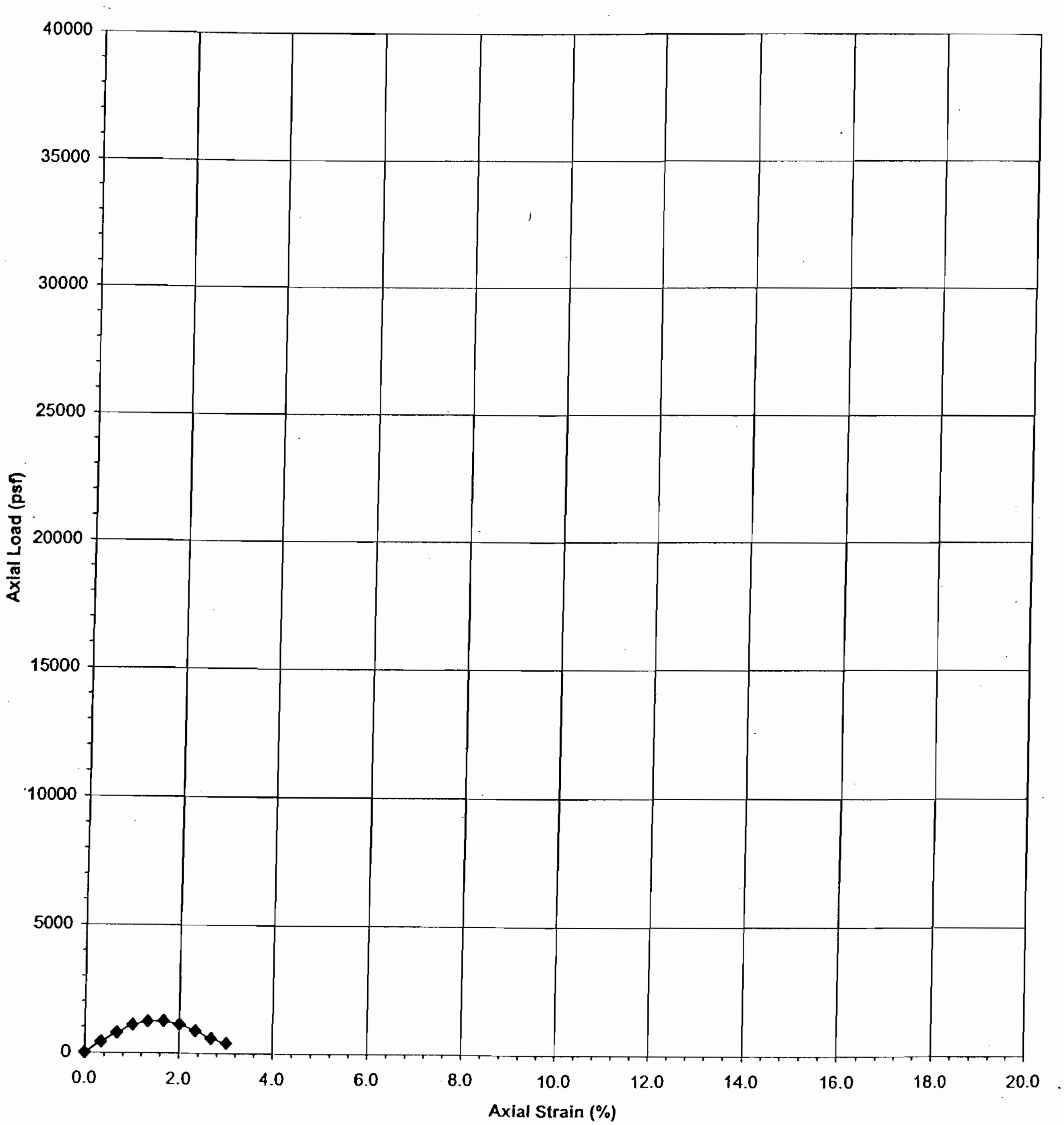
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	14	0.26	93
0.02	26	0.27	90
0.03	40	0.28	86
0.04	53	0.29	83
0.05	65	0.30	79
0.06	75	0.31	75
0.07	83	0.32	70
0.08	89	0.33	67
0.09	93	0.34	65
0.10	96	0.35	62
0.11	99	0.36	60
0.12	101	0.37	
0.13	103	0.38	
0.14	105	0.39	
0.15	107	0.40	
0.16	108	0.41	
0.17	108	0.42	
0.18	108	0.43	
0.19	108	0.44	
0.20	108	0.45	
0.21	106	0.46	
0.22	105	0.47	
0.23	102	0.48	
0.24	100	0.49	
0.25	97	0.50	

Sketch of Sample After Test:



Comments:

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 30.0'
Orn Brn w/ Yel Brn Weathered Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	30.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.99	0.00	0	0.00	0	0.0	0
2.40	5.99	0.02	19	13.21	421	0.3	421
2.40	5.99	0.04	35	24.34	775	0.7	775
2.40	5.99	0.06	49	34.07	1085	1.0	1085
2.40	5.99	0.08	55	38.25	1217	1.3	1217
2.40	5.99	0.10	56	38.94	1240	1.7	1240
2.40	5.99	0.12	50	34.77	1107	2.0	1107
2.40	5.99	0.14	39	27.12	863	2.3	863
2.40	5.99	0.16	26	18.08	576	2.7	576
2.40	5.99	0.18	18	12.52	398	3.0	398
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.42		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.44		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.46		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.48		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.50		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.52		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.54		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.56		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.58		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.60		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.62		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.64		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.66		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.68		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.70		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.72		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.74		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.76		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.78		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.80		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data

Ring Constant = 0.6954 lb/div

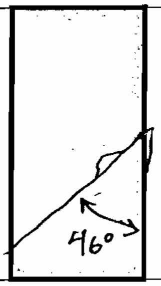
CLIENT: CAL ENG & GEOL
PROJECT: VASCO
PROJ. #: 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 30.0

Sample Diameter: 2.40
Sample Length: 5.99
Wet Wt./Dry Wt.: 942.1 W/
Description: OLYBRN W/YEL BRN CLAYSTONE TR VFG SAND

F-81

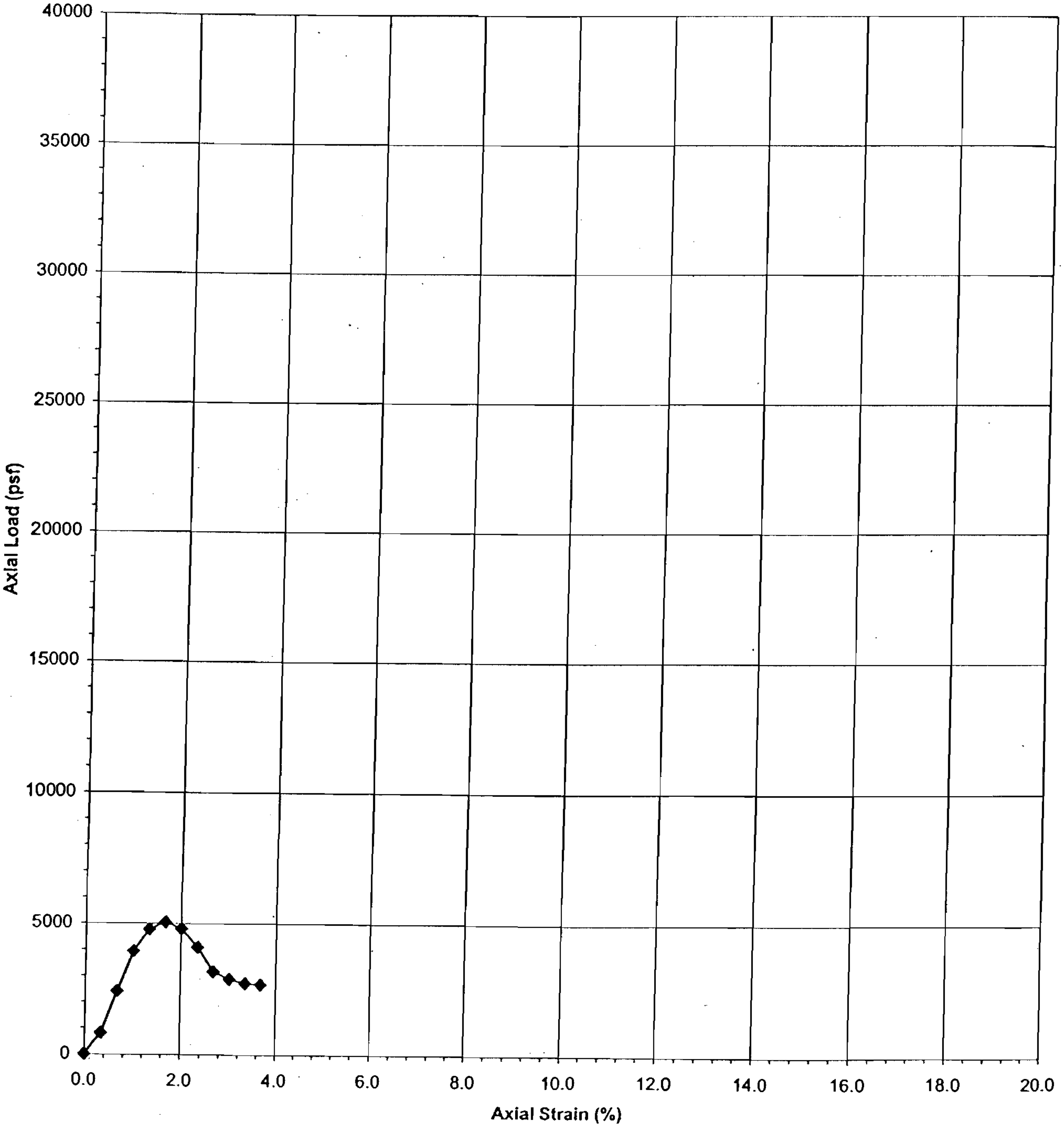
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.02	19	0.52	
0.04	35	0.54	
0.06	49	0.56	
0.08	55	0.58	
0.10	56	0.60	
0.12	50	0.62	
0.14	39	0.64	
0.16	26	0.66	
0.18	18	0.68	
0.20		0.70	
0.22		0.72	
0.24		0.74	
0.26		0.76	
0.28		0.78	
0.30		0.80	
0.32		0.82	
0.34		0.84	
0.36		0.86	
0.38		0.88	
0.40		0.90	
0.42		0.92	
0.44		0.94	
0.46		0.96	
0.48		0.98	
0.50		1.00	

Sketch of Sample After Test:



Comments: BREAK HAS SLICKENED SURFACE
10YR 5/6 YEL BRN 2.5Y 4/4 OLIVE BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 39.0'
V Dk Gry Weathered Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 39.0'

Ring Constant = 0.6954 lb/div

SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.38	5.98	0.00	0	0.00	0	0.0	0
2.38	5.98	0.02	36	25.03	810	0.3	810
2.38	5.98	0.04	107	74.41	2408	0.7	2408
2.38	5.98	0.06	175	121.70	3939	1.0	3939
2.38	5.98	0.08	212	147.42	4772	1.3	4772
2.38	5.98	0.10	224	155.77	5042	1.7	5042
2.38	5.98	0.12	213	148.12	4794	2.0	4794
2.38	5.98	0.14	182	126.56	4097	2.3	4097
2.38	5.98	0.16	141	98.05	3174	2.7	3174
2.38	5.98	0.18	128	89.01	2881	3.0	2881
2.38	5.98	0.20	121	84.14	2724	3.3	2724
2.38	5.98	0.22	119	82.75	2679	3.7	2679
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.42		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.44		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.46		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.48		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.50		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.52		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.54		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.56		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.58		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.60		2.38	5.98	#DIV/0!	#DIV/0!
		0.62		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.64		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.66		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.68		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.70		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.72		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.74		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.76		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.78		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.80		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data

Ring Constant = 0.6954 lb/div

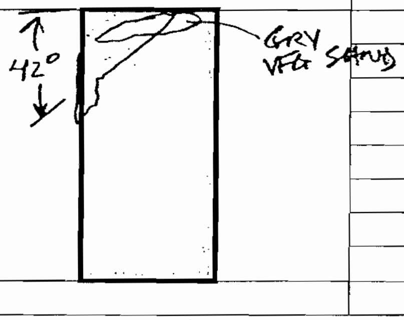
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 39.0

Sample Diameter: 2.38
Sample Length: 5.98
Wet Wt./Dry Wt.: 943.7W/
Description: V DK GRY CLAYSTONE

F-28

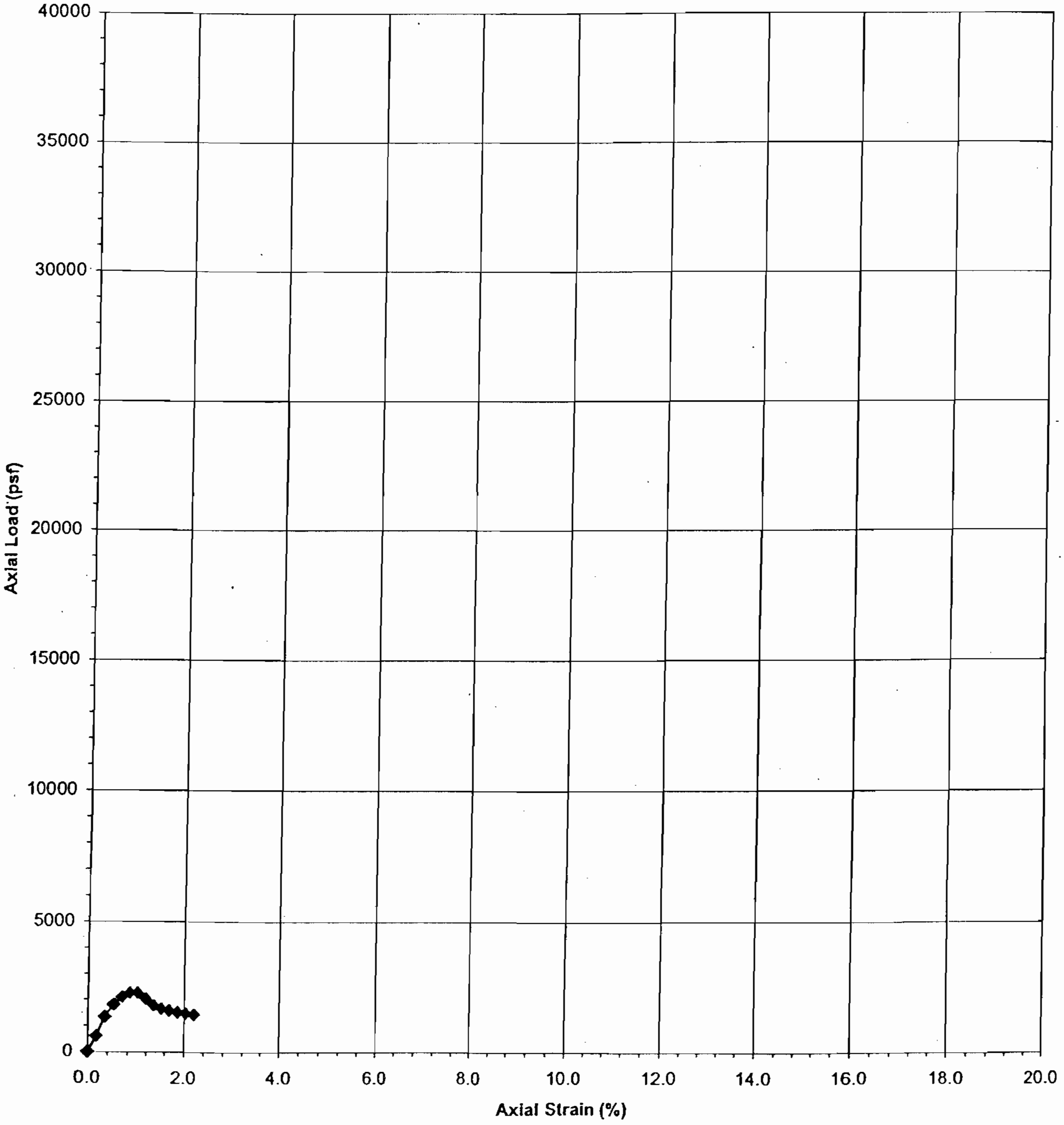
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.02	36	0.52	
0.04	107	0.54	
0.06	175	0.56	
0.08	212	0.58	
0.10	224	0.60	
0.12	213	0.62	
0.14	182	0.64	
0.16	141	0.66	
0.18	128	0.68	
0.20	121	0.70	
0.22	119	0.72	
0.24		0.74	
0.26		0.76	
0.28		0.78	
0.30		0.80	
0.32		0.82	
0.34		0.84	
0.36		0.86	
0.38		0.88	
0.40		0.90	
0.42		0.92	
0.44		0.94	
0.46		0.96	
0.48		0.98	
0.50		1.00	

Sketch of Sample After Test:



Comments: SLICKENSIDED/POLISHED BREAK
2.5Y 2.5/1 BLACK TO 2.5Y 3/1 V DK GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 44.0'
V Dk Gry Weathered Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 44.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.92	0.00	0	0.00	0	0.0	0
2.39	5.92	0.01	27	18.78	603	0.2	603
2.39	5.92	0.02	60	41.72	1339	0.3	1339
2.39	5.92	0.03	81	56.33	1808	0.5	1808
2.39	5.92	0.04	94	65.37	2098	0.7	2098
2.39	5.92	0.05	101	70.24	2254	0.8	2254
2.39	5.92	0.06	101	70.24	2254	1.0	2254
2.39	5.92	0.07	91	63.28	2031	1.2	2031
2.39	5.92	0.08	80	55.63	1786	1.4	1786
2.39	5.92	0.09	74	51.46	1652	1.5	1652
2.39	5.92	0.10	71	49.37	1585	1.7	1585
2.39	5.92	0.11	68	47.29	1518	1.9	1518
2.39	5.92	0.12	66	45.90	1473	2.0	1473
2.39	5.92	0.13	64	44.51	1429	2.2	1429
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

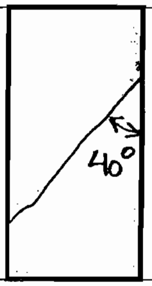
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 44.0

Sample Diameter: 2.39
Sample Length: 5.92
Wet Wt./Dry Wt.: GRY
Description: VDK CLAYSTONE
w/TR VFG SAND

F-68

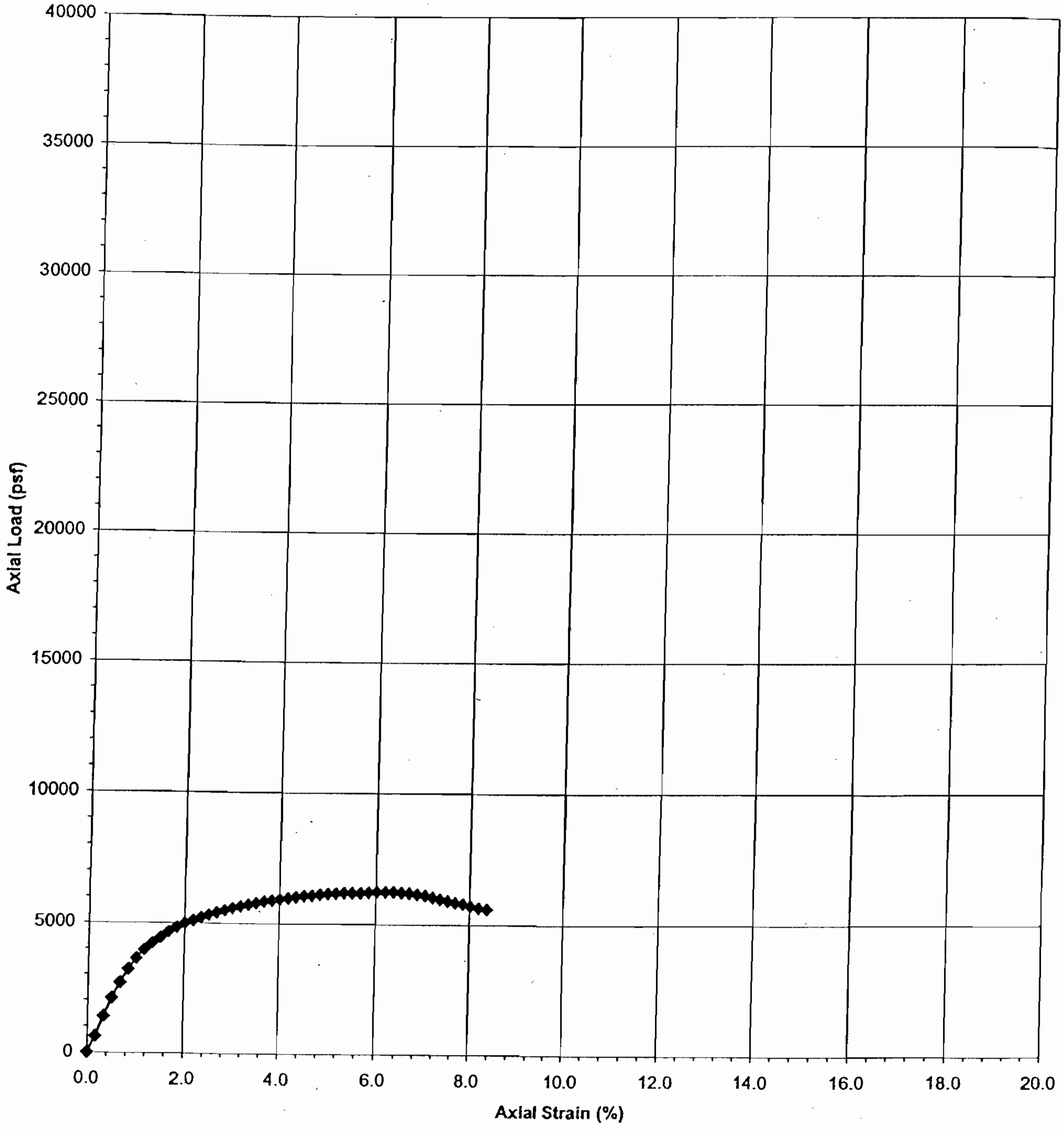
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	27	0.26	
0.02	60	0.27	
0.03	81	0.28	
0.04	94	0.29	
0.05	101	0.30	
0.06	101	0.31	
0.07	91	0.32	
0.08	80	0.33	
0.09	74	0.34	
0.10	71	0.35	
0.11	68	0.36	
0.12	66	0.37	
0.13	64	0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED BREAK LINEAR

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 49.0'
V Dk Gry/Blk Weathered Claystone w/Sand Lenses



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	49.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	5.98	0.00	0	0.00	0	0.0	0
2.41	5.98	0.01	28	19.47	615	0.2	615
2.41	5.98	0.02	63	43.81	1383	0.3	1383
2.41	5.98	0.03	95	66.06	2085	0.5	2085
2.41	5.98	0.04	122	84.84	2678	0.7	2678
2.41	5.98	0.05	146	101.53	3205	0.8	3205
2.41	5.98	0.06	165	114.74	3622	1.0	3622
2.41	5.98	0.07	180	125.17	3951	1.2	3951
2.41	5.98	0.08	192	133.52	4215	1.3	4215
2.41	5.98	0.09	202	140.47	4434	1.5	4434
2.41	5.98	0.10	212	147.42	4654	1.7	4654
2.41	5.98	0.11	220	152.99	4829	1.8	4829
2.41	5.98	0.12	227	157.86	4983	2.0	4983
2.41	5.98	0.13	232	161.33	5093	2.2	5093
2.41	5.98	0.14	237	164.81	5203	2.3	5203
2.41	5.98	0.15	242	168.29	5312	2.5	5312
2.41	5.98	0.16	246	171.07	5400	2.7	5400
2.41	5.98	0.17	250	173.85	5488	2.8	5488
2.41	5.98	0.18	254	176.63	5576	3.0	5576
2.41	5.98	0.19	257	178.72	5642	3.2	5642
2.41	5.98	0.20	260	180.80	5707	3.3	5707
2.41	5.98	0.21	263	182.89	5773	3.5	5773
2.41	5.98	0.22	266	184.98	5839	3.7	5839
2.41	5.98	0.23	268	186.37	5883	3.8	5883
2.41	5.98	0.24	270	187.76	5927	4.0	5927
2.41	5.98	0.25	272	189.15	5971	4.2	5971
2.41	5.98	0.26	274	190.54	6015	4.3	6015
2.41	5.98	0.27	276	191.93	6059	4.5	6059
2.41	5.98	0.28	277	192.63	6081	4.7	6081
2.41	5.98	0.29	279	194.02	6125	4.8	6125
2.41	5.98	0.30	280	194.71	6147	5.0	6147
2.41	5.98	0.31	281	195.41	6168	5.2	6168
2.41	5.98	0.32	282	196.10	6190	5.4	6190
2.41	5.98	0.33	282	196.10	6190	5.5	6190
2.41	5.98	0.34	282	196.10	6190	5.7	6190
2.41	5.98	0.35	283	196.80	6212	5.9	6212
2.41	5.98	0.36	284	197.49	6234	6.0	6234
2.41	5.98	0.37	284	197.49	6234	6.2	6234
2.41	5.98	0.38	284	197.49	6234	6.4	6234
2.41	5.98	0.39	283	196.80	6212	6.5	6212
2.41	5.98	0.40	282	196.10	6190	6.7	6190

2.41	5.98	0.41	280	194.71	6147	6.9	6147
2.41	5.98	0.42	278	193.32	6103	7.0	6103
2.41	5.98	0.43	275	191.24	6037	7.2	6037
2.41	5.98	0.44	272	189.15	5971	7.4	5971
2.41	5.98	0.45	269	187.06	5905	7.5	5905
2.41	5.98	0.46	266	184.98	5839	7.7	5839
2.41	5.98	0.47	264	183.59	5795	7.9	5795
2.41	5.98	0.48	260	180.80	5707	8.0	5707
2.41	5.98	0.49	257	178.72	5642	8.2	5642
2.41	5.98	0.50	255	177.33	5598	8.4	5598

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

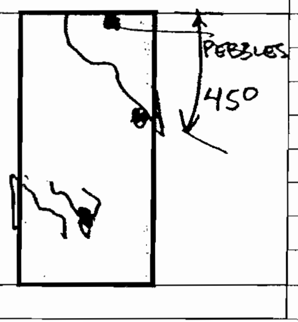
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 49.0'

Sample Diameter: 2.41
Sample Length: 5.98
Wet Wt./Dry Wt.:
Description: VDK GRY/BLK CLAYSTONE W/SAND LUMPS <¼" AND PEBBLES <½"

F-62

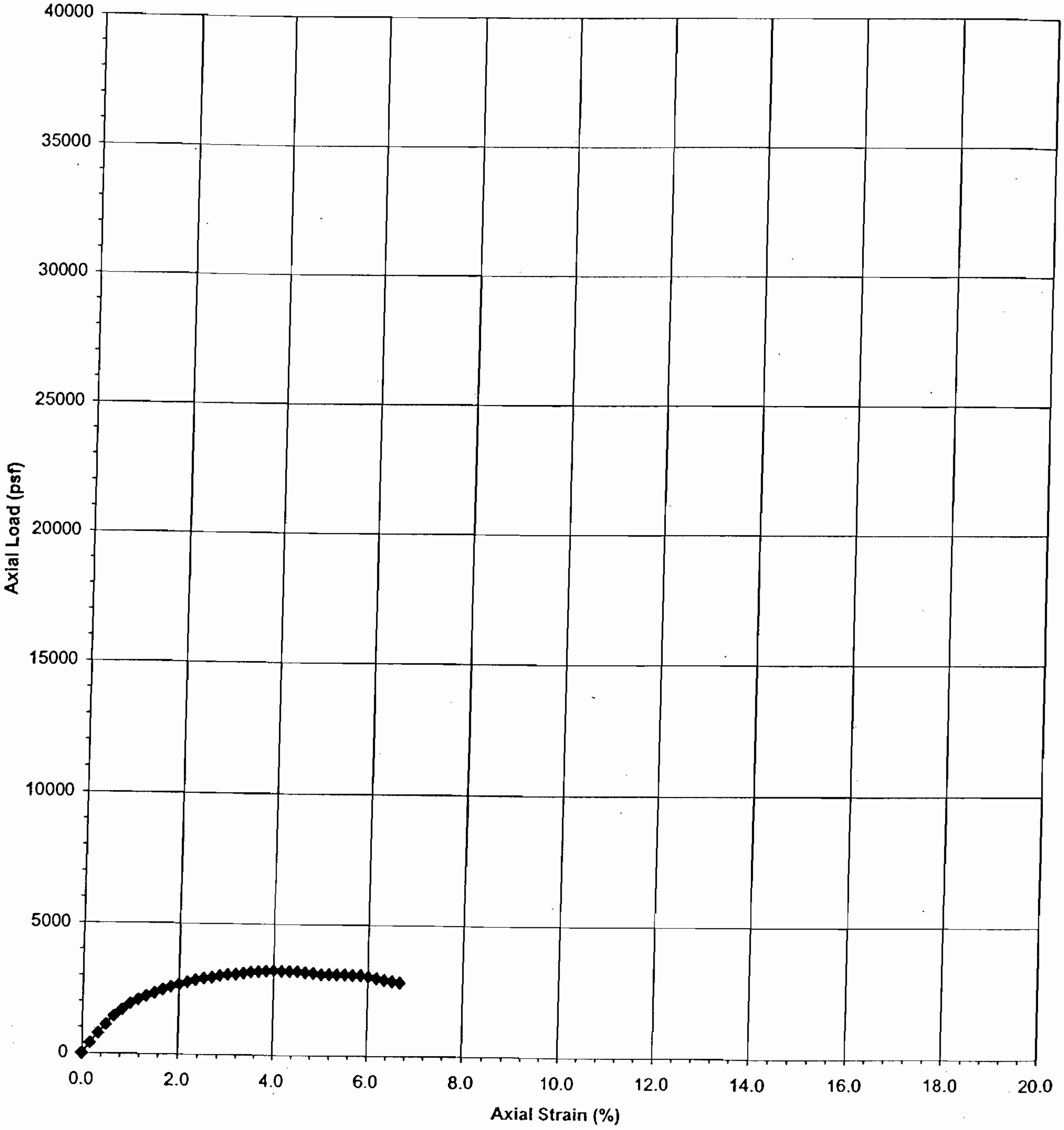
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	28	0.26	274
0.02	63	0.27	276
0.03	95	0.28	277
0.04	122	0.29	279
0.05	146	0.30	280
0.06	165	0.31	281
0.07	180	0.32	282
0.08	192	0.33	282
0.09	202	0.34	282
0.10	212	0.35	283
0.11	220	0.36	284
0.12	227	0.37	284
0.13	232	0.38	284
0.14	237	0.39	283
0.15	242	0.40	282
0.16	246	0.41	280
0.17	250	0.42	278
0.18	254	0.43	275
0.19	257	0.44	272
0.20	260	0.45	269
0.21	263	0.46	266
0.22	266	0.47	264
0.23	268	0.48	260
0.24	270	0.49	257
0.25	272	0.50	255

Sketch of Sample After Test:



Comments: 2.5Y 2.5/1 BLK ONLY MINOR POLISHING ON SHEAR PLANE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 56.0'
Blk Weathered Claystone w/VFG Sand Lenses



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 56.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.41	5.99	0.00	0	0.00	0	0.0	0
2.41	5.99	0.01	18	12.52	395	0.2	395
2.41	5.99	0.02	35	24.34	768	0.3	768
2.41	5.99	0.03	50	34.77	1098	0.5	1098
2.41	5.99	0.04	65	45.20	1427	0.7	1427
2.41	5.99	0.05	76	52.85	1668	0.8	1668
2.41	5.99	0.06	87	60.50	1910	1.0	1910
2.41	5.99	0.07	94	65.37	2063	1.2	2063
2.41	5.99	0.08	100	69.54	2195	1.3	2195
2.41	5.99	0.09	106	73.71	2327	1.5	2327
2.41	5.99	0.10	112	77.88	2459	1.7	2459
2.41	5.99	0.11	117	81.36	2568	1.8	2568
2.41	5.99	0.12	121	84.14	2656	2.0	2656
2.41	5.99	0.13	125	86.93	2744	2.2	2744
2.41	5.99	0.14	129	89.71	2832	2.3	2832
2.41	5.99	0.15	132	91.79	2898	2.5	2898
2.41	5.99	0.16	134	93.18	2942	2.7	2942
2.41	5.99	0.17	137	95.27	3007	2.8	3007
2.41	5.99	0.18	139	96.66	3051	3.0	3051
2.41	5.99	0.19	140	97.36	3073	3.2	3073
2.41	5.99	0.20	142	98.75	3117	3.3	3117
2.41	5.99	0.21	144	100.14	3161	3.5	3161
2.41	5.99	0.22	145	100.83	3183	3.7	3183
2.41	5.99	0.23	146	101.53	3205	3.8	3205
2.41	5.99	0.24	147	102.22	3227	4.0	3227
2.41	5.99	0.25	146	101.53	3205	4.2	3205
2.41	5.99	0.26	146	101.53	3205	4.3	3205
2.41	5.99	0.27	146	101.53	3205	4.5	3205
2.41	5.99	0.28	144	100.14	3161	4.7	3161
2.41	5.99	0.29	143	99.44	3139	4.8	3139
2.41	5.99	0.30	141	98.05	3095	5.0	3095
2.41	5.99	0.31	141	98.05	3095	5.2	3095
2.41	5.99	0.32	141	98.05	3095	5.3	3095
2.41	5.99	0.33	141	98.05	3095	5.5	3095
2.41	5.99	0.34	140	97.36	3073	5.7	3073
2.41	5.99	0.35	140	97.36	3073	5.8	3073
2.41	5.99	0.36	138	95.97	3029	6.0	3029
2.41	5.99	0.37	135	93.88	2964	6.2	2964
2.41	5.99	0.38	132	91.79	2898	6.3	2898
2.41	5.99	0.39	130	90.40	2854	6.5	2854
2.41	5.99	0.40	128	89.01	2810	6.7	2810

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

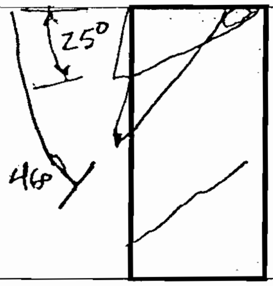
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. #: 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 56.0'

Sample Diameter: 2.41
Sample Length: 5.99
Wet Wt./Dry Wt.:
Description: BLK WEATH CLAYSTONE W/VFG SAND LENSES < 1/4"

F-23

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	18	0.26	146
0.02	35	0.27	146
0.03	50	0.28	144
0.04	65	0.29	143
0.05	76	0.30	141
0.06	87	0.31	141
0.07	94	0.32	141
0.08	100	0.33	141
0.09	106	0.34	140
0.10	112	0.35	140
0.11	117	0.36	138
0.12	121	0.37	135
0.13	125	0.38	132
0.14	129	0.39	130
0.15	132	0.40	128
0.16	134	0.41	
0.17	137	0.42	
0.18	139	0.43	
0.19	140	0.44	
0.20	142	0.45	
0.21	144	0.46	
0.22	145	0.47	
0.23	146	0.48	
0.24	147	0.49	
0.25	146	0.50	

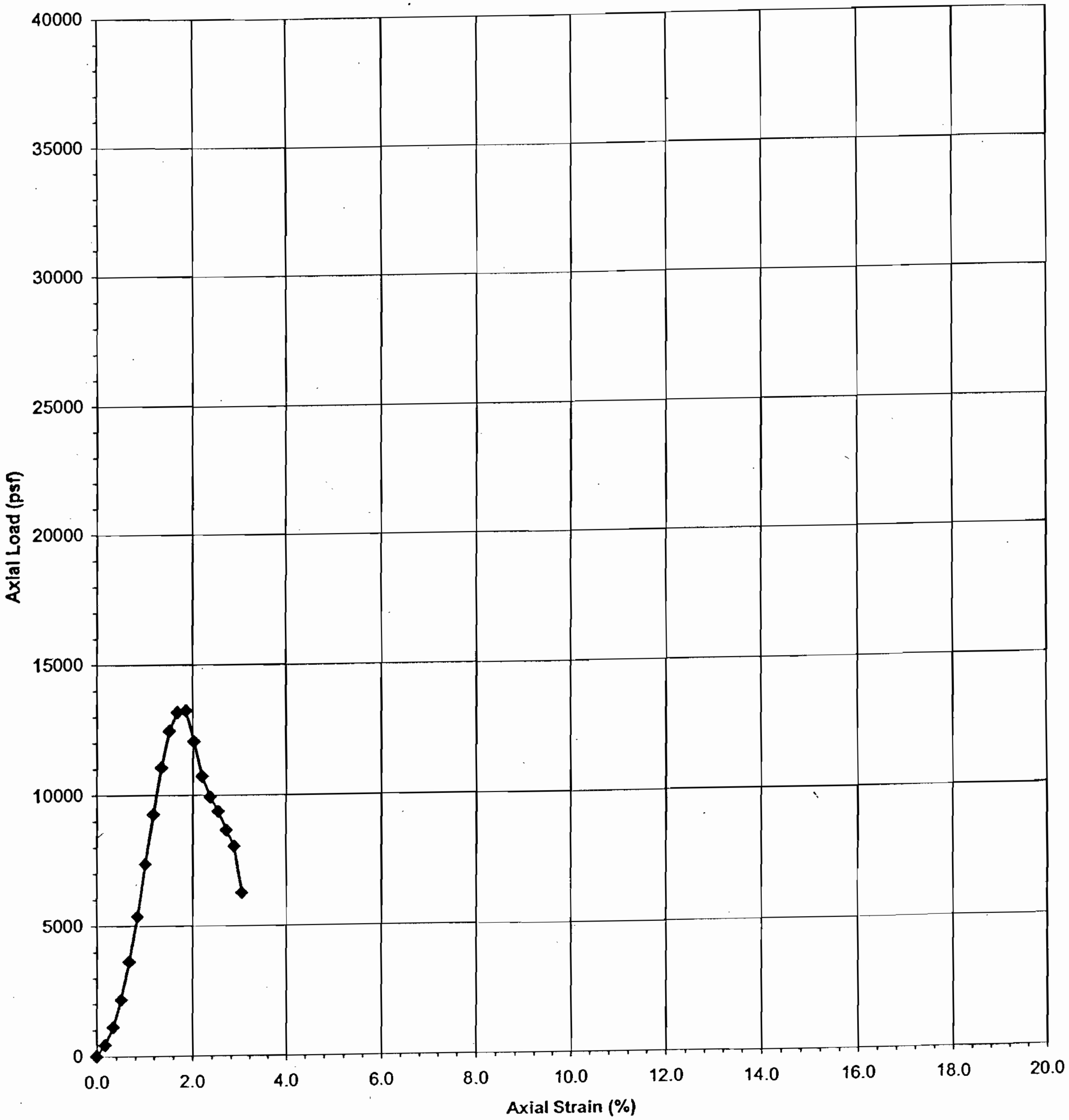
Sketch of Sample After Test:



Comments: 2.5Y 2.5/1 W/FINE MICA/PYRITE IN FINE SAND LENSES
POLISHED SHEAR SURFACE

Unconfined Compression Test Results

Vasco Road, Project 001860
Boring B-4 @ 64.5'
Dk Grn Gry and Grn Gry Weathered Clayey Sandstone/Sandy Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 64.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.92	0.00	0	0.00	0	0.0	0
2.39	5.92	0.01	19	13.21	424	0.2	424
2.39	5.92	0.02	50	34.77	1116	0.3	1116
2.39	5.92	0.03	97	67.45	2165	0.5	2165
2.39	5.92	0.04	163	113.35	3638	0.7	3638
2.39	5.92	0.05	240	166.90	5357	0.8	5357
2.39	5.92	0.06	330	229.48	7366	1.0	7366
2.39	5.92	0.07	415	288.59	9263	1.2	9263
2.39	5.92	0.08	495	344.22	11049	1.4	11049
2.39	5.92	0.09	558	388.03	12455	1.5	12455
2.39	5.92	0.10	590	410.29	13169	1.7	13169
2.39	5.92	0.11	593	412.37	13236	1.9	13236
2.39	5.92	0.12	540	375.52	12053	2.0	12053
2.39	5.92	0.13	480	333.79	10714	2.2	10714
2.39	5.92	0.14	445	309.45	9933	2.4	9933
2.39	5.92	0.15	420	292.07	9375	2.5	9375
2.39	5.92	0.16	388	269.82	8660	2.7	8660
2.39	5.92	0.17	360	250.34	8036	2.9	8036
2.39	5.92	0.18	280	194.71	6250	3.0	6250
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 64.5

Sample Diameter: 2.39
Sample Length: 5.92
Wet Wt./Dry Wt.:
Description: CLAYEY SANDSTONE/SANDY CLAYSTONE, INTERBEDDED CLAYEY + SANDY ZONES WITH GRAV < 1/2", DK GRN GRY + GRN GRY

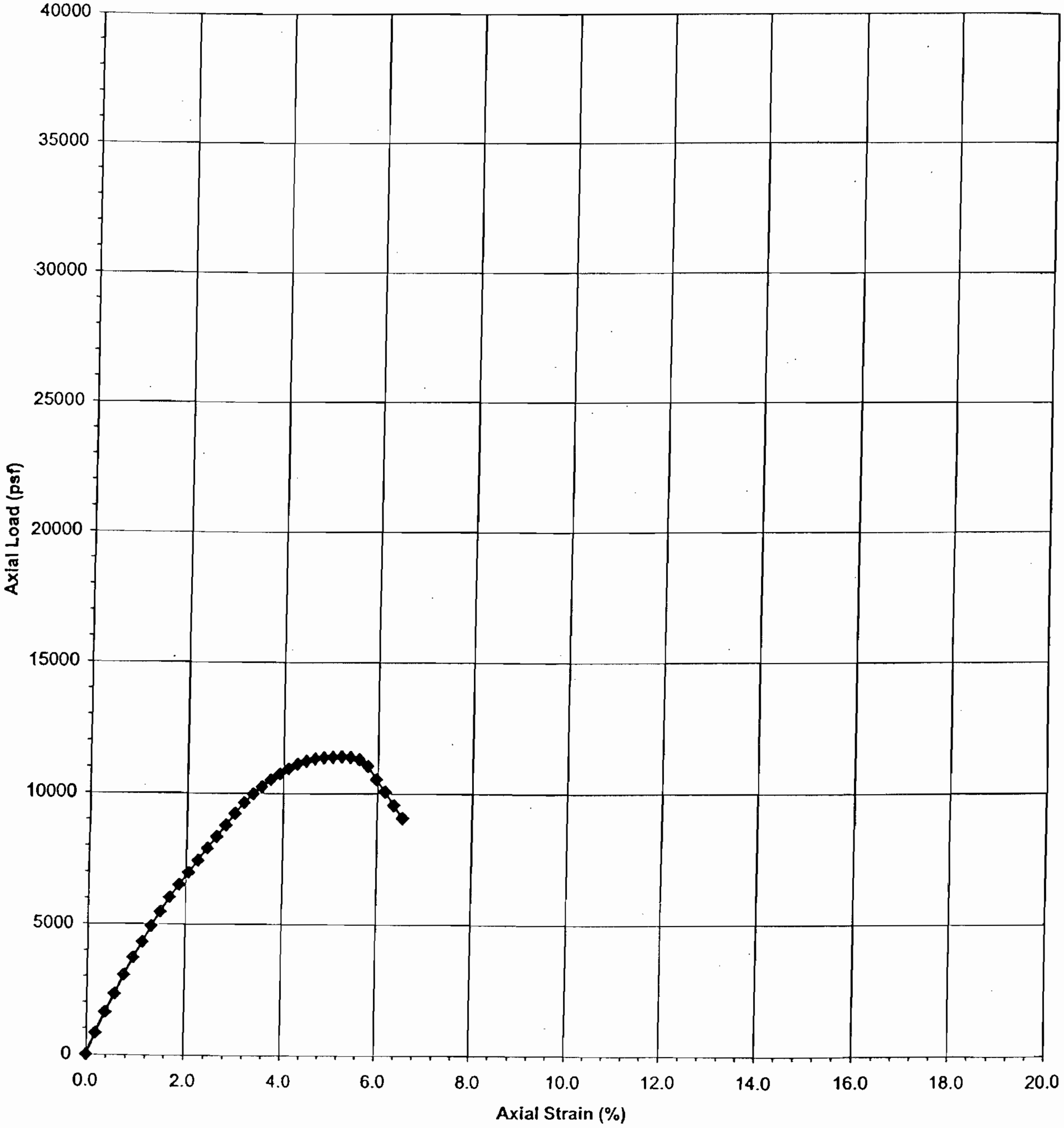
F-63

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	19		0.26	
0.02	50		0.27	
0.03	97		0.28	
0.04	163		0.29	
0.05	240		0.30	
0.06	330		0.31	
0.07	415		0.32	
0.08	495		0.33	
0.09	558		0.34	
0.10	590		0.35	
0.11	593	97	0.36	
0.12	540		0.37	
0.13	480		0.38	
0.14	445		0.39	
0.15	420		0.40	
0.16	388		0.41	
0.17	360		0.42	
0.18	280		0.43	
0.19			0.44	
0.20			0.45	
0.21			0.46	
0.22			0.47	
0.23			0.48	
0.24			0.49	
0.25			0.50	

Sketch of Sample After Test:

Comments: NO POLISHED SHEAR SURFACE
5G 4/1 DK GRN GRY + 10Y 5/1 GRN GRY

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 66.5'
Dk Grn Gry Weathered Sandy Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 66.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.40	5.36	0.00	0	0.00	0	0.0	0
2.40	5.36	0.01	37	25.73	819	0.2	819
2.40	5.36	0.02	73	50.76	1616	0.4	1616
2.40	5.36	0.03	105	73.02	2324	0.6	2324
2.40	5.36	0.04	138	95.97	3055	0.7	3055
2.40	5.36	0.05	168	116.83	3719	0.9	3719
2.40	5.36	0.06	195	135.60	4316	1.1	4316
2.40	5.36	0.07	222	154.38	4914	1.3	4914
2.40	5.36	0.08	247	171.76	5467	1.5	5467
2.40	5.36	0.09	272	189.15	6021	1.7	6021
2.40	5.36	0.10	294	204.45	6508	1.9	6508
2.40	5.36	0.11	315	219.05	6973	2.1	6973
2.40	5.36	0.12	336	233.65	7437	2.2	7437
2.40	5.36	0.13	357	248.26	7902	2.4	7902
2.40	5.36	0.14	377	262.17	8345	2.6	8345
2.40	5.36	0.15	397	276.07	8788	2.8	8788
2.40	5.36	0.16	417	289.98	9230	3.0	9230
2.40	5.36	0.17	436	303.19	9651	3.2	9651
2.40	5.36	0.18	451	313.63	9983	3.4	9983
2.40	5.36	0.19	463	321.97	10249	3.5	10249
2.40	5.36	0.20	475	330.32	10514	3.7	10514
2.40	5.36	0.21	485	337.27	10736	3.9	10736
2.40	5.36	0.22	494	343.53	10935	4.1	10935
2.40	5.36	0.23	502	349.09	11112	4.3	11112
2.40	5.36	0.24	507	352.57	11223	4.5	11223
2.40	5.36	0.25	511	355.35	11311	4.7	11311
2.40	5.36	0.26	513	356.74	11355	4.9	11355
2.40	5.36	0.27	514	357.44	11378	5.0	11378
2.40	5.36	0.28	515	358.13	11400	5.2	11400
2.40	5.36	0.29	514	357.44	11378	5.4	11378
2.40	5.36	0.30	510	354.65	11289	5.6	11289
2.40	5.36	0.31	499	347.00	11045	5.8	11045
2.40	5.36	0.32	476	331.01	10536	6.0	10536
2.40	5.36	0.33	455	316.41	10072	6.2	10072
2.40	5.36	0.34	432	300.41	9562	6.3	9562
2.40	5.36	0.35	410	285.11	9075	6.5	9075
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

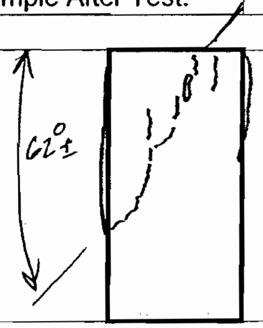
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 66.5

Sample Diameter: 2.40
Sample Length: 5.36
Wet Wt./Dry Wt.:
Description: DKGRNGRY SANDY CLAYSTONE, VFG, TR FG + CG

F-99

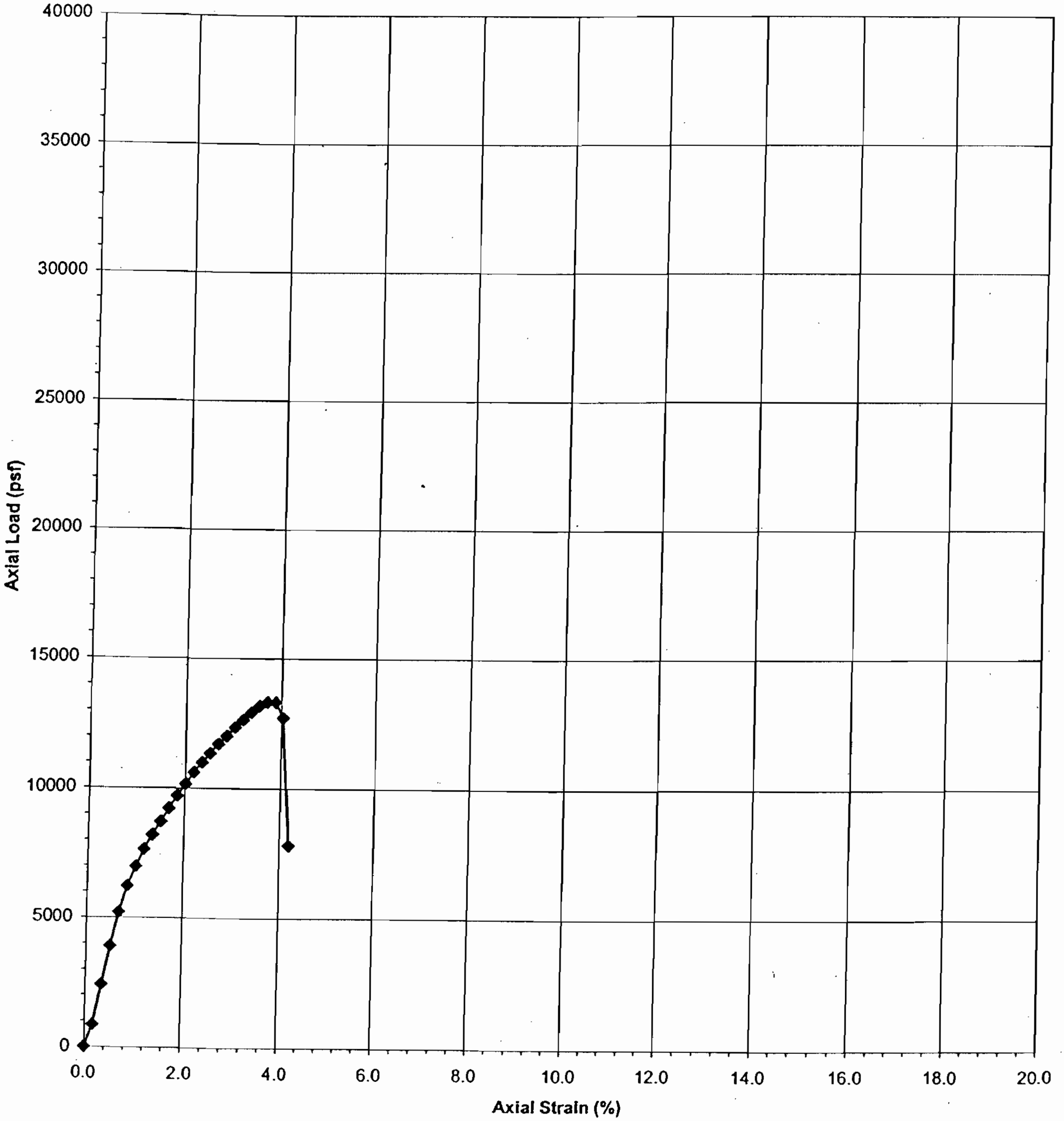
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	
0.01	37	0.26		513
0.02	73	0.27		514
0.03	105	0.28		515
0.04	138	0.29		514
0.05	168	0.30		510
0.06	195	0.31		499
0.07	222	0.32		476
0.08	247	0.33		455
0.09	272	0.34		432
0.10	294	0.35		410
0.11	315	0.36		
0.12	336	0.37		
0.13	357	0.38		
0.14	377	0.39		
0.15	397	0.40		
0.16	417	0.41		
0.17	436	0.42		
0.18	451	0.43		
0.19	463	0.44		
0.20	475	0.45		
0.21	485	0.46		
0.22	494	0.47		
0.23	502	0.48		
0.24	507	0.49		
0.25	511	0.50		

Sketch of Sample After Test:



Comments: NO POLISHED SHEAR SURFACE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 70.5'
Dk Grn Gry Weathered Sandy Claystone w/ VFG Sand Lens



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	70.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.95	0.00	0	0.00	0	0.0	0
2.39	5.95	0.01	38	26.43	848	0.2	848
2.39	5.95	0.02	108	75.10	2411	0.3	2411
2.39	5.95	0.03	175	121.70	3906	0.5	3906
2.39	5.95	0.04	233	162.03	5201	0.7	5201
2.39	5.95	0.05	278	193.32	6205	0.8	6205
2.39	5.95	0.06	312	216.96	6964	1.0	6964
2.39	5.95	0.07	342	237.83	7634	1.2	7634
2.39	5.95	0.08	367	255.21	8192	1.3	8192
2.39	5.95	0.09	390	271.21	8705	1.5	8705
2.39	5.95	0.10	413	287.20	9219	1.7	9219
2.39	5.95	0.11	435	302.50	9710	1.8	9710
2.39	5.95	0.12	455	316.41	10156	2.0	10156
2.39	5.95	0.13	475	330.32	10602	2.2	10602
2.39	5.95	0.14	492	342.14	10982	2.4	10982
2.39	5.95	0.15	508	353.26	11339	2.5	11339
2.39	5.95	0.16	524	364.39	11696	2.7	11696
2.39	5.95	0.17	538	374.13	12009	2.9	12009
2.39	5.95	0.18	553	384.56	12343	3.0	12343
2.39	5.95	0.19	566	393.60	12634	3.2	12634
2.39	5.95	0.20	579	402.64	12924	3.4	12924
2.39	5.95	0.21	590	410.29	13169	3.5	13169
2.39	5.95	0.22	597	415.15	13326	3.7	13326
2.39	5.95	0.23	597	415.15	13326	3.9	13326
2.39	5.95	0.24	570	396.38	12723	4.0	12723
2.39	5.95	0.25	350	243.39	7812	4.2	7812
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

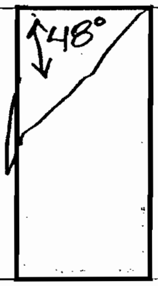
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 70.5'

Sample Diameter: 2.39
Sample Length: 5.95
Wet Wt./Dry Wt.:
Description: DK GRNGRY SANDY CLAYSTONE ½" VFG SAND LENS IN UPPER 2"

F-20

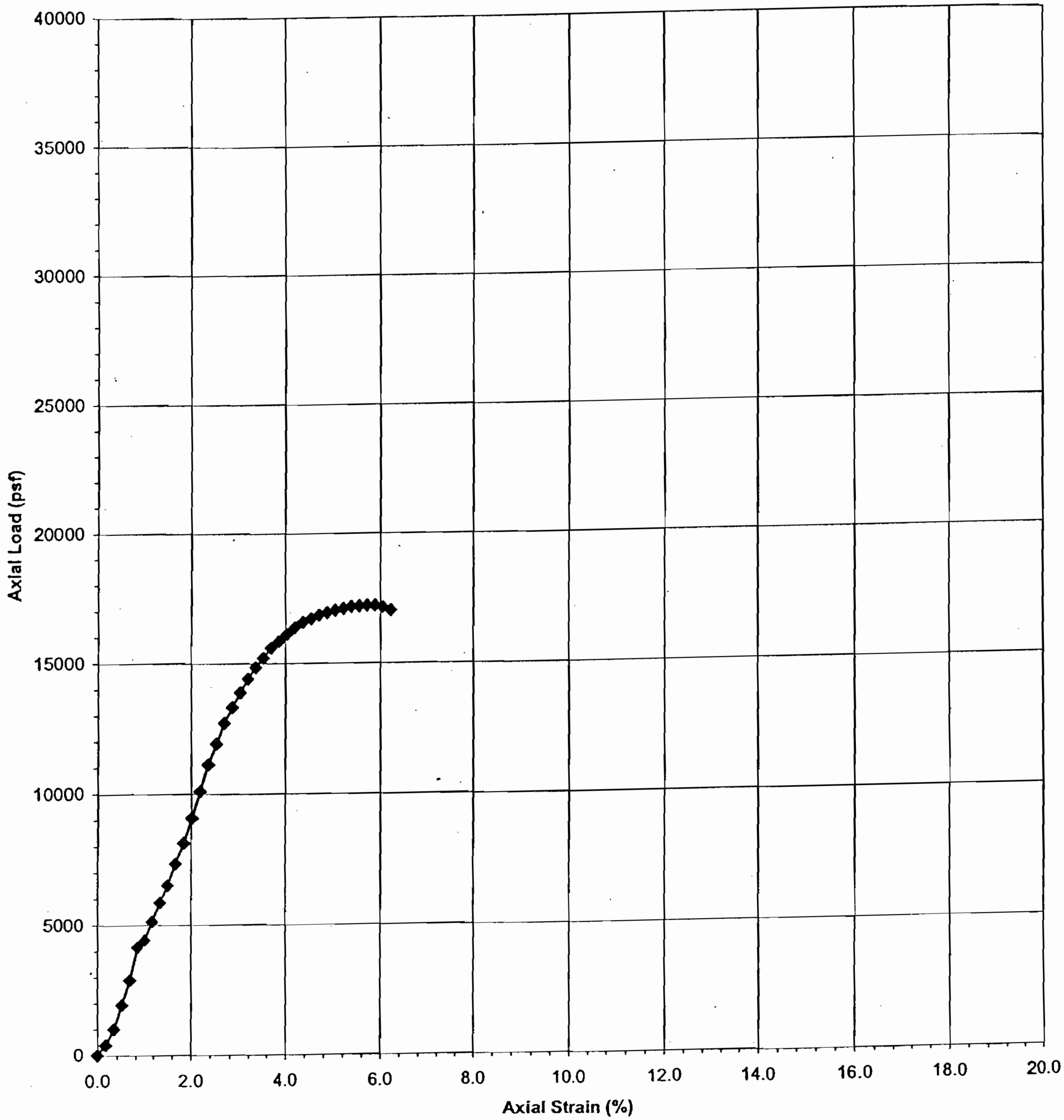
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	38	0.26	
0.02	108	0.27	
0.03	175	0.28	
0.04	233	0.29	
0.05	278	0.30	
0.06	312	0.31	
0.07	342	0.32	
0.08	367	0.33	
0.09	390	0.34	
0.10	413	0.35	
0.11	435	0.36	
0.12	455	0.37	
0.13	475	0.38	
0.14	492	0.39	
0.15	508	0.40	
0.16	524	0.41	
0.17	538	0.42	
0.18	553	0.43	
0.19	566	0.44	
0.20	579	0.45	
0.21	590	0.46	
0.22	597	0.47	
0.23	597	0.48	
0.24	570	0.49	
0.25	350	0.50	

Sketch of Sample After Test:



Comments:
5G 4/1

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 75.5'
Dk Grn Gry Weathered Sandy Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	75.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.37	5.95	0.00	0	0.00	0	0.0	0
2.37	5.95	0.01	17	11.82	386	0.2	386
2.37	5.95	0.02	44	30.60	999	0.3	999
2.37	5.95	0.03	85	59.11	1929	0.5	1929
2.37	5.95	0.04	127	88.32	2883	0.7	2883
2.37	5.95	0.05	183	127.26	4154	0.8	4154
2.37	5.95	0.06	195	135.60	4426	1.0	4426
2.37	5.95	0.07	226	157.16	5130	1.2	5130
2.37	5.95	0.08	258	179.41	5856	1.3	5856
2.37	5.95	0.09	287	199.58	6515	1.5	6515
2.37	5.95	0.10	323	224.61	7332	1.7	7332
2.37	5.95	0.11	358	248.95	8126	1.8	8126
2.37	5.95	0.12	400	278.16	9080	2.0	9080
2.37	5.95	0.13	445	309.45	10101	2.2	10101
2.37	5.95	0.14	490	340.75	11123	2.4	11123
2.37	5.95	0.15	525	365.09	11917	2.5	11917
2.37	5.95	0.16	560	389.42	12712	2.7	12712
2.37	5.95	0.17	587	408.20	13324	2.9	13324
2.37	5.95	0.18	612	425.58	13892	3.0	13892
2.37	5.95	0.19	635	441.58	14414	3.2	14414
2.37	5.95	0.20	654	454.79	14845	3.4	14845
2.37	5.95	0.21	670	465.92	15208	3.5	15208
2.37	5.95	0.22	687	477.74	15594	3.7	15594
2.37	5.95	0.23	698	485.39	15844	3.9	15844
2.37	5.95	0.24	710	493.73	16116	4.0	16116
2.37	5.95	0.25	721	501.38	16366	4.2	16366
2.37	5.95	0.26	730	507.64	16570	4.4	16570
2.37	5.95	0.27	736	511.81	16707	4.5	16707
2.37	5.95	0.28	742	515.99	16843	4.7	16843
2.37	5.95	0.29	746	518.77	16934	4.9	16934
2.37	5.95	0.30	750	521.55	17024	5.0	17024
2.37	5.95	0.31	753	523.64	17092	5.2	17092
2.37	5.95	0.32	756	525.72	17161	5.4	17161
2.37	5.95	0.33	757	526.42	17183	5.5	17183
2.37	5.95	0.34	758	527.11	17206	5.7	17206
2.37	5.95	0.35	758	527.11	17206	5.9	17206
2.37	5.95	0.36	755	525.03	17138	6.1	17138
2.37	5.95	0.37	750	521.55	17024	6.2	17024
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

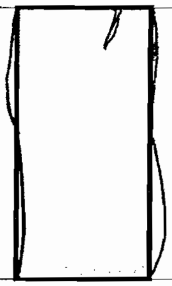
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 75.5

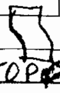
Sample Diameter: 2.37
Sample Length: 5.95
Wet Wt./Dry Wt.:
Description: DK GRN GRY SANDY CLAYSTONE, VFG W/TR CG

F-64

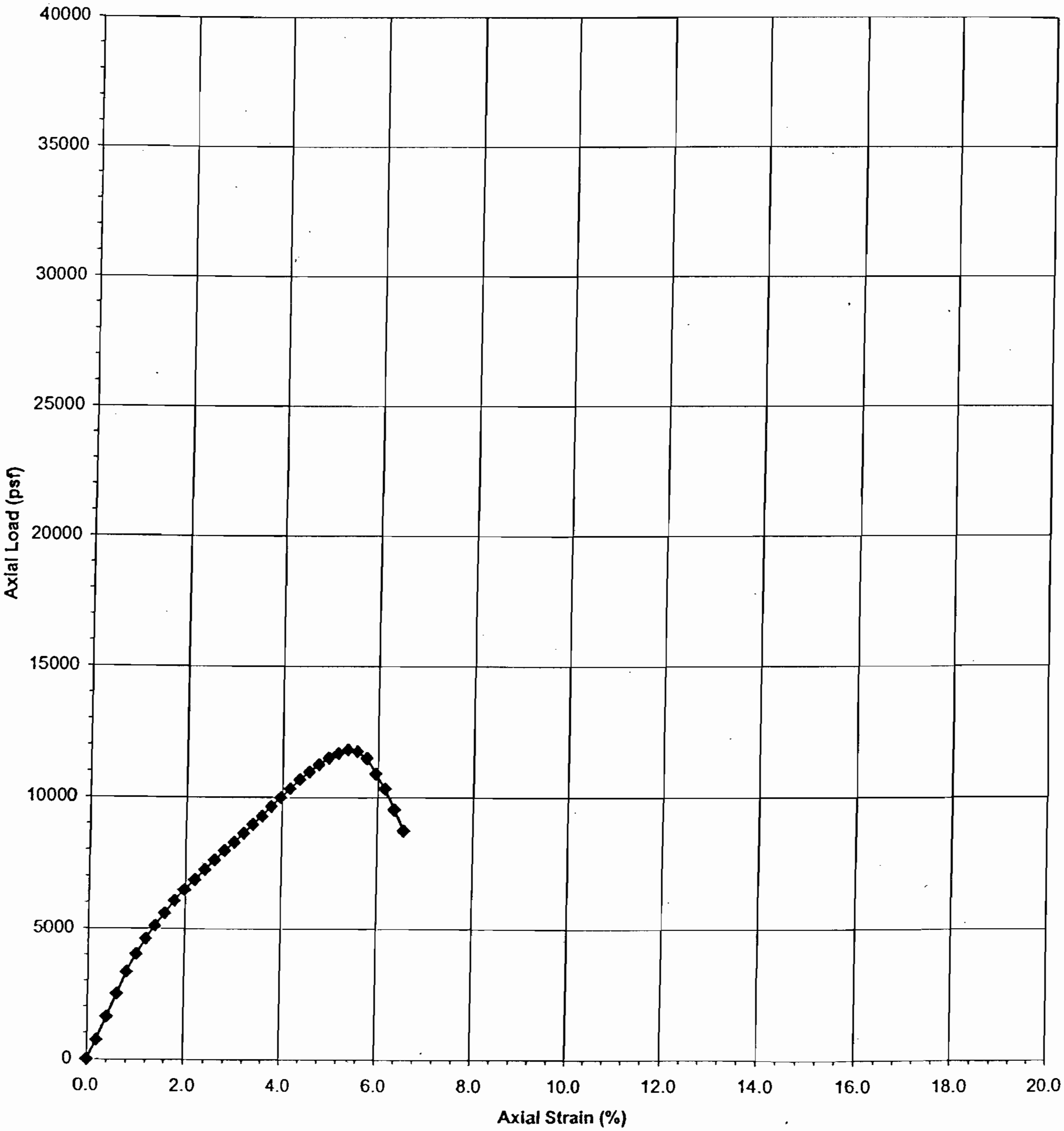
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	
0.01	17	0.26	730	
0.02	44	0.27	736	
0.03	85	0.28	742	
0.04	127	0.29	746	
0.05	183	0.30	750	
0.06	195	0.31	753	
0.07	226	0.32	756	
0.08	258	0.33	757	
0.09	287	0.34	758	
0.10	323	0.35	758	
0.11	358	0.36	755	✓ GOOD
0.12	400	0.37	750	✓ GOOD
0.13	445	0.38		
0.14	490	0.39		
0.15	525	0.40		
0.16	560	0.41		
0.17	587	0.42		
0.18	612	0.43		
0.19	635	0.44		
0.20	654	0.45		
0.21	670	0.46		
0.22	687	0.47		
0.23	698	0.48		
0.24	710	0.49		
0.25	721	0.50		

Sketch of Sample After Test:



Comments: SAMPLE DEFORMING  ONLY ONE SMALL CRACK
SG 4/1 TEST STOPPED GAUGE OUT OF ALIGN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 79.5'
Dk Grn Gry Weathered Sandy Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/12/2001
BORING: B-4
DEPTH: 79.5'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.37	5.04	0.00	0	0.00	0	0.0	0
2.37	5.04	0.01	32	22.25	726	0.2	726
2.37	5.04	0.02	71	49.37	1612	0.4	1612
2.37	5.04	0.03	110	76.49	2497	0.6	2497
2.37	5.04	0.04	147	102.22	3337	0.8	3337
2.37	5.04	0.05	177	123.09	4018	1.0	4018
2.37	5.04	0.06	203	141.17	4608	1.2	4608
2.37	5.04	0.07	225	156.47	5107	1.4	5107
2.37	5.04	0.08	246	171.07	5584	1.6	5584
2.37	5.04	0.09	267	185.67	6061	1.8	6061
2.37	5.04	0.10	285	198.19	6469	2.0	6469
2.37	5.04	0.11	302	210.01	6855	2.2	6855
2.37	5.04	0.12	319	221.83	7241	2.4	7241
2.37	5.04	0.13	335	232.96	7604	2.6	7604
2.37	5.04	0.14	351	244.09	7967	2.8	7967
2.37	5.04	0.15	365	253.82	8285	3.0	8285
2.37	5.04	0.16	380	264.25	8626	3.2	8626
2.37	5.04	0.17	395	274.68	8966	3.4	8966
2.37	5.04	0.18	409	284.42	9284	3.6	9284
2.37	5.04	0.19	425	295.55	9647	3.8	9647
2.37	5.04	0.20	440	305.98	9988	4.0	9988
2.37	5.04	0.21	455	316.41	10328	4.2	10328
2.37	5.04	0.22	470	326.84	10669	4.4	10669
2.37	5.04	0.23	483	335.88	10964	4.6	10964
2.37	5.04	0.24	495	344.22	11236	4.8	11236
2.37	5.04	0.25	506	351.87	11486	5.0	11486
2.37	5.04	0.26	514	357.44	11667	5.2	11667
2.37	5.04	0.27	520	361.61	11804	5.4	11804
2.37	5.04	0.28	517	359.52	11735	5.6	11735
2.37	5.04	0.29	506	351.87	11486	5.8	11486
2.37	5.04	0.30	480	333.79	10896	6.0	10896
2.37	5.04	0.31	455	316.41	10328	6.2	10328
2.37	5.04	0.32	420	292.07	9534	6.3	9534
2.37	5.04	0.33	385	267.73	8739	6.5	8739
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

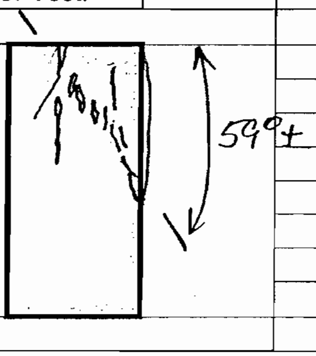
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 79.5'

Sample Diameter: 2.37
Sample Length: 5.04
Wet Wt./Dry Wt.:
Description: DK GRN GRY SANDY CLAYSTONE, VFG-FG

F-22

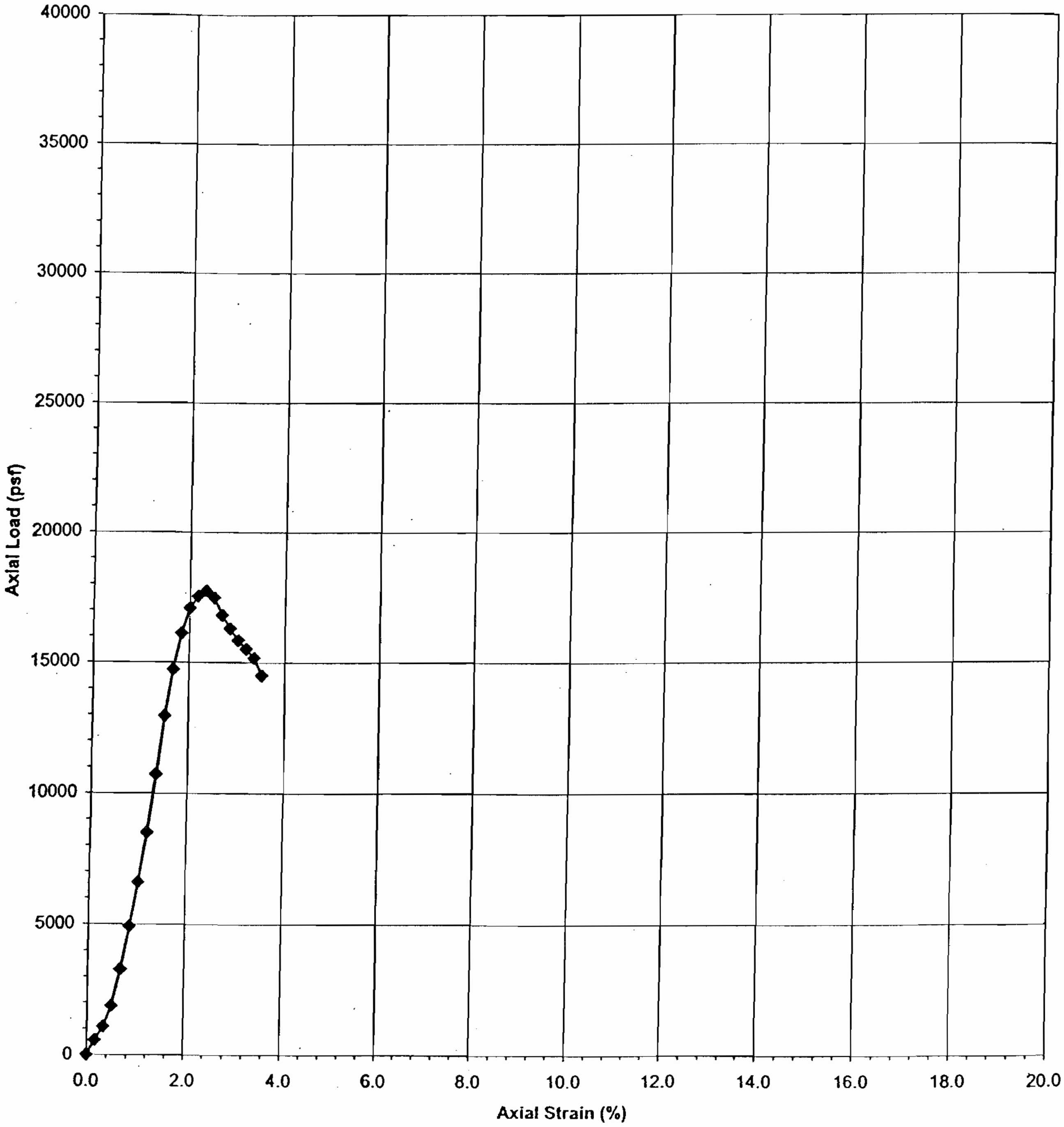
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	32	0.26	514
0.02	71	0.27	520
0.03	110	0.28	517
0.04	147	0.29	506
0.05	177	0.30	480
0.06	203	0.31	455
0.07	225	0.32	420
0.08	246	0.33	385
0.09	267	0.34	
0.10	285	0.35	
0.11	302	0.36	
0.12	319	0.37	
0.13	335	0.38	
0.14	351	0.39	
0.15	365	0.40	
0.16	380	0.41	
0.17	395	0.42	
0.18	409	0.43	
0.19	425	0.44	
0.20	440	0.45	
0.21	455	0.46	
0.22	470	0.47	
0.23	483	0.48	
0.24	495	0.49	
0.25	506	0.50	

Sketch of Sample After Test:



Comments: SL POLISHED SHEAR SURFACE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-4 @ 83.5'
Dk Grn Gry Weathered Sandstone and Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/12/2001						
BORING:	B-4			Ring Constant = 0.6954 lb/div			
DEPTH:	83.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.39	5.97	0.00	0	0.00	0	0.0	0
2.39	5.97	0.01	25	17.39	558	0.2	558
2.39	5.97	0.02	48	33.38	1071	0.3	1071
2.39	5.97	0.03	84	58.41	1875	0.5	1875
2.39	5.97	0.04	147	102.22	3281	0.7	3281
2.39	5.97	0.05	220	152.99	4911	0.8	4911
2.39	5.97	0.06	295	205.14	6585	1.0	6585
2.39	5.97	0.07	380	264.25	8482	1.2	8482
2.39	5.97	0.08	480	333.79	10714	1.3	10714
2.39	5.97	0.09	580	403.33	12946	1.5	12946
2.39	5.97	0.10	660	458.96	14732	1.7	14732
2.39	5.97	0.11	722	502.08	16116	1.8	16116
2.39	5.97	0.12	765	531.98	17075	2.0	17075
2.39	5.97	0.13	785	545.89	17522	2.2	17522
2.39	5.97	0.14	794	552.15	17723	2.3	17723
2.39	5.97	0.15	783	544.50	17477	2.5	17477
2.39	5.97	0.16	753	523.64	16808	2.7	16808
2.39	5.97	0.17	730	507.64	16294	2.8	16294
2.39	5.97	0.18	710	493.73	15848	3.0	15848
2.39	5.97	0.19	695	483.30	15513	3.2	15513
2.39	5.97	0.20	680	472.87	15178	3.4	15178
2.39	5.97	0.21	650	452.01	14509	3.5	14509
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

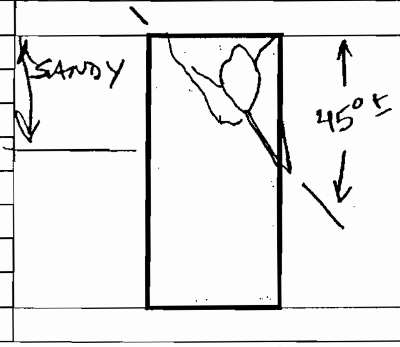
CLIENT: CAL ENGINEERING
PROJECT: VASCO RD
PROJ. # : 001860
DATE: 2/8/01
BORING: B-4
DEPTH: 83.5

Sample Diameter: 2.39
Sample Length: 5.97
Wet Wt./Dry Wt.:
Description: DK GRN GRY CLAYSTONE AND SANDSTONE, VFG-FG

F-44

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	25	0.26	180
0.02	48	0.27	
0.03	84	0.28	
0.04	147	0.29	
0.05	220	0.30	
0.06	295	0.31	
0.07	380	0.32	
0.08	480	0.33	
0.09	580	0.34	
0.10	660	0.35	
0.11	722	0.36	
0.12	765	0.37	
0.13	785	0.38	
0.14	794	0.39	
0.15	783	0.40	
0.16	753	0.41	
0.17	730	0.42	
0.18	710	0.43	
0.19	695	0.44	
0.20	680	0.45	
0.21	650	0.46	
0.22	↓	0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

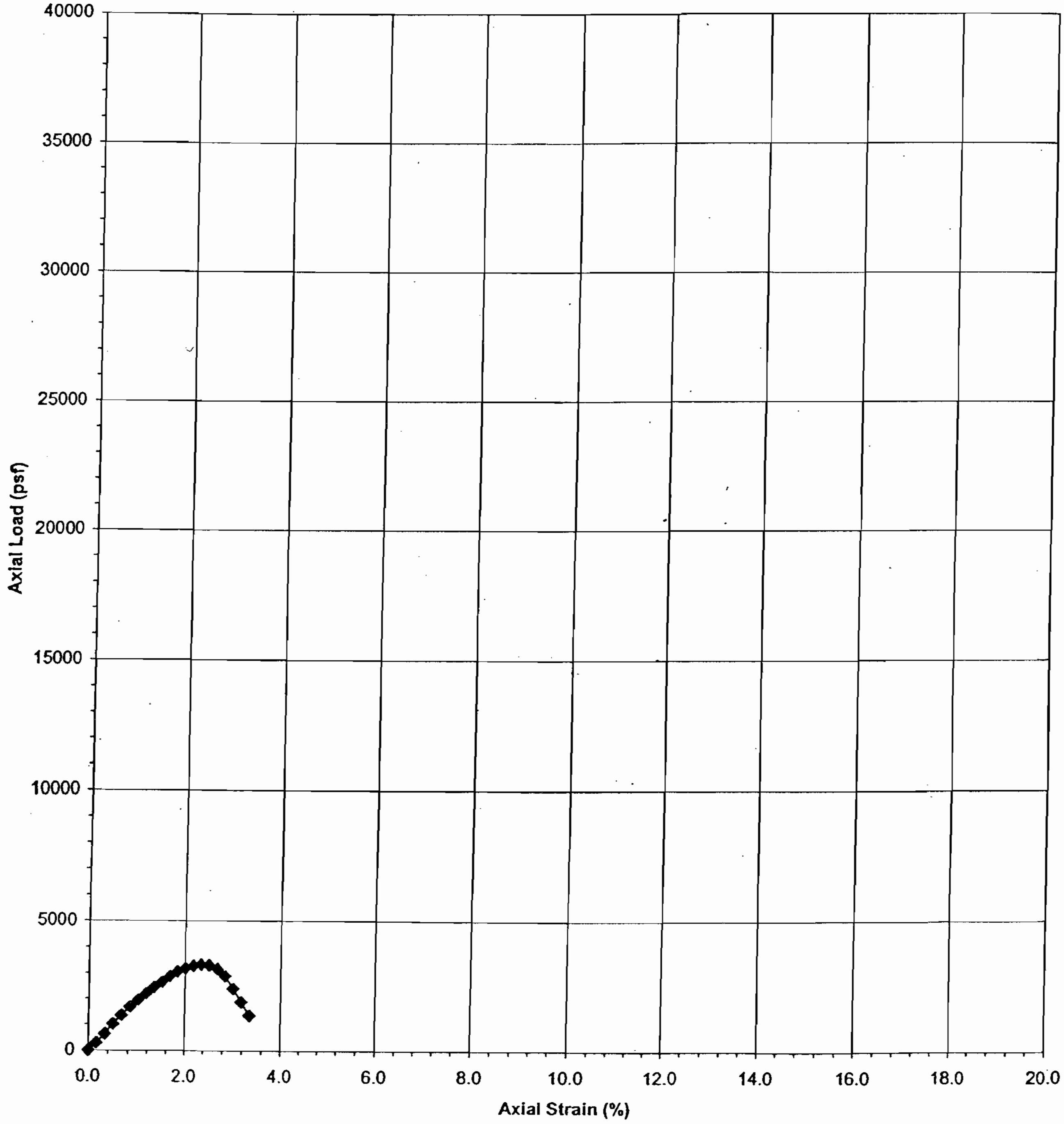
Sketch of Sample After Test:



Comments:

SG 4/1

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 8.0'
Yel Brn Mot. W/ Dk Brn and Gry Weathered Claystone w/ Wt Tuff Inclusions



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/16/2001
BORING: B-5
DEPTH: 8.0'

Ring Constant = 0.6954 lb/div

SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.38	5.97	0.00	0	0.00	0	0.0	0
2.38	5.97	0.01	13	9.04	293	0.2	293
2.38	5.97	0.02	28	19.47	630	0.3	630
2.38	5.97	0.03	45	31.29	1013	0.5	1013
2.38	5.97	0.04	60	41.72	1351	0.7	1351
2.38	5.97	0.05	74	51.46	1666	0.8	1666
2.38	5.97	0.06	86	59.80	1936	1.0	1936
2.38	5.97	0.07	97	67.45	2183	1.2	2183
2.38	5.97	0.08	108	75.10	2431	1.3	2431
2.38	5.97	0.09	117	81.36	2634	1.5	2634
2.38	5.97	0.10	127	88.32	2859	1.7	2859
2.38	5.97	0.11	135	93.88	3039	1.8	3039
2.38	5.97	0.12	141	98.05	3174	2.0	3174
2.38	5.97	0.13	145	100.83	3264	2.2	3264
2.38	5.97	0.14	147	102.22	3309	2.3	3309
2.38	5.97	0.15	146	101.53	3286	2.5	3286
2.38	5.97	0.16	140	97.36	3151	2.7	3151
2.38	5.97	0.17	128	89.01	2881	2.8	2881
2.38	5.97	0.18	106	73.71	2386	3.0	2386
2.38	5.97	0.19	83	57.72	1868	3.2	1868
2.38	5.97	0.20	60	41.72	1351	3.4	1351
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

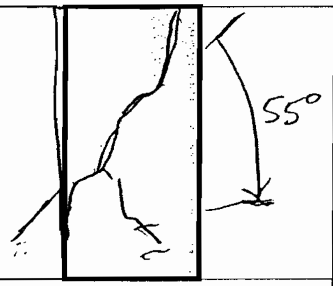
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 8.0'

Sample Diameter: 2.38
Sample Length: 5.97
Wet Wt./Dry Wt.:
Description: YEL BRN MOT W/DK BRN + GRY CLAYSTONE W/WT (TUFF?) INCLUSIONS

F-100

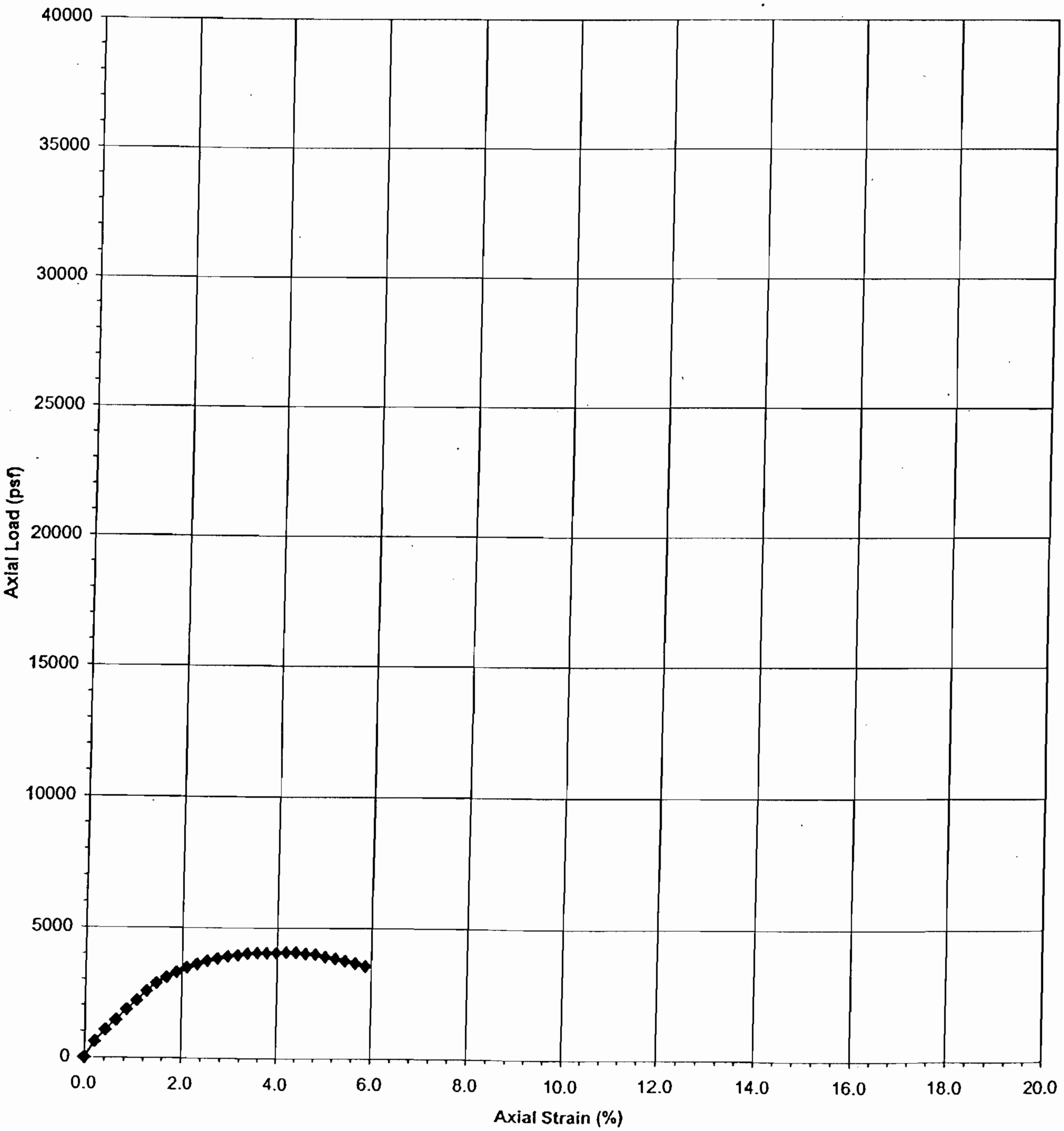
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	13	0.26	
0.02	28	0.27	
0.03	45	0.28	
0.04	60	0.29	
0.05	74	0.30	
0.06	86	0.31	
0.07	97	0.32	
0.08	108	0.33	
0.09	117	0.34	
0.10	127	0.35	
0.11	135	0.36	
0.12	141	0.37	
0.13	145	0.38	
0.14	147	0.39	
0.15	146	0.40	
0.16	140	0.41	
0.17	128	0.42	
0.18	106	0.43	
0.19	83	0.44	
0.20	60	0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 10YR 5/6

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 27.0'
Lt Olv Brn w/ Olv Yel Claystone w/ Trace VFG Sand and Pebbles



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/16/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	27.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	4.77	0.00	0	0.00	0	0.0	0
2.39	4.77	0.01	27	18.78	603	0.2	603
2.39	4.77	0.02	47	32.68	1049	0.4	1049
2.39	4.77	0.03	64	44.51	1429	0.6	1429
2.39	4.77	0.04	82	57.02	1830	0.8	1830
2.39	4.77	0.05	98	68.15	2187	1.0	2187
2.39	4.77	0.06	114	79.28	2545	1.3	2545
2.39	4.77	0.07	128	89.01	2857	1.5	2857
2.39	4.77	0.08	138	95.97	3080	1.7	3080
2.39	4.77	0.09	147	102.22	3281	1.9	3281
2.39	4.77	0.10	155	107.79	3460	2.1	3460
2.39	4.77	0.11	161	111.96	3594	2.3	3594
2.39	4.77	0.12	167	116.13	3728	2.5	3728
2.39	4.77	0.13	171	118.91	3817	2.7	3817
2.39	4.77	0.14	175	121.70	3906	2.9	3906
2.39	4.77	0.15	177	123.09	3951	3.1	3951
2.39	4.77	0.16	180	125.17	4018	3.4	4018
2.39	4.77	0.17	181	125.87	4040	3.6	4040
2.39	4.77	0.18	181	125.87	4040	3.8	4040
2.39	4.77	0.19	181	125.87	4040	4.0	4040
2.39	4.77	0.20	182	126.56	4062	4.2	4062
2.39	4.77	0.21	182	126.56	4062	4.4	4062
2.39	4.77	0.22	180	125.17	4018	4.6	4018
2.39	4.77	0.23	179	124.48	3995	4.8	3995
2.39	4.77	0.24	175	121.70	3906	5.0	3906
2.39	4.77	0.25	172	119.61	3839	5.2	3839
2.39	4.77	0.26	168	116.83	3750	5.5	3750
2.39	4.77	0.27	164	114.05	3661	5.7	3661
2.39	4.77	0.28	159	110.57	3549	5.9	3549
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

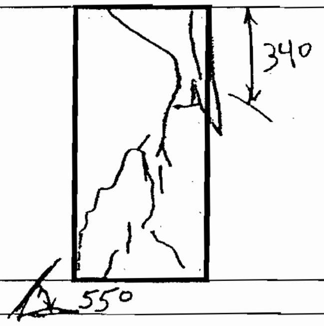
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-5
DEPTH: 27.0

Sample Diameter: 2.39
Sample Length: 4.77
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/ OLV YEL CLAYSTONE, TR VFG SAND TR PEBBLE

E-84

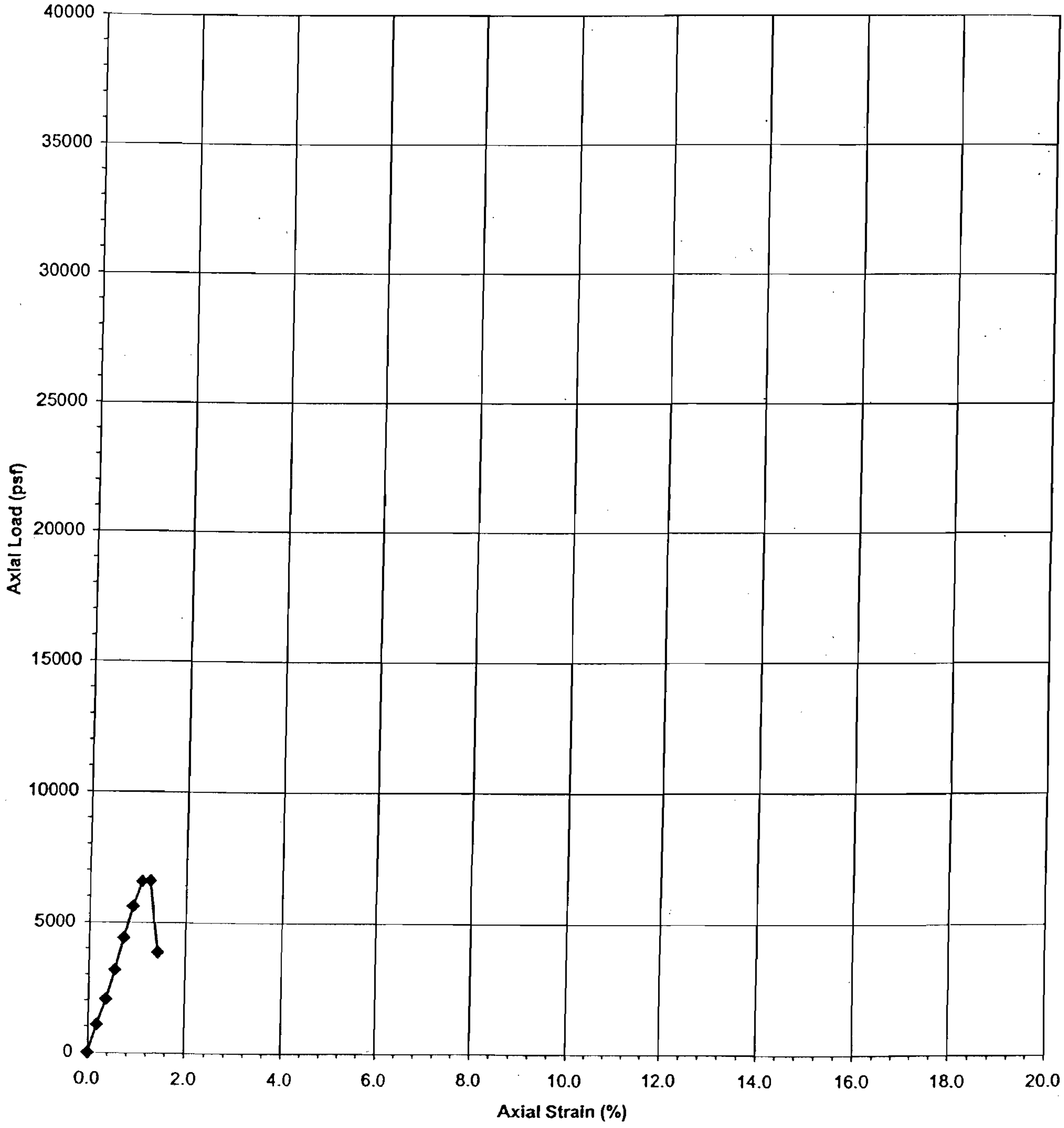
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	27	0.26	168
0.02	47	0.27	164
0.03	64	0.28	159
0.04	82	0.29	
0.05	98	0.30	
0.06	114	0.31	
0.07	128	0.32	
0.08	138	0.33	
0.09	147	0.34	
0.10	155	0.35	
0.11	161	0.36	
0.12	167	0.37	
0.13	171	0.38	
0.14	175	0.39	
0.15	177	0.40	
0.16	180	0.41	
0.17	181	0.42	
0.18	181	0.43	
0.19	181	0.44	
0.20	182	0.45	
0.21	182	0.46	
0.22	180	0.47	
0.23	179	0.48	
0.24	175	0.49	
0.25	172	0.50	

Sketch of Sample After Test:



Comments:
2.5Y 5/3 LT OLV BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 36.5'
Lt Yel Brn and Yel Brn Sandstone (VFG-FG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	36.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.37	5.57	0.00	0	0.00	0	0.0	0
2.37	5.57	0.01	47	32.68	1067	0.2	1067
2.37	5.57	0.02	90	62.59	2043	0.4	2043
2.37	5.57	0.03	140	97.36	3178	0.5	3178
2.37	5.57	0.04	194	134.91	4404	0.7	4404
2.37	5.57	0.05	247	171.76	5607	0.9	5607
2.37	5.57	0.06	289	200.97	6560	1.1	6560
2.37	5.57	0.07	290	201.67	6583	1.3	6583
2.37	5.57	0.08	170	118.22	3859	1.4	3859
		0.09		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.10		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.11		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.12		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.13		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

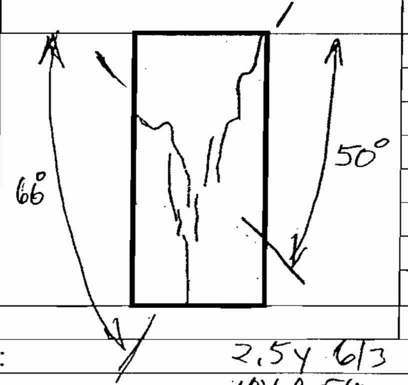
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-5
DEPTH: 36.5

Sample Diameter: 2.37
Sample Length: 5.57
Wet Wt./Dry Wt.:
Description: LT YEL BRN + YEL BRN SANDSTONE VFG-FG

F-201

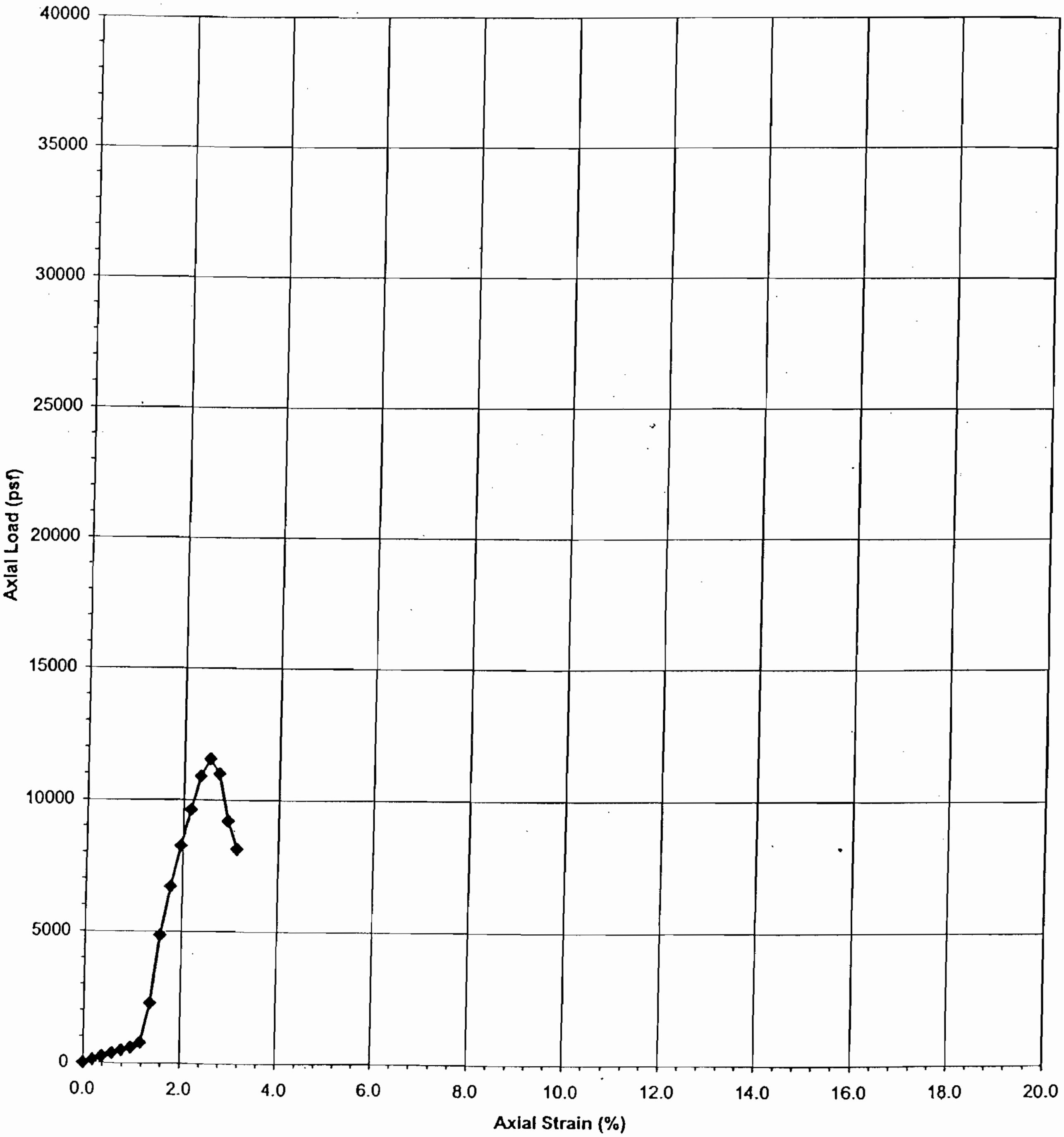
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	47	0.26	
0.02	90	0.27	
0.03	140	0.28	
0.04	194	0.29	
0.05	247	0.30	
0.06	289	0.31	
0.07	290	0.32	
0.08	170	0.33	
0.09		0.34	
0.10		0.35	
0.11		0.36	
0.12		0.37	
0.13		0.38	
0.14		0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 2.5Y 6/3 LT YEL BRN
10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 41.0'
Lt Olv Brn w/ Yel Brn VFG Sandy Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology
PROJECT	Vasco Road
PROJ. # :	001860
DATE:	02/16/2001
BORING:	B-5
DEPTH:	41.0'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.31	5.11	0.00	0	0.00	0	0.0	0
2.31	5.11	0.01	5	3.48	119	0.2	119
2.31	5.11	0.02	10	6.95	239	0.4	239
2.31	5.11	0.03	15	10.43	358	0.6	358
2.31	5.11	0.04	20	13.91	478	0.8	478
2.31	5.11	0.05	24	16.69	573	1.0	573
2.31	5.11	0.06	32	22.25	765	1.2	765
2.31	5.11	0.07	95	66.06	2270	1.4	2270
2.31	5.11	0.08	203	141.17	4850	1.6	4850
2.31	5.11	0.09	280	194.71	6690	1.8	6690
2.31	5.11	0.10	345	239.91	8243	2.0	8243
2.31	5.11	0.11	403	280.25	9629	2.2	9629
2.31	5.11	0.12	456	317.10	10895	2.3	10895
2.31	5.11	0.13	483	335.88	11541	2.5	11541
2.31	5.11	0.14	460	319.88	10991	2.7	10991
2.31	5.11	0.15	385	267.73	9199	2.9	9199
2.31	5.11	0.16	340	236.44	8124	3.1	8124
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

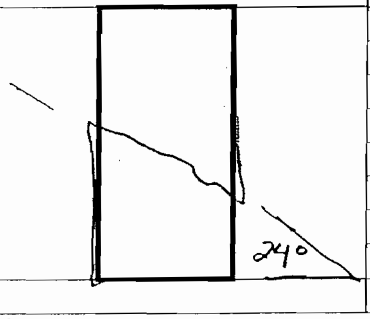
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-5
DEPTH: 41.0

Sample Diameter: 2.31
Sample Length: 5.11
Wet Wt./Dry Wt.:
Description: LT OLV BRN W/YEL BRN SANDY CLAYSTONE, VFG

E-32

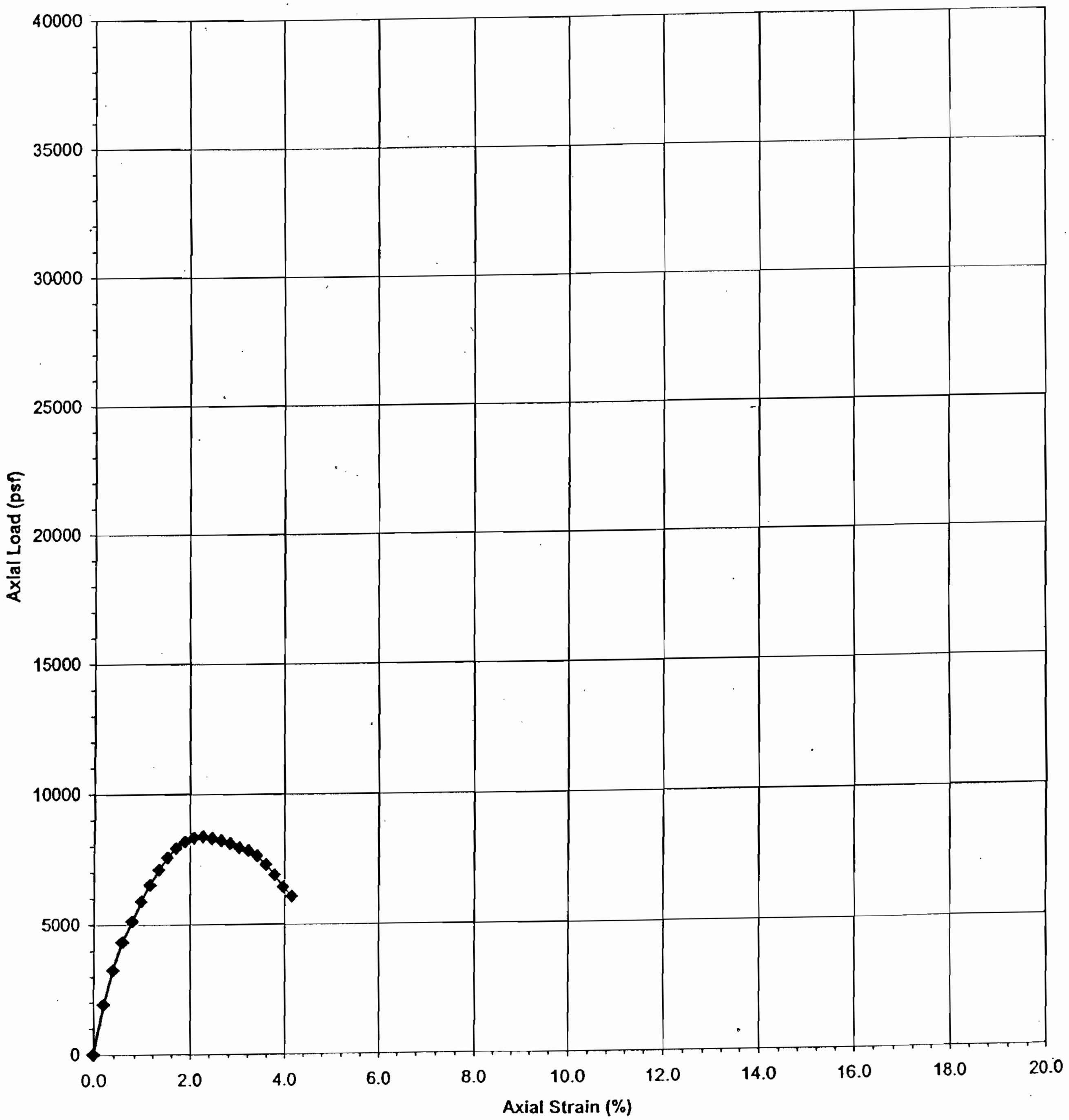
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	5	0.26	
0.02	10	0.27	
0.03	15	0.28	
0.04	20	0.29	
0.05	24	0.30	
0.06	32	0.31	
0.07	95	0.32	
0.08	203	0.33	
0.09	280	0.34	
0.10	345	0.35	
0.11	403	0.36	
0.12	456	0.37	
0.13	483	0.38	
0.14	460	0.39	
0.15	385	0.40	
0.16	340	0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: POLISHED SHEAR SURFACE 2.54 5.3 LT OL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 47.5'
Yel Brn Mot w/ Gry Brn Claystone w/Trace VFG Sand



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/17/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	47.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.39	5.29	0.00	0	0.00	0	0.0	0
2.39	5.29	0.01	86	59.80	1920	0.2	1920
2.39	5.29	0.02	146	101.53	3259	0.4	3259
2.39	5.29	0.03	194	134.91	4330	0.6	4330
2.39	5.29	0.04	230	159.94	5134	0.8	5134
2.39	5.29	0.05	264	183.59	5893	0.9	5893
2.39	5.29	0.06	292	203.06	6518	1.1	6518
2.39	5.29	0.07	318	221.14	7098	1.3	7098
2.39	5.29	0.08	339	235.74	7567	1.5	7567
2.39	5.29	0.09	355	246.87	7924	1.7	7924
2.39	5.29	0.10	366	254.52	8169	1.9	8169
2.39	5.29	0.11	373	259.38	8326	2.1	8326
2.39	5.29	0.12	375	260.78	8370	2.3	8370
2.39	5.29	0.13	372	258.69	8303	2.5	8303
2.39	5.29	0.14	368	255.91	8214	2.6	8214
2.39	5.29	0.15	363	252.43	8102	2.8	8102
2.39	5.29	0.16	356	247.56	7946	3.0	7946
2.39	5.29	0.17	351	244.09	7835	3.2	7835
2.39	5.29	0.18	342	237.83	7634	3.4	7634
2.39	5.29	0.19	327	227.40	7299	3.6	7299
2.39	5.29	0.20	309	214.88	6897	3.8	6897
2.39	5.29	0.21	288	200.28	6428	4.0	6428
2.39	5.29	0.22	272	189.15	6071	4.2	6071
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

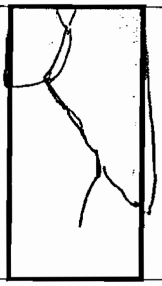
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/17/01
BORING: B-5
DEPTH: 47.5'

Sample Diameter: 2.39
Sample Length: 5.29
Wet Wt./Dry Wt.:
Description: YEL BRN MOT w/GRY BRN CLAYSTONE TR. VFG SAND

F-71

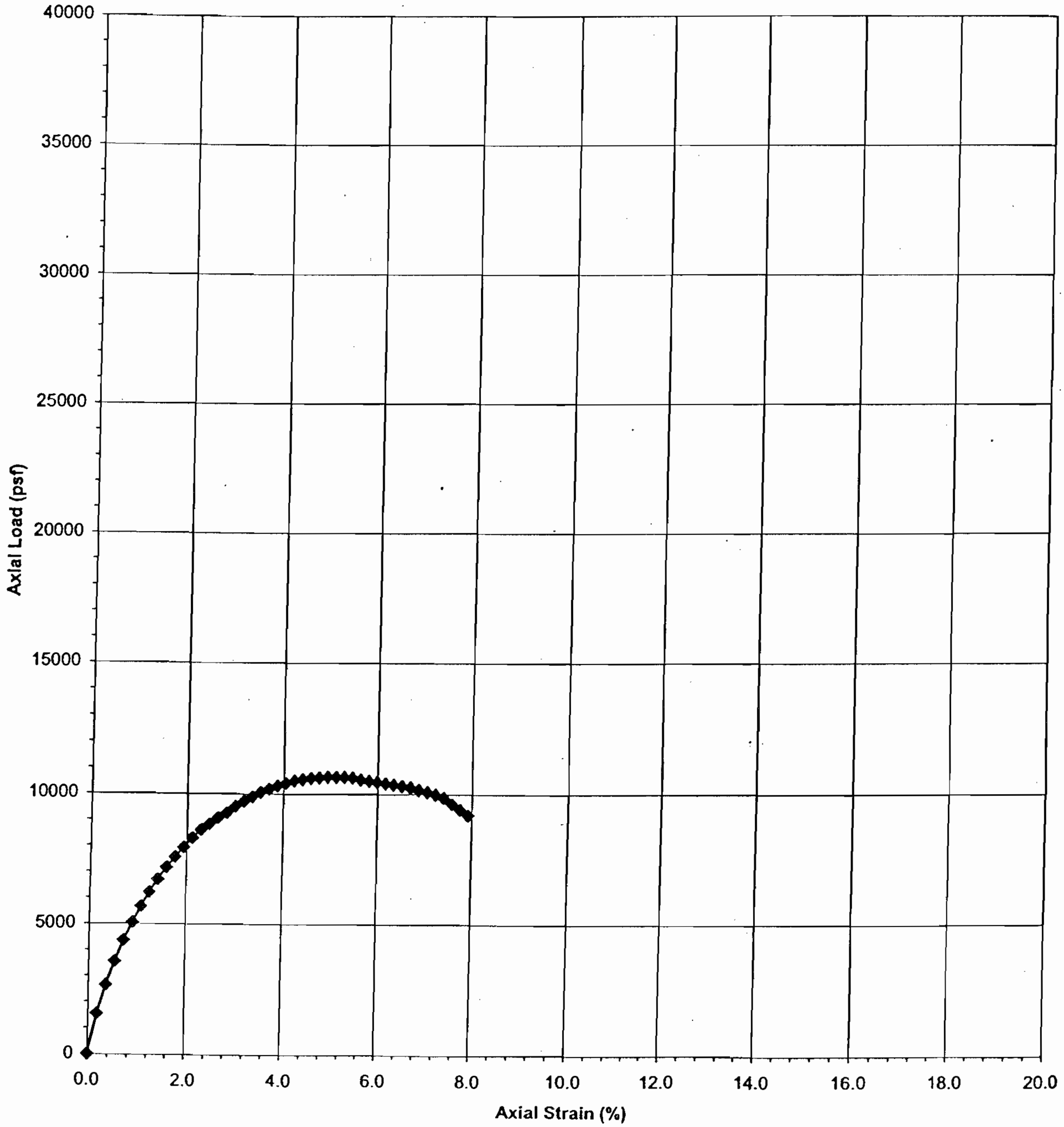
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	86	0.26	
0.02	146	0.27	
0.03	194	0.28	
0.04	230	0.29	
0.05	264	0.30	
0.06	292	0.31	
0.07	318	0.32	
0.08	339	0.33	
0.09	355	0.34	
0.10	366	0.35	
0.11	373	0.36	
0.12	375	0.37	
0.13	372	0.38	
0.14	368	0.39	
0.15	363	0.40	
0.16	356	0.41	
0.17	351	0.42	
0.18	342	0.43	
0.19	327	0.44	
0.20	309	0.45	
0.21	288	0.46	
0.22	272	0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 10 YR 5/4 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 55.0'
Lt Yel Brn Sandy Claystone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/16/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	55.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.28	5.68	0.00	0	0.00	0	0.0	0
2.28	5.68	0.01	63	43.81	1545	0.2	1545
2.28	5.68	0.02	108	75.10	2649	0.4	2649
2.28	5.68	0.03	145	100.83	3556	0.5	3556
2.28	5.68	0.04	178	123.78	4366	0.7	4366
2.28	5.68	0.05	206	143.25	5052	0.9	5052
2.28	5.68	0.06	231	160.64	5666	1.1	5666
2.28	5.68	0.07	253	175.94	6205	1.2	6205
2.28	5.68	0.08	273	189.84	6696	1.4	6696
2.28	5.68	0.09	292	203.06	7162	1.6	7162
2.28	5.68	0.10	308	214.18	7554	1.8	7554
2.28	5.68	0.11	323	224.61	7922	1.9	7922
2.28	5.68	0.12	338	235.05	8290	2.1	8290
2.28	5.68	0.13	351	244.09	8609	2.3	8609
2.28	5.68	0.14	360	250.34	8830	2.5	8830
2.28	5.68	0.15	370	257.30	9075	2.6	9075
2.28	5.68	0.16	378	262.86	9271	2.8	9271
2.28	5.68	0.17	388	269.82	9516	3.0	9516
2.28	5.68	0.18	396	275.38	9713	3.2	9713
2.28	5.68	0.19	403	280.25	9884	3.3	9884
2.28	5.68	0.20	410	285.11	10056	3.5	10056
2.28	5.68	0.21	415	288.59	10179	3.7	10179
2.28	5.68	0.22	420	292.07	10301	3.9	10301
2.28	5.68	0.23	424	294.85	10399	4.0	10399
2.28	5.68	0.24	428	297.63	10497	4.2	10497
2.28	5.68	0.25	430	299.02	10546	4.4	10546
2.28	5.68	0.26	432	300.41	10595	4.6	10595
2.28	5.68	0.27	433	301.11	10620	4.8	10620
2.28	5.68	0.28	434	301.80	10645	4.9	10645
2.28	5.68	0.29	434	301.80	10645	5.1	10645
2.28	5.68	0.30	434	301.80	10645	5.3	10645
2.28	5.68	0.31	433	301.11	10620	5.5	10620
2.28	5.68	0.32	430	299.02	10546	5.6	10546
2.28	5.68	0.33	428	297.63	10497	5.8	10497
2.28	5.68	0.34	426	296.24	10448	6.0	10448
2.28	5.68	0.35	424	294.85	10399	6.2	10399
2.28	5.68	0.36	422	293.46	10350	6.3	10350
2.28	5.68	0.37	420	292.07	10301	6.5	10301
2.28	5.68	0.38	418	290.68	10252	6.7	10252
2.28	5.68	0.39	414	287.90	10154	6.9	10154
2.28	5.68	0.40	411	285.81	10080	7.0	10080

UNCONFINED COMPRESSION
(UNCONF.XLS)

2.28	5.68	0.41	407	283.03	9982	7.2	9982
2.28	5.68	0.42	402	279.55	9860	7.4	9860
2.28	5.68	0.43	393	273.29	9639	7.6	9639
2.28	5.68	0.44	384	267.03	9418	7.7	9418
2.28	5.68	0.45	375	260.78	9197	7.9	9197
		0.46		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.47		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.48		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.49		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.50		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

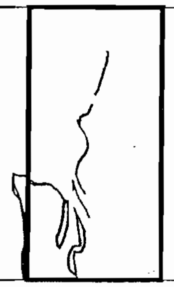
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 55.0

Sample Diameter: 2.28
Sample Length: 5.68
Wet Wt./Dry Wt.:
Description: YEL BRN SANDY CLAYSTONE VFG

F-27

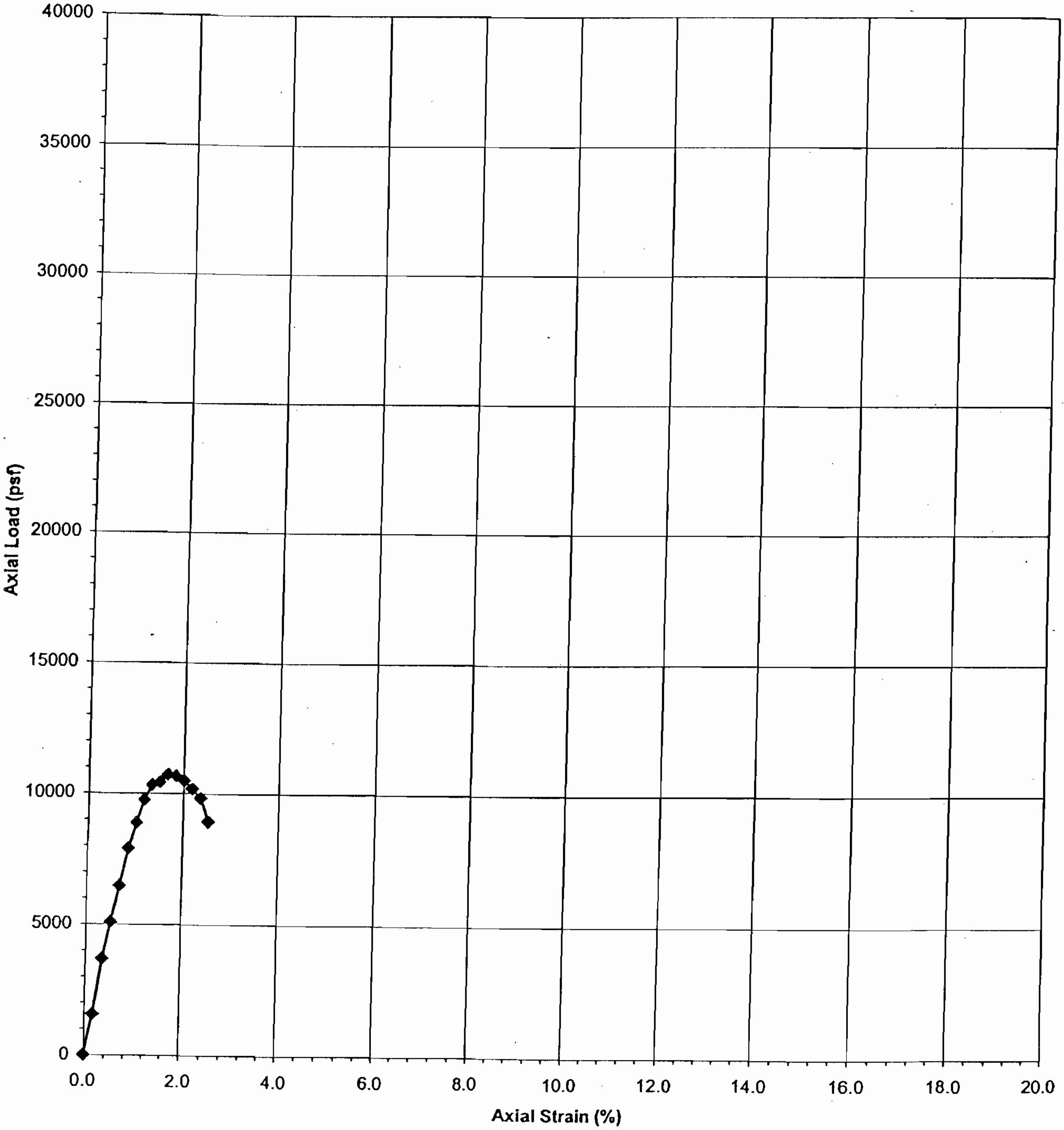
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	63	0.26	432
0.02	108	0.27	433
0.03	145	0.28	434
0.04	178	0.29	434
0.05	206	0.30	434
0.06	231	0.31	433
0.07	253	0.32	430
0.08	273	0.33	428
0.09	292	0.34	426
0.10	308	0.35	424
0.11	323	0.36	422
0.12	338	0.37	420
0.13	351	0.38	418
0.14	360	0.39	414
0.15	370	0.40	411
0.16	378	0.41	407
0.17	388	0.42	402
0.18	396	0.43	393
0.19	403	0.44	384
0.20	410	0.45	375
0.21	415	0.46	
0.22	420	0.47	
0.23	424	0.48	
0.24	428	0.49	
0.25	430	0.50	

Sketch of Sample After Test:



Comments: 10YR 5/4 5/6

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 62.5'
Yel Brn Clayey Sandstone (VFG-MG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/16/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	62.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.39	5.98	0.00	0	0.00	0	0.0	0
2.39	5.98	0.01	70	48.68	1562	0.2	1562
2.39	5.98	0.02	165	114.74	3683	0.3	3683
2.39	5.98	0.03	228	158.55	5089	0.5	5089
2.39	5.98	0.04	290	201.67	6473	0.7	6473
2.39	5.98	0.05	354	246.17	7902	0.8	7902
2.39	5.98	0.06	398	276.77	8884	1.0	8884
2.39	5.98	0.07	437	303.89	9754	1.2	9754
2.39	5.98	0.08	462	321.27	10312	1.3	10312
2.39	5.98	0.09	467	324.75	10424	1.5	10424
2.39	5.98	0.10	480	333.79	10714	1.7	10714
2.39	5.98	0.11	478	332.40	10669	1.8	10669
2.39	5.98	0.12	470	326.84	10491	2.0	10491
2.39	5.98	0.13	456	317.10	10178	2.2	10178
2.39	5.98	0.14	440	305.98	9821	2.3	9821
2.39	5.98	0.15	400	278.16	8928	2.5	8928
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

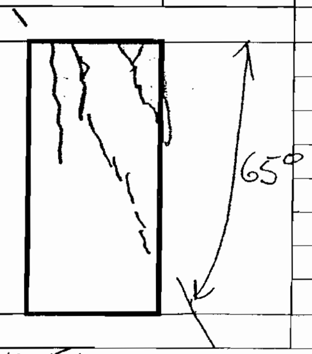
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 62.5

Sample Diameter: 2.39
Sample Length: 5.98
Wet Wt./Dry Wt.:
Description: YEL BRN CLAYEY SANDSTONE VFG - MG TR WT & RD

F-92

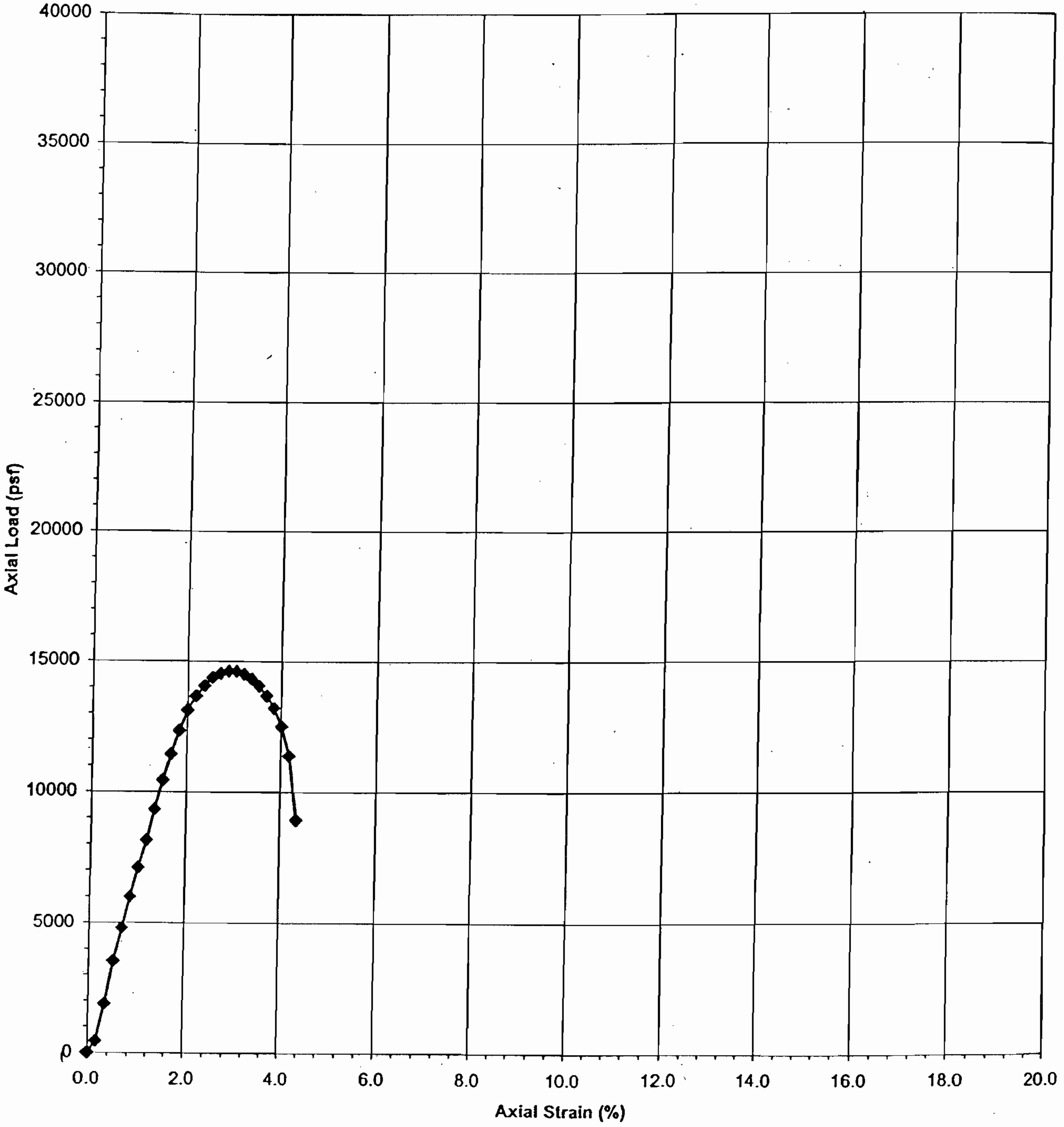
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	70	0.26	
0.02	165	0.27	
0.03	228	0.28	
0.04	290	0.29	
0.05	354	0.30	
0.06	398	0.31	
0.07	437	0.32	
0.08	462	0.33	
0.09	476	0.34	
0.10	480	0.35	
0.11	478	0.36	
0.12	470	0.37	
0.13	456	0.38	
0.14	440	0.39	
0.15	400	0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 10 YR 5/6 ± YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 66.5'
Gry Brn and Lt Olv Brn w/ Yel Brn Clayey Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT: CAL Engineering and Geology
PROJECT Vasco Road
PROJ. # : 001860
DATE: 02/16/2001
BORING: B-5
DEPTH: 66.5'

Ring Constant = 0.6954 lb/div

SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.39	5.98	0.00	0	0.00	0	0.0	0
2.39	5.98	0.01	20	13.91	446	0.2	446
2.39	5.98	0.02	84	58.41	1875	0.3	1875
2.39	5.98	0.03	158	109.87	3527	0.5	3527
2.39	5.98	0.04	215	149.51	4799	0.7	4799
2.39	5.98	0.05	268	186.37	5982	0.8	5982
2.39	5.98	0.06	318	221.14	7098	1.0	7098
2.39	5.98	0.07	365	253.82	8147	1.2	8147
2.39	5.98	0.08	418	290.68	9330	1.3	9330
2.39	5.98	0.09	468	325.45	10446	1.5	10446
2.39	5.98	0.10	513	356.74	11451	1.7	11451
2.39	5.98	0.11	553	384.56	12343	1.8	12343
2.39	5.98	0.12	588	408.90	13125	2.0	13125
2.39	5.98	0.13	612	425.58	13660	2.2	13660
2.39	5.98	0.14	630	438.10	14062	2.3	14062
2.39	5.98	0.15	644	447.84	14375	2.5	14375
2.39	5.98	0.16	651	452.71	14531	2.7	14531
2.39	5.98	0.17	655	455.49	14620	2.8	14620
2.39	5.98	0.18	655	455.49	14620	3.0	14620
2.39	5.98	0.19	650	452.01	14509	3.2	14509
2.39	5.98	0.20	642	446.45	14330	3.3	14330
2.39	5.98	0.21	630	438.10	14062	3.5	14062
2.39	5.98	0.22	613	426.28	13683	3.7	13683
2.39	5.98	0.23	592	411.68	13214	3.8	13214
2.39	5.98	0.24	560	389.42	12500	4.0	12500
2.39	5.98	0.25	510	354.65	11384	4.2	11384
2.39	5.98	0.26	400	278.16	8928	4.3	8928
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

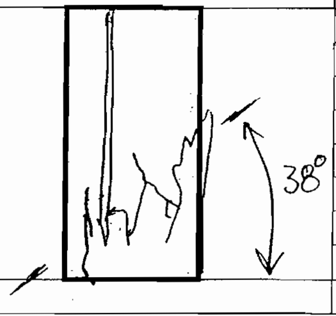
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 66.5

Sample Diameter: 2.39
Sample Length: 5.98
Wet Wt./Dry Wt.:
Description: GRY BRN & LT OLIVE BRN CLAYEY SANDSTONE VFG w/ YEL BRN

F-70

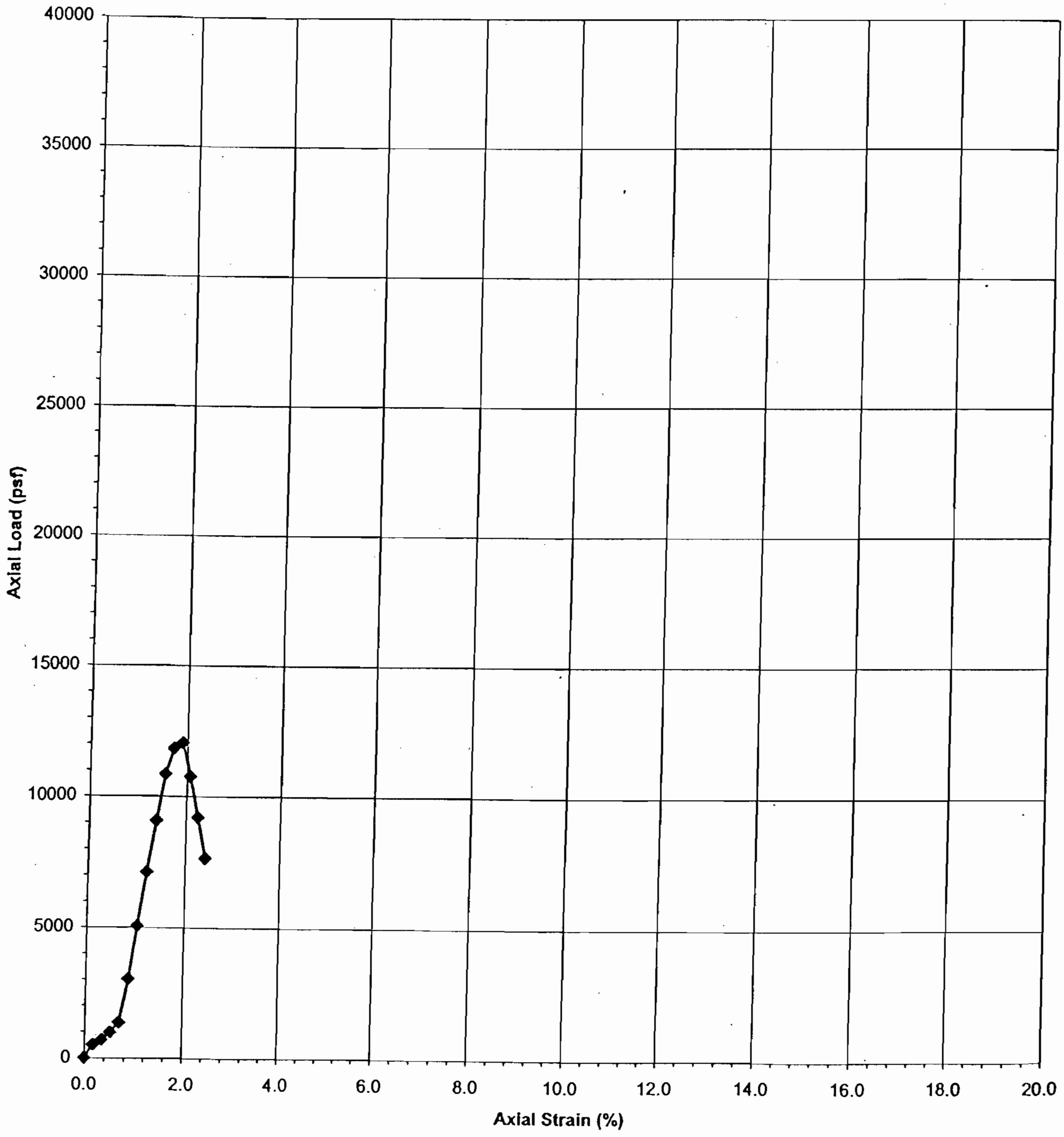
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	20	0.26	400
0.02	84	0.27	
0.03	158	0.28	
0.04	215	0.29	
0.05	268	0.30	
0.06	318	0.31	
0.07	365	0.32	
0.08	418	0.33	
0.09	468	0.34	
0.10	513	0.35	
0.11	553	0.36	
0.12	588	0.37	
0.13	612	0.38	
0.14	630	0.39	
0.15	644	0.40	
0.16	651	0.41	
0.17	655	0.42	
0.18	655	0.43	
0.19	650	0.44	
0.20	642	0.45	
0.21	630	0.46	
0.22	613	0.47	
0.23	592	0.48	
0.24	560	0.49	
0.25	510	0.50	

Sketch of Sample After Test:



Comments: 2.5Y 5/2 GRY BRN 2.5Y 5/3 LT OLV BRN
& 10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 75.0'
Dk Gry Brn w/ Yel Brn Clayey Sandstone / Sandy Claystone (VFG)



UNCONFINED COMPRESSION

(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/16/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	75.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.31	5.80	0.00	0	0.00	0	0.0	0
2.31	5.80	0.01	21	14.60	502	0.2	502
2.31	5.80	0.02	29	20.17	693	0.3	693
2.31	5.80	0.03	41	28.51	980	0.5	980
2.31	5.80	0.04	57	39.64	1362	0.7	1362
2.31	5.80	0.05	127	88.32	3034	0.9	3034
2.31	5.80	0.06	212	147.42	5065	1.0	5065
2.31	5.80	0.07	298	207.23	7120	1.2	7120
2.31	5.80	0.08	380	264.25	9080	1.4	9080
2.31	5.80	0.09	454	315.71	10848	1.6	10848
2.31	5.80	0.10	495	344.22	11827	1.7	11827
2.31	5.80	0.11	504	350.48	12042	1.9	12042
2.31	5.80	0.12	450	312.93	10752	2.1	10752
2.31	5.80	0.13	385	267.73	9199	2.2	9199
2.31	5.80	0.14	320	222.53	7646	2.4	7646
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 75.0

Sample Diameter: 2.31
Sample Length: 5.80
Wet Wt./Dry Wt.:
Description: DK GRY W/YEL BRN CLAYEY SANDSTONE/SANDY CLAYSTONE VFG

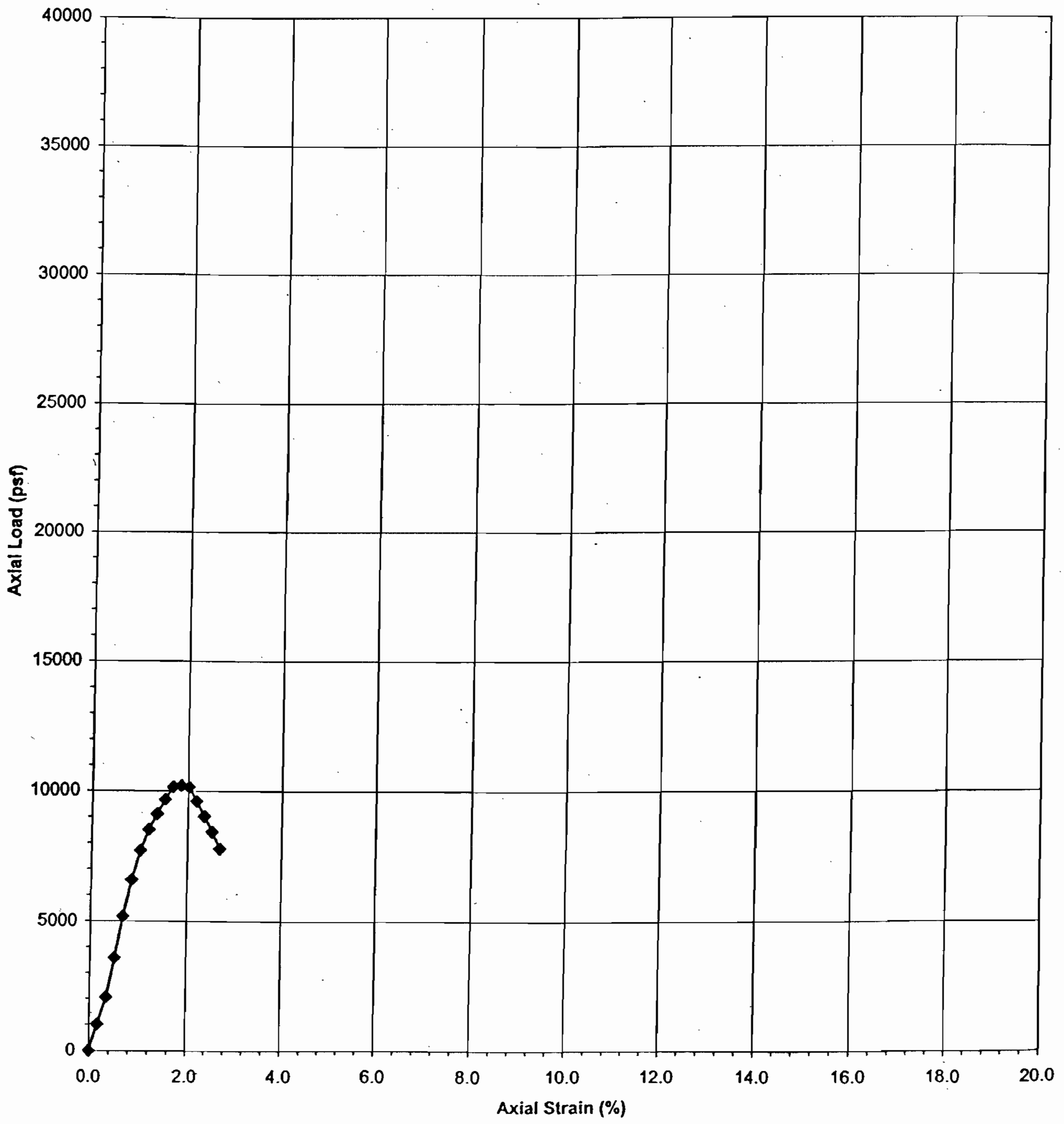
F-203

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	21	0.26	
0.02	29	0.27	
0.03	41	0.28	
0.04	57	0.29	
0.05	127	0.30	
0.06	212	0.31	
0.07	298	0.32	
0.08	380	0.33	
0.09	454	0.34	
0.10	495	0.35	
0.11	504	0.36	
0.12	450	0.37	
0.13	385	0.38	
0.14	320	0.39	
0.15		0.40	
0.16		0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:

Comments: 2.5Y 4/1 DK GRY W/10YR 5/8 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-5 @ 80.5'
Grn Gry Sandstone and Dk Grn Gry Clayey Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/16/2001						
BORING:	B-5			Ring Constant = 0.6954 lb/div			
DEPTH:	80.5'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.43	5.94	0.00	0	0.00	0	0.0	0
2.43	5.94	0.01	47	32.68	1015	0.2	1015
2.43	5.94	0.02	95	66.06	2051	0.3	2051
2.43	5.94	0.03	166	115.44	3584	0.5	3584
2.43	5.94	0.04	240	166.90	5182	0.7	5182
2.43	5.94	0.05	305	212.10	6586	0.8	6586
2.43	5.94	0.06	357	248.26	7708	1.0	7708
2.43	5.94	0.07	394	273.99	8507	1.2	8507
2.43	5.94	0.08	422	293.46	9112	1.3	9112
2.43	5.94	0.09	448	311.54	9673	1.5	9673
2.43	5.94	0.10	470	326.84	10148	1.7	10148
2.43	5.94	0.11	473	328.92	10213	1.9	10213
2.43	5.94	0.12	470	326.84	10148	2.0	10148
2.43	5.94	0.13	445	309.45	9608	2.2	9608
2.43	5.94	0.14	418	290.68	9025	2.4	9025
2.43	5.94	0.15	390	271.21	8421	2.5	8421
2.43	5.94	0.16	360	250.34	7773	2.7	7773
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

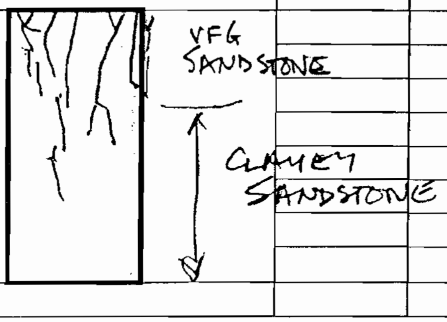
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-5
DEPTH: 80.5

Sample Diameter: 2.34
Sample Length: 5.94
Wet Wt./Dry Wt.:
Description: GRN GRY VFG SANDSTONE AND DK GRN GRY CLAYEY SANDSTONE

F-26

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	47	0.26	
0.02	95	0.27	
0.03	166	0.28	
0.04	240	0.29	
0.05	305	0.30	
0.06	357	0.31	
0.07	394	0.32	
0.08	422	0.33	
0.09	448	0.34	
0.10	470	0.35	
0.11	473	0.36	
0.12	470	0.37	
0.13	445	0.38	
0.14	418	0.39	
0.15	390	0.40	
0.16	360	0.41	
0.17		0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



GRNGRY 5GY 5/1

DK GRNGRY 5G4/1

Comments:

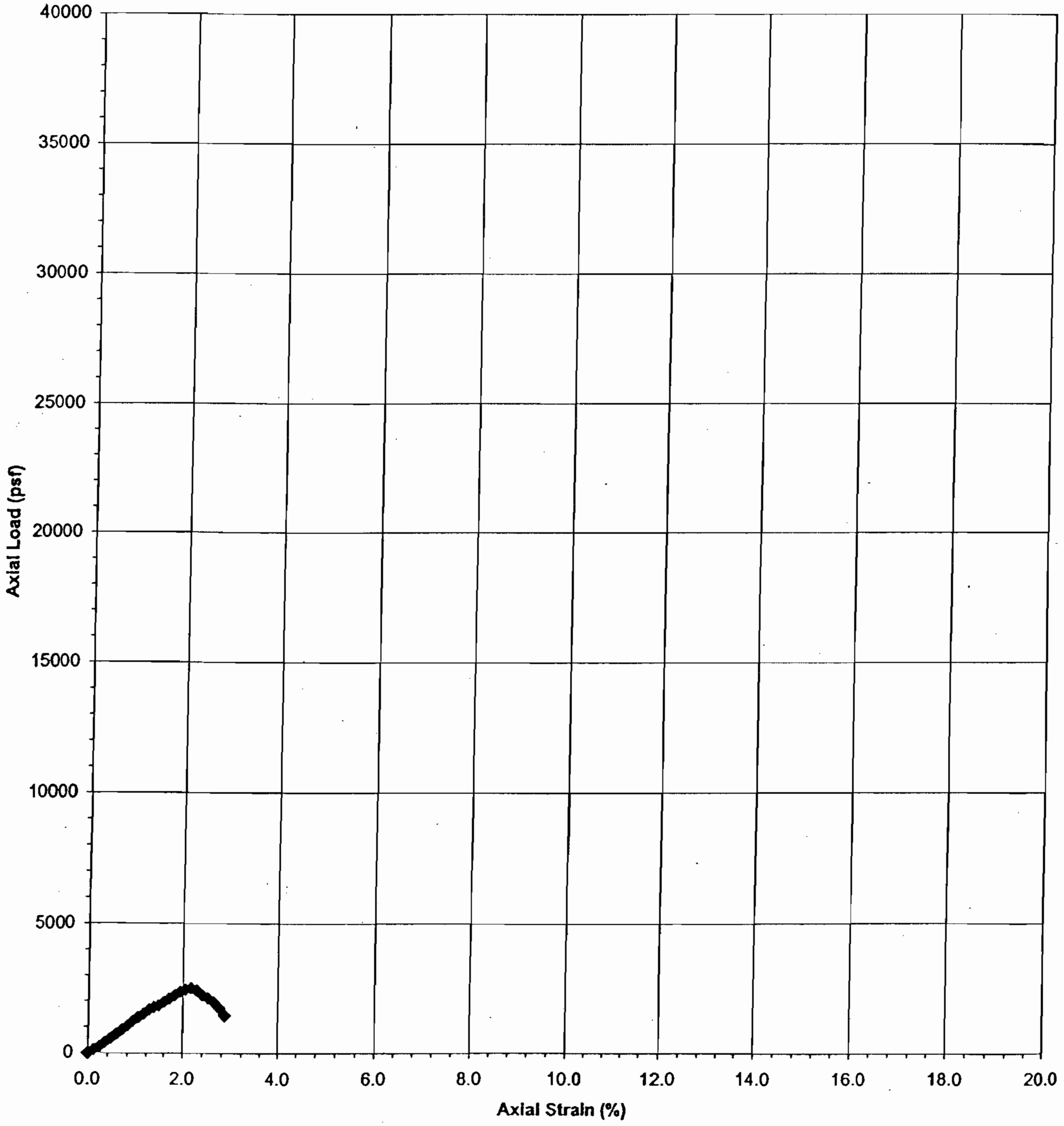
MOISTURE CONT[illegible]ND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD.
Client Project No: 001860

Date Sampled: ______ Date Received ______
Date Tested: 2/18/01
Tested by: ______

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-6	17.5	3.33	2.41	F-29	13.8	541.7	473.0	115.2	15.0	LT YEL BRN W/YEL BRN SANDSTONE, VFG FRIABLE
B-6	28.5	4.38	2.40	F-66	13.7	663.5	562.0	105.4	18.5	LT YEL BRN W/DK YEL BRN + LT GRN SANDSTONE, VFG FRIABLE

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-6 @ 28.5'
Lt Gry w/ Yel Brn Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/18/2001						
BORING:	B-6			Ring Constant = 0.6954 lb/div			
DEPTH:	28.5'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.40	4.38	0.000	0	0.00	0	0.0	0
2.40	4.38	0.005	6	4.17	133	0.1	133
2.40	4.38	0.010	11	7.65	243	0.2	243
2.40	4.38	0.015	18	12.52	398	0.3	398
2.40	4.38	0.020	25	17.39	553	0.5	553
2.40	4.38	0.025	33	22.95	730	0.6	730
2.40	4.38	0.030	40	27.82	885	0.7	885
2.40	4.38	0.035	47	32.68	1040	0.8	1040
2.40	4.38	0.040	55	38.25	1217	0.9	1217
2.40	4.38	0.045	62	43.11	1372	1.0	1372
2.40	4.38	0.050	68	47.29	1505	1.1	1505
2.40	4.38	0.055	75	52.16	1660	1.3	1660
2.40	4.38	0.060	79	54.94	1749	1.4	1749
2.40	4.38	0.065	82	57.02	1815	1.5	1815
2.40	4.38	0.070	88	61.20	1948	1.6	1948
2.40	4.38	0.075	94	65.37	2081	1.7	2081
2.40	4.38	0.080	100	69.54	2214	1.8	2214
2.40	4.38	0.085	106	73.71	2346	1.9	2346
2.40	4.38	0.090	110	76.49	2435	2.1	2435
2.40	4.38	0.095	112	77.88	2479	2.2	2479
2.40	4.38	0.100	108	75.10	2391	2.3	2391
2.40	4.38	0.105	100	69.54	2214	2.4	2214
2.40	4.38	0.110	95	66.06	2103	2.5	2103
2.40	4.38	0.115	88	61.20	1948	2.6	1948
2.40	4.38	0.120	78	54.24	1727	2.7	1727
2.40	4.38	0.125	65	45.20	1439	2.9	1439
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

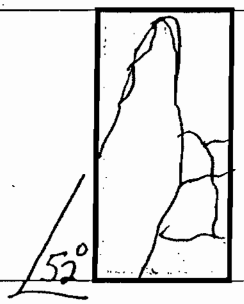
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/18/01
BORING: B-6
DEPTH: 28.5'

Sample Diameter: 2,40
Sample Length: 4,38
Wet Wt./Dry Wt.:
Description: LT GRAY W/YEL BRN SANDSTONE, VFG, V WEAK/SOFT

F-66
13.7

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0,005 ~~0.01~~	6		0.26	
0,01 ~~0.02~~	11		0.27	
0,015 ~~0.03~~	18		0.28	
0,02 ~~0.04~~	25		0.29	
0,025 ~~0.05~~	33		0.30	
0,03 ~~0.06~~	40		0.31	
0,035 ~~0.07~~	47		0.32	
0,04 ~~0.08~~	55		0.33	
0,045 ~~0.09~~	62		0.34	
0,05 ~~0.10~~	68		0.35	
0,055 ~~0.11~~	75		0.36	
0,06 ~~0.12~~	79		0.37	
0,065 ~~0.13~~	82		0.38	
0,07 ~~0.14~~	88		0.39	
0,075 ~~0.15~~	94		0.40	
0,08 ~~0.16~~	100		0.41	
0,085 ~~0.17~~	106		0.42	
0,09 ~~0.18~~	110		0.43	
0,095 ~~0.19~~	112	←	0.44	
0,10 ~~0.20~~	108		0.45	
0,105 ~~0.21~~	100		0.46	
0,110 ~~0.22~~	95		0.47	
0,115 ~~0.23~~	88		0.48	
0,120 ~~0.24~~	78		0.49	
0,125 ~~0.25~~	65		0.50	

Sketch of Sample After Test:



Comments:

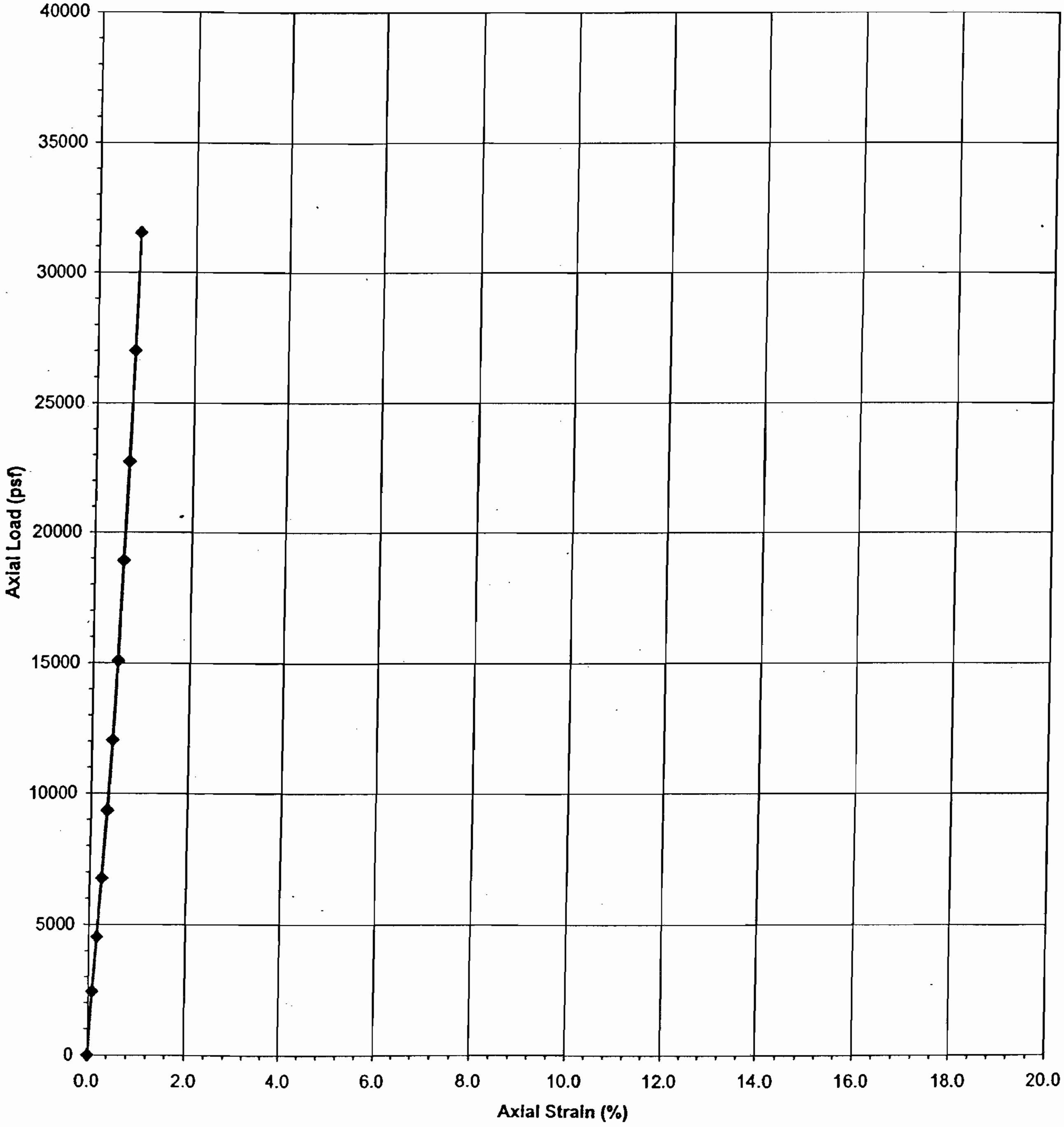
MOISTURE CONT ND DRY DENSITY

Client Name: CAL ENGINEERING + GEOLOGY
Project Name: VASCO RD.
Client Project No: 001860

Date Sampled: Date Received
Date Tested: 2/18/01
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-7	13.0	5.87	2.38	F-96	13.5	986.7	933.1	134.1	5.8	YEL BRN SANDSTONE, VFG, V HARD
	18.0	5.87	2.38	F-83	16.0	997.5	919.7	131.8	8.6	YEL BRN SANDSTONE, VFG

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-7 @ 13.0'
Yel Brn Sandstone (VFG)



UNCONFINED COMPRESSION

(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/18/2001						
BORING:	B-7			Ring Constant = 0.6954 lb/div			
DEPTH:	13.0'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.38	5.87	0.000	0	0.00	0	0.0	0
2.38	5.87	0.005	108	75.10	2431	0.1	2431
2.38	5.87	0.010	201	139.78	4524	0.2	4524
2.38	5.87	0.015	300	208.62	6753	0.3	6753
2.38	5.87	0.020	415	288.59	9341	0.3	9341
2.38	5.87	0.025	535	372.04	12042	0.4	12042
2.38	5.87	0.030	670	465.92	15081	0.5	15081
2.38	5.87	0.035	840	584.14	18907	0.6	18907
2.38	5.87	0.040	1010	702.35	22734	0.7	22734
2.38	5.87	0.045	1200	834.48	27011	0.8	27011
2.38	5.87	0.050	1400	973.56	31512	0.9	31512
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.14		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.15		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.16		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.17		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

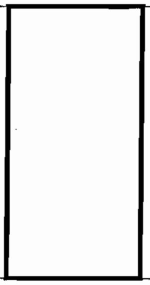
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/18/01
BORING: B-7
DEPTH: 13.0

Sample Diameter: 2.38
Sample Length: 5.87
Wet Wt./Dry Wt.: 986.7
Description: YEL BRN SANDSTONE VFG

F-96
13.5

	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)			CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0	.005 ~~0.01~~	108			0.26	
0	.01 ~~0.02~~	201			0.27	
0	.015 ~~0.03~~	300			0.28	
0	.02 ~~0.04~~	415			0.29	
0	.025 ~~0.05~~	535			0.30	
0	.03 ~~0.06~~	670			0.31	
0	.035 ~~0.07~~	840			0.32	
0	.04 ~~0.08~~	1010			0.33	
0	.045 ~~0.09~~	1200			0.34	
0	.05 0.10	1400			0.35	
0	.055 0.11	1400+	MAX		0.36	
0	.06 0.12		RING		0.37	
0	.065 0.13		CAP.		0.38	
0	.07 0.14				0.39	
	0.15				0.40	
	0.16				0.41	
	0.17				0.42	
	0.18				0.43	
	0.19				0.44	
	0.20				0.45	
	0.21				0.46	
	0.22				0.47	
	0.23				0.48	
	0.24				0.49	
	0.25				0.50	

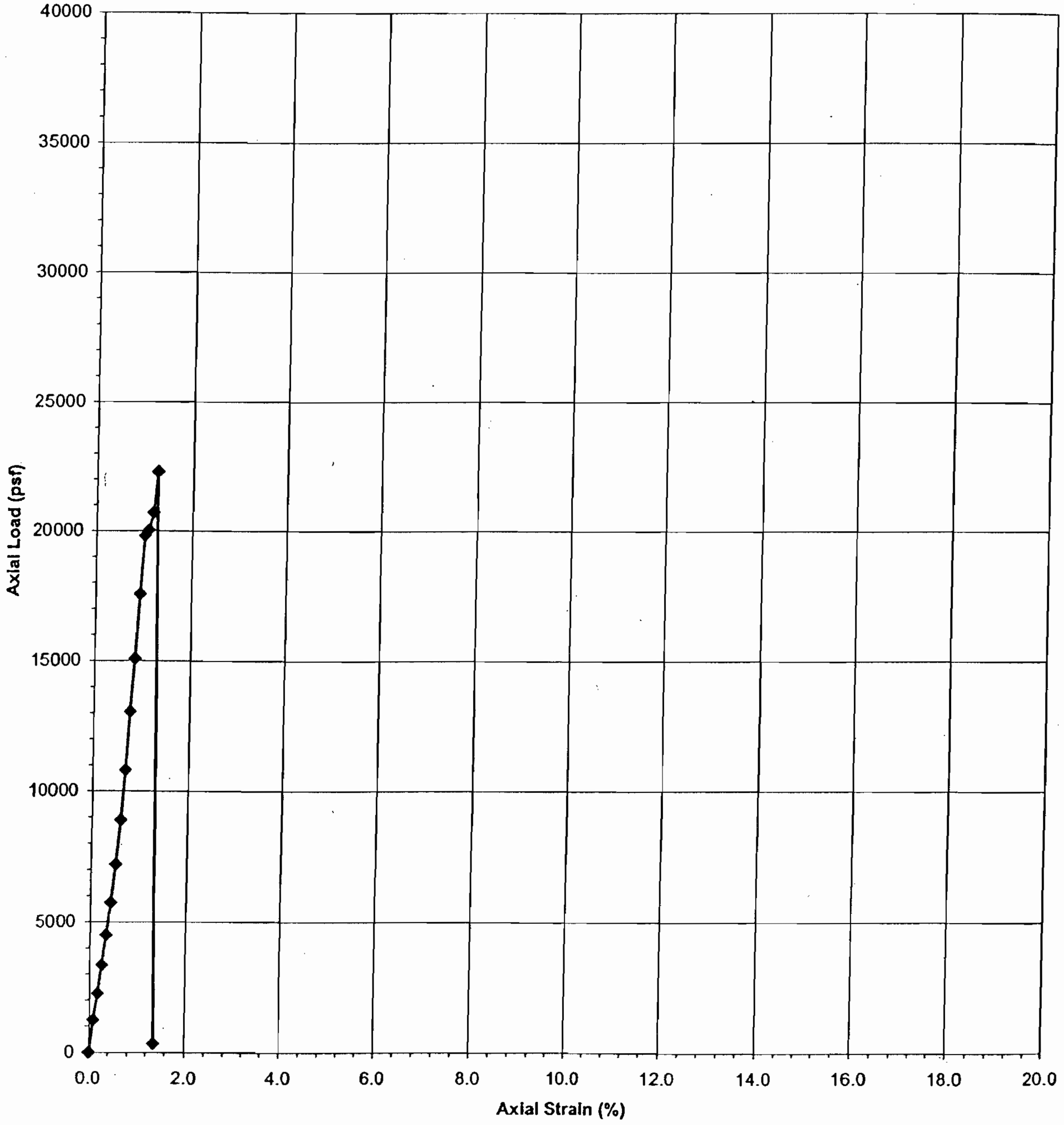
Sketch of Sample After Test:



NO FAILURE

Comments: 10YR 5/4 5/6 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-7 @ 18.0'
Yel Brn Sandstone (VFG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	02/18/2001						
BORING:	B-7			Ring Constant = 0.6954 lb/div			
DEPTH:	18.0'						
SAMPLE	ORIGINAL	CHANGE IN	PROVING	PROVING	PRESSURE	STRAIN	PRESSURE
DIAMETER	HEIGHT	HEIGHT	RING READ.	RING LOAD			
(IN)	(IN)	(IN)		(LBS)	(PSF)	(%)	(PSF)
2.38	5.87	0.000	0	0.00	0	0.0	0
2.38	5.87	0.005	55	38.25	1238	0.1	1238
2.38	5.87	0.010	100	69.54	2251	0.2	2251
2.38	5.87	0.015	149	103.61	3354	0.3	3354
2.38	5.87	0.020	200	139.08	4502	0.3	4502
2.38	5.87	0.025	255	177.33	5740	0.4	5740
2.38	5.87	0.030	320	222.53	7203	0.5	7203
2.38	5.87	0.035	395	274.68	8891	0.6	8891
2.38	5.87	0.040	480	333.79	10804	0.7	10804
2.38	5.87	0.045	580	403.33	13055	0.8	13055
2.38	5.87	0.050	670	465.92	15081	0.9	15081
2.38	5.87	0.055	780	542.41	17557	0.9	17557
2.38	5.87	0.060	880	611.95	19808	1.0	19808
2.38	5.87	0.065	890	618.91	20033	1.1	20033
2.38	5.87	0.070	920	639.77	20708	1.2	20708
2.38	5.87	0.075	990	688.45	22284	1.3	22284
2.38	5.87	0.080	15	10.43	338	1.4	338
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
				0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

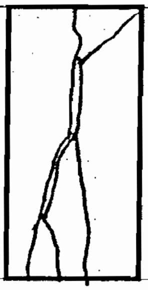
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 2/16/01
BORING: B-7
DEPTH: 18.0

Sample Diameter: 2.38
Sample Length: 5.87
Wet Wt./Dry Wt.: 997.5
Description: YEL BRN SANDSTONE VFG

F-83
16.0

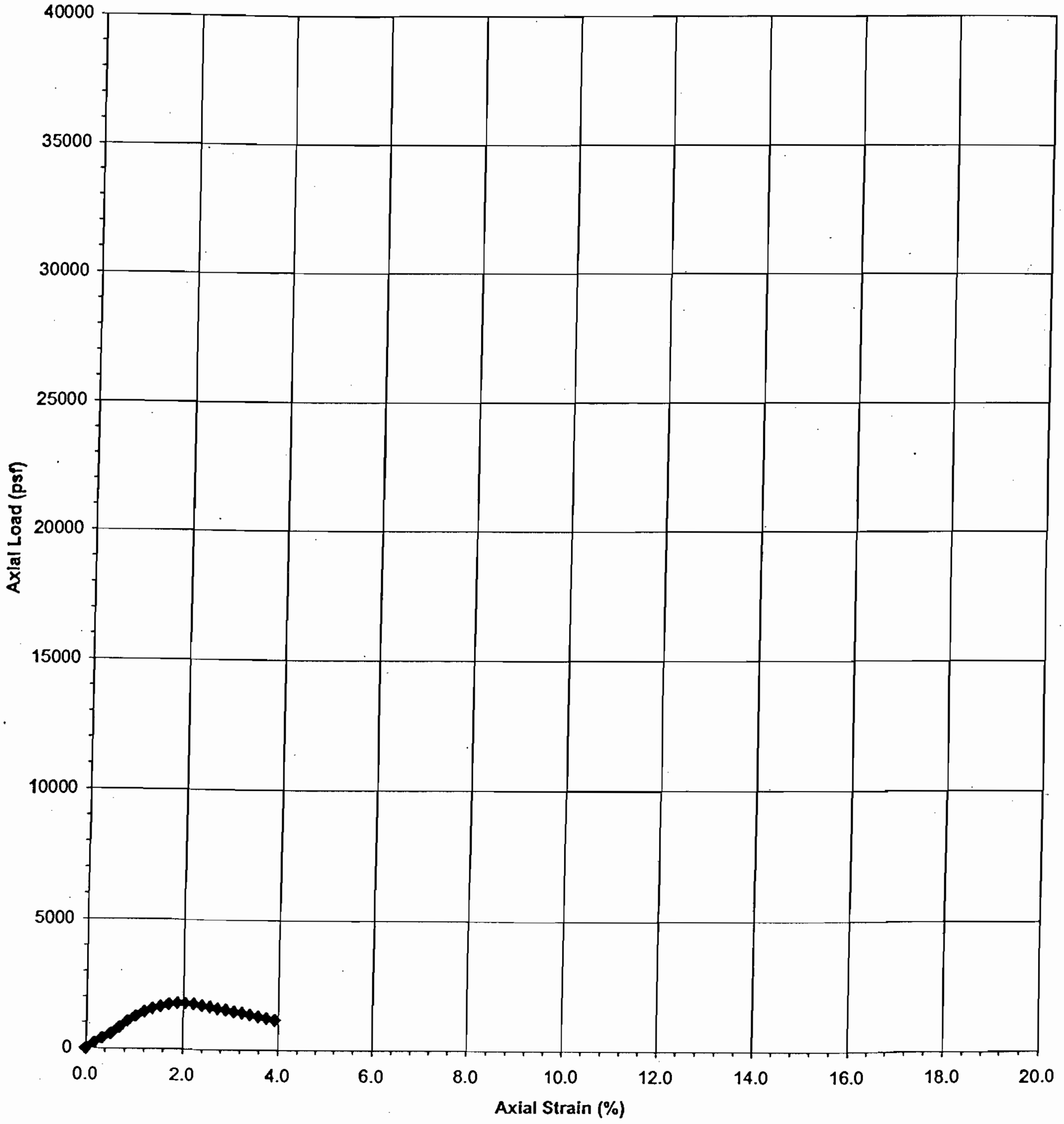
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)		CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.005 ~~0.01~~	55		0.26	
0.01 ~~0.02~~	100		0.27	
0.015 ~~0.03~~	149		0.28	
0.02 ~~0.04~~	200		0.29	
0.025 ~~0.05~~	255		0.30	
0.03 ~~0.06~~	320		0.31	
0.035 ~~0.07~~	395		0.32	
0.04 ~~0.08~~	480		0.33	
0.045 ~~0.09~~	580		0.34	
0.05 ~~0.10~~	670		0.35	
0.055 ~~0.11~~	780		0.36	
0.06 ~~0.12~~	880		0.37	
0.065 ~~0.13~~	840		0.38	
0.07 ~~0.14~~	920		0.39	
0.075 ~~0.15~~	990	← BRITTLE FAILURE	0.40	
0.08 ~~0.16~~	15		0.41	
0.085 ~~0.17~~			0.42	
0.09 ~~0.18~~			0.43	
0.095 ~~0.19~~			0.44	
0.10 ~~0.20~~			0.45	
0.21			0.46	
0.22			0.47	
0.23			0.48	
0.24			0.49	
0.25			0.50	

Sketch of Sample After Test:



Comments: 10 YR 5/4 5/6 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-8 @ 15.25'
Yel Brn Sandstone (VFG-FG) w/clayey zones and Wt tuff seam



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology
PROJECT	Vasco Road
PROJ. # :	001860
DATE:	03/02/2001
BORING:	B-8
DEPTH:	15.25'

Ring Constant = 0.6954 lb/div

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.42	5.87	0.00	0	0.00	0	0.0	0
2.42	5.87	0.01	10	6.95	218	0.2	218
2.42	5.87	0.02	18	12.52	392	0.3	392
2.42	5.87	0.03	26	18.08	566	0.5	566
2.42	5.87	0.04	37	25.73	806	0.7	806
2.42	5.87	0.05	48	33.38	1045	0.9	1045
2.42	5.87	0.06	57	39.64	1241	1.0	1241
2.42	5.87	0.07	65	45.20	1415	1.2	1415
2.42	5.87	0.08	71	49.37	1546	1.4	1546
2.42	5.87	0.09	75	52.16	1633	1.5	1633
2.42	5.87	0.10	79	54.94	1720	1.7	1720
2.42	5.87	0.11	81	56.33	1763	1.9	1763
2.42	5.87	0.12	81	56.33	1763	2.0	1763
2.42	5.87	0.13	80	55.63	1742	2.2	1742
2.42	5.87	0.14	77	53.55	1676	2.4	1676
2.42	5.87	0.15	75	52.16	1633	2.6	1633
2.42	5.87	0.16	72	50.07	1568	2.7	1568
2.42	5.87	0.17	70	48.68	1524	2.9	1524
2.42	5.87	0.18	67	46.59	1459	3.1	1459
2.42	5.87	0.19	65	45.20	1415	3.2	1415
2.42	5.87	0.20	62	43.11	1350	3.4	1350
2.42	5.87	0.21	59	41.03	1284	3.6	1284
2.42	5.87	0.22	56	38.94	1219	3.7	1219
2.42	5.87	0.23	53	36.86	1154	3.9	1154
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

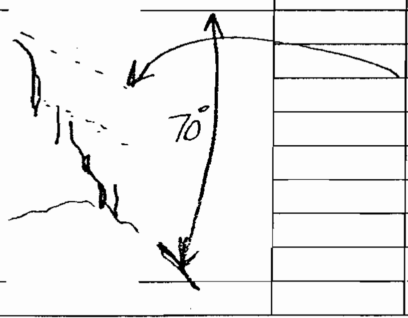
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 3/2/01
BORING: B-8
DEPTH: 15.25'

Sample Diameter: 2.42
Sample Length: 5.87
Wet Wt./Dry Wt.:
Description: SANDSTONE, VFG-FG, CLAYEY ZONES, W/TUFF ZONE

F-304

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	10	0.26	
0.02	18	0.27	
0.03	26	0.28	
0.04	37	0.29	
0.05	48	0.30	
0.06	57	0.31	
0.07	65	0.32	
0.08	71	0.33	
0.09	75	0.34	
0.10	79	0.35	
0.11	81	0.36	
0.12	81	0.37	
0.13	80	0.38	
0.14	77	0.39	
0.15	75	0.40	
0.16	72	0.41	
0.17	70	0.42	
0.18	67	0.43	
0.19	65	0.44	
0.20	62	0.45	
0.21	59	0.46	
0.22	56	0.47	
0.23	53	0.48	
0.24		0.49	
0.25		0.50	

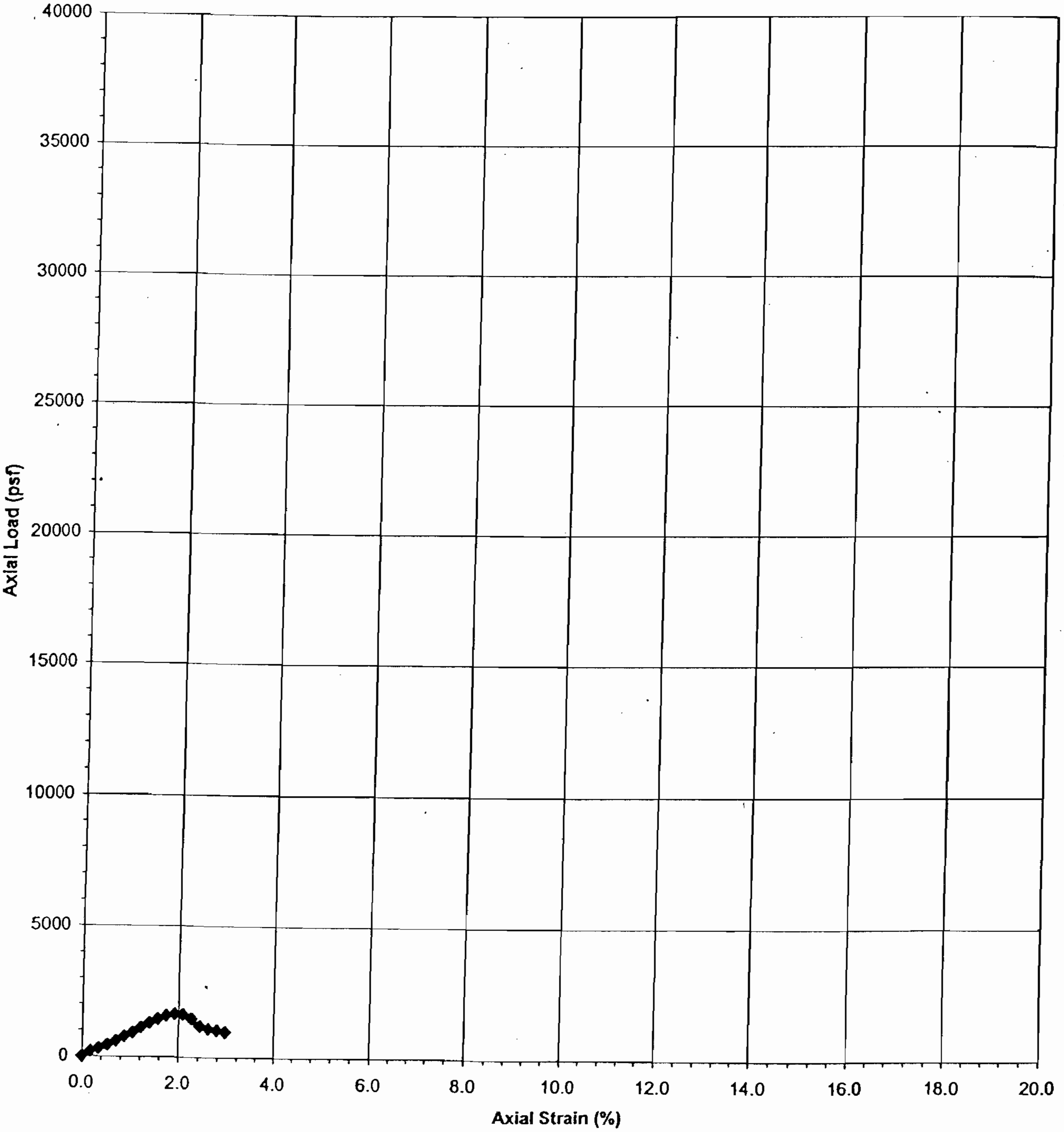
Sketch of Sample After Test:



2.5Y 8/3 PALE YELLOW
CO_3 OR TUFF ZONE

Comments: YEL BRN 10 YR 5/6

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-8 @ 18.5'
Yel Brn slightly clayey Sandstone (VFG-FG)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	03/02/2001						
BORING:	B-8			Ring Constant = 0.6954 lb/div			
DEPTH:	18.5'						

SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.42	5.75	0.00	0	0.00	0	0.0	0
2.42	5.75	0.01	9	6.26	196	0.2	196
2.42	5.75	0.02	14	9.74	305	0.3	305
2.42	5.75	0.03	20	13.91	435	0.5	435
2.42	5.75	0.04	27	18.78	588	0.7	588
2.42	5.75	0.05	35	24.34	762	0.9	762
2.42	5.75	0.06	42	29.21	914	1.0	914
2.42	5.75	0.07	51	35.47	1110	1.2	1110
2.42	5.75	0.08	59	41.03	1284	1.4	1284
2.42	5.75	0.09	66	45.90	1437	1.6	1437
2.42	5.75	0.10	72	50.07	1568	1.7	1568
2.42	5.75	0.11	75	52.16	1633	1.9	1633
2.42	5.75	0.12	74	51.46	1611	2.1	1611
2.42	5.75	0.13	67	46.59	1459	2.3	1459
2.42	5.75	0.14	54	37.55	1176	2.4	1176
2.42	5.75	0.15	49	34.07	1067	2.6	1067
2.42	5.75	0.16	47	32.68	1023	2.8	1023
2.42	5.75	0.17	44	30.60	958	3.0	958
		0.18		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.19		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.20		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.21		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.22		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.23		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.24		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.25		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.26		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.27		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.28		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.29		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.30		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.31		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.32		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.33		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.34		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.35		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.36		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.37		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.38		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

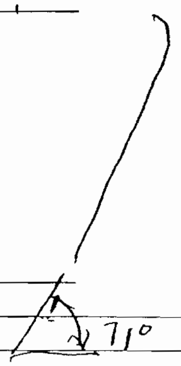
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 3/2/01
BORING: B-8
DEPTH: 18.5

Sample Diameter: 2,42
Sample Length: 5,75
Wet Wt./Dry Wt.:
Description: YEL BRN SANDSTONE VFG-FG, SL CLAYEY, V MOIST,

F-308

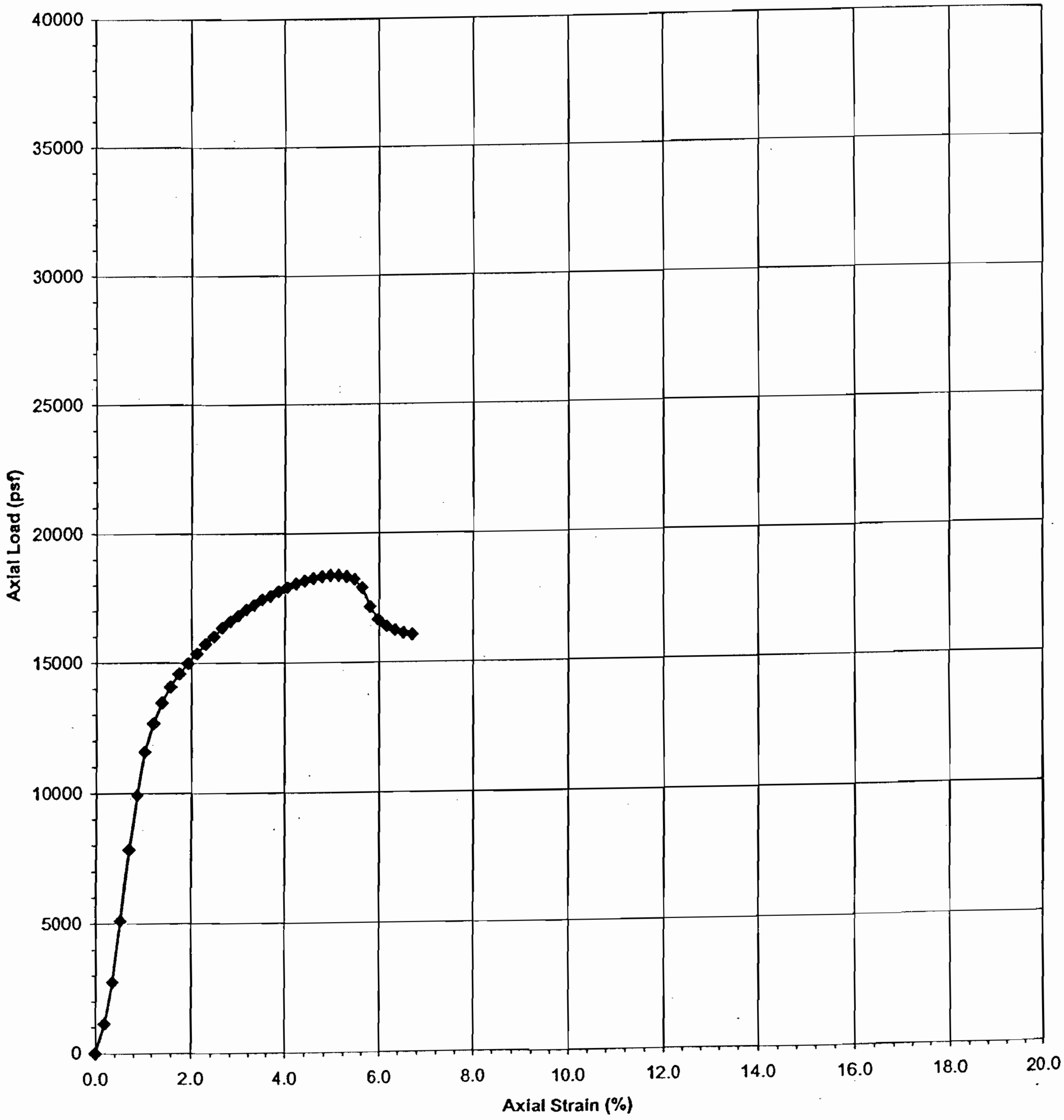
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	9	0.26	
0.02	14	0.27	
0.03	20	0.28	
0.04	27	0.29	
0.05	35	0.30	
0.06	42	0.31	
0.07	51	0.32	
0.08	59	0.33	
0.09	66	0.34	
0.10	72	0.35	
0.11	75	0.36	
0.12	74	0.37	
0.13	67	0.38	
0.14	54	0.39	
0.15	49	0.40	
0.16	47	0.41	
0.17	44	0.42	
0.18		0.43	
0.19		0.44	
0.20		0.45	
0.21		0.46	
0.22		0.47	
0.23		0.48	
0.24		0.49	
0.25		0.50	

Sketch of Sample After Test:



Comments: 71° 10YR 5/6 YEL BRN

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-14 @ 9.0'
V Dk Gry Clay (CH)



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	03/02/2001						
BORING:	B-14			Ring Constant = 0.6954 lb/div			
DEPTH:	9.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.37	5.68	0.00	0	0.00	0	0.0	0
2.37	5.68	0.01	50	34.77	1135	0.2	1135
2.37	5.68	0.02	121	84.14	2747	0.4	2747
2.37	5.68	0.03	225	156.47	5107	0.5	5107
2.37	5.68	0.04	345	239.91	7831	0.7	7831
2.37	5.68	0.05	437	303.89	9920	0.9	9920
2.37	5.68	0.06	510	354.65	11577	1.1	11577
2.37	5.68	0.07	558	388.03	12666	1.2	12666
2.37	5.68	0.08	593	412.37	13461	1.4	13461
2.37	5.68	0.09	620	431.15	14073	1.6	14073
2.37	5.68	0.10	642	446.45	14573	1.8	14573
2.37	5.68	0.11	660	458.96	14981	1.9	14981
2.37	5.68	0.12	676	470.09	15345	2.1	15345
2.37	5.68	0.13	692	481.22	15708	2.3	15708
2.37	5.68	0.14	705	490.26	16003	2.5	16003
2.37	5.68	0.15	720	500.69	16343	2.6	16343
2.37	5.68	0.16	731	508.34	16593	2.8	16593
2.37	5.68	0.17	741	515.29	16820	3.0	16820
2.37	5.68	0.18	751	522.25	17047	3.2	17047
2.37	5.68	0.19	759	527.81	17229	3.3	17229
2.37	5.68	0.20	768	534.07	17433	3.5	17433
2.37	5.68	0.21	774	538.24	17569	3.7	17569
2.37	5.68	0.22	782	543.80	17751	3.9	17751
2.37	5.68	0.23	789	548.67	17910	4.0	17910
2.37	5.68	0.24	795	552.84	18046	4.2	18046
2.37	5.68	0.25	800	556.32	18159	4.4	18159
2.37	5.68	0.26	804	559.10	18250	4.6	18250
2.37	5.68	0.27	807	561.19	18318	4.8	18318
2.37	5.68	0.28	809	562.58	18364	4.9	18364
2.37	5.68	0.29	809	562.58	18364	5.1	18364
2.37	5.68	0.30	807	561.19	18318	5.3	18318
2.37	5.68	0.31	802	557.71	18205	5.5	18205
2.37	5.68	0.32	788	547.98	17887	5.6	17887
2.37	5.68	0.33	755	525.03	17138	5.8	17138
2.37	5.68	0.34	733	509.73	16638	6.0	16638
2.37	5.68	0.35	722	502.08	16389	6.2	16389
2.37	5.68	0.36	715	497.21	16230	6.3	16230
2.37	5.68	0.37	710	493.73	16116	6.5	16116
2.37	5.68	0.38	707	491.65	16048	6.7	16048
		0.39		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.40		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

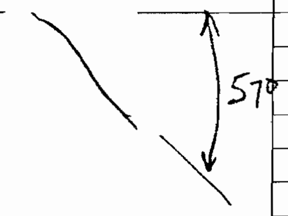
CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 3/2/01
BORING: B-14
DEPTH: 9.0

Sample Diameter: 2.37
Sample Length: 5.68
Wet Wt./Dry Wt.:
Description: V DK GRY CLAY (CH)
V STIFF/HARD

F-104

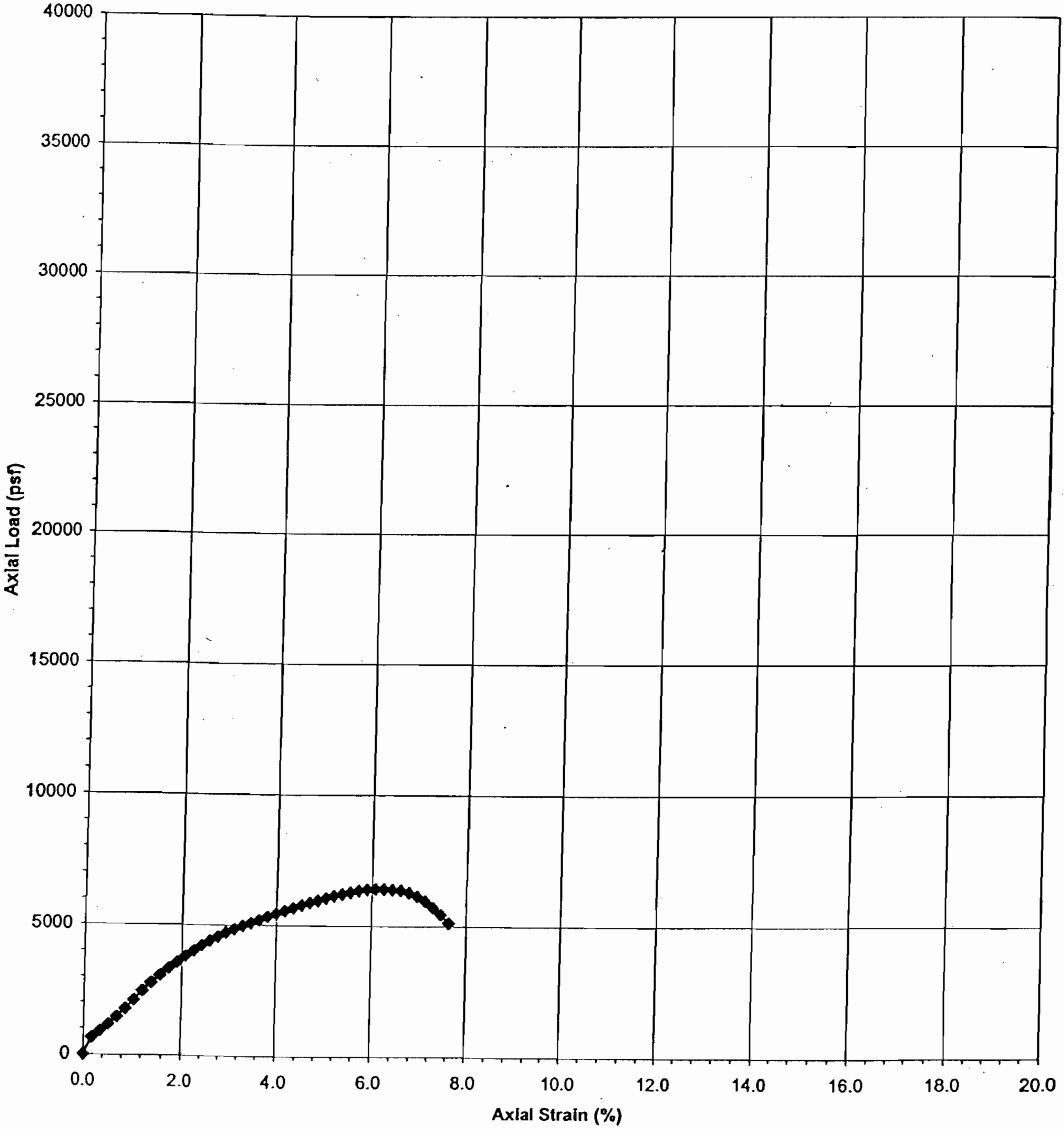
CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	50	0.26	804
0.02	121	0.27	807
0.03	225	0.28	809
0.04	345	0.29	809
0.05	437	0.30	807
0.06	510	0.31	802
0.07	558	0.32	788
0.08	593	0.33	755
0.09	620	0.34	733
0.10	642	0.35	722
0.11	660	0.36	715
0.12	676	0.37	710
0.13	692	0.38	707
0.14	705	0.39	
0.15	720	0.40	
0.16	731	0.41	
0.17	741	0.42	
0.18	751	0.43	
0.19	759	0.44	
0.20	768	0.45	
0.21	774	0.46	
0.22	782	0.47	
0.23	789	0.48	
0.24	795	0.49	
0.25	800	0.50	

Sketch of Sample After Test:



Comments: 10YR 3/1 V DK GRY (VDK OLV BRN)

Unconfined Compression Test Results
Vasco Road, Project 001860
Boring B-14 @ 14.0'
Dk Yel Brn Claystone



UNCONFINED COMPRESSION
(UNCONF.XLS)

CLIENT:	CAL Engineering and Geology						
PROJECT	Vasco Road						
PROJ. # :	001860						
DATE:	03/02/2001						
BORING:	B-14			Ring Constant = 0.6954 lb/div			
DEPTH:	14.0'						
SAMPLE DIAMETER (IN)	ORIGINAL HEIGHT (IN)	CHANGE IN HEIGHT (IN)	PROVING RING READ.	PROVING RING LOAD (LBS)	PRESSURE (PSF)	STRAIN (%)	PRESSURE (PSF)
2.38	5.76	0.00	0	0.00	0	0.0	0
2.38	5.76	0.01	29	20.17	653	0.2	653
2.38	5.76	0.02	40	27.82	900	0.3	900
2.38	5.76	0.03	51	35.47	1148	0.5	1148
2.38	5.76	0.04	64	44.51	1441	0.7	1441
2.38	5.76	0.05	78	54.24	1756	0.9	1756
2.38	5.76	0.06	93	64.67	2093	1.0	2093
2.38	5.76	0.07	109	75.80	2453	1.2	2453
2.38	5.76	0.08	123	85.53	2769	1.4	2769
2.38	5.76	0.09	136	94.57	3061	1.6	3061
2.38	5.76	0.10	148	102.92	3331	1.7	3331
2.38	5.76	0.11	158	109.87	3556	1.9	3556
2.38	5.76	0.12	169	117.52	3804	2.1	3804
2.38	5.76	0.13	178	123.78	4007	2.3	4007
2.38	5.76	0.14	187	130.04	4209	2.4	4209
2.38	5.76	0.15	195	135.60	4389	2.6	4389
2.38	5.76	0.16	202	140.47	4547	2.8	4547
2.38	5.76	0.17	209	145.34	4704	3.0	4704
2.38	5.76	0.18	215	149.51	4839	3.1	4839
2.38	5.76	0.19	221	153.68	4974	3.3	4974
2.38	5.76	0.20	226	157.16	5087	3.5	5087
2.38	5.76	0.21	231	160.64	5200	3.6	5200
2.38	5.76	0.22	237	164.81	5335	3.8	5335
2.38	5.76	0.23	242	168.29	5447	4.0	5447
2.38	5.76	0.24	247	171.76	5560	4.2	5560
2.38	5.76	0.25	252	175.24	5672	4.3	5672
2.38	5.76	0.26	257	178.72	5785	4.5	5785
2.38	5.76	0.27	261	181.50	5875	4.7	5875
2.38	5.76	0.28	265	184.28	5965	4.9	5965
2.38	5.76	0.29	269	187.06	6055	5.0	6055
2.38	5.76	0.30	273	189.84	6145	5.2	6145
2.38	5.76	0.31	276	191.93	6212	5.4	6212
2.38	5.76	0.32	279	194.02	6280	5.6	6280
2.38	5.76	0.33	282	196.10	6347	5.7	6347
2.38	5.76	0.34	284	197.49	6392	5.9	6392
2.38	5.76	0.35	285	198.19	6415	6.1	6415
2.38	5.76	0.36	285	198.19	6415	6.3	6415
2.38	5.76	0.37	284	197.49	6392	6.4	6392
2.38	5.76	0.38	283	196.80	6370	6.6	6370
2.38	5.76	0.39	279	194.02	6280	6.8	6280
2.38	5.76	0.40	273	189.84	6145	6.9	6145

UNCONFINED COMPRESSION
(UNCONF.XLS)

2.38	5.76	0.41	265	184.28	5965	7.1	5965
2.38	5.76	0.42	254	176.63	5717	7.3	5717
2.38	5.76	0.43	242	168.29	5447	7.5	5447
2.38	5.76	0.44	228	158.55	5132	7.6	5132
		0.45		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.46		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.47		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.48		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.49		0.00	#DIV/0!	#DIV/0!	#DIV/0!
		0.50		0.00	#DIV/0!	#DIV/0!	#DIV/0!

Unconfined Compression Test Data (Rock)

Ring Constant = 0.6954 lb/div

CLIENT: Cal Engineering and Geology
PROJECT: Vasco Road
PROJ. # : 001860
DATE: 3/2/01
BORING: B-14
DEPTH: 14.0

Sample Diameter: 2.38
Sample Length: 5.76
Wet Wt./Dry Wt.:
Description: DK YEL BRN CLAYSTONE

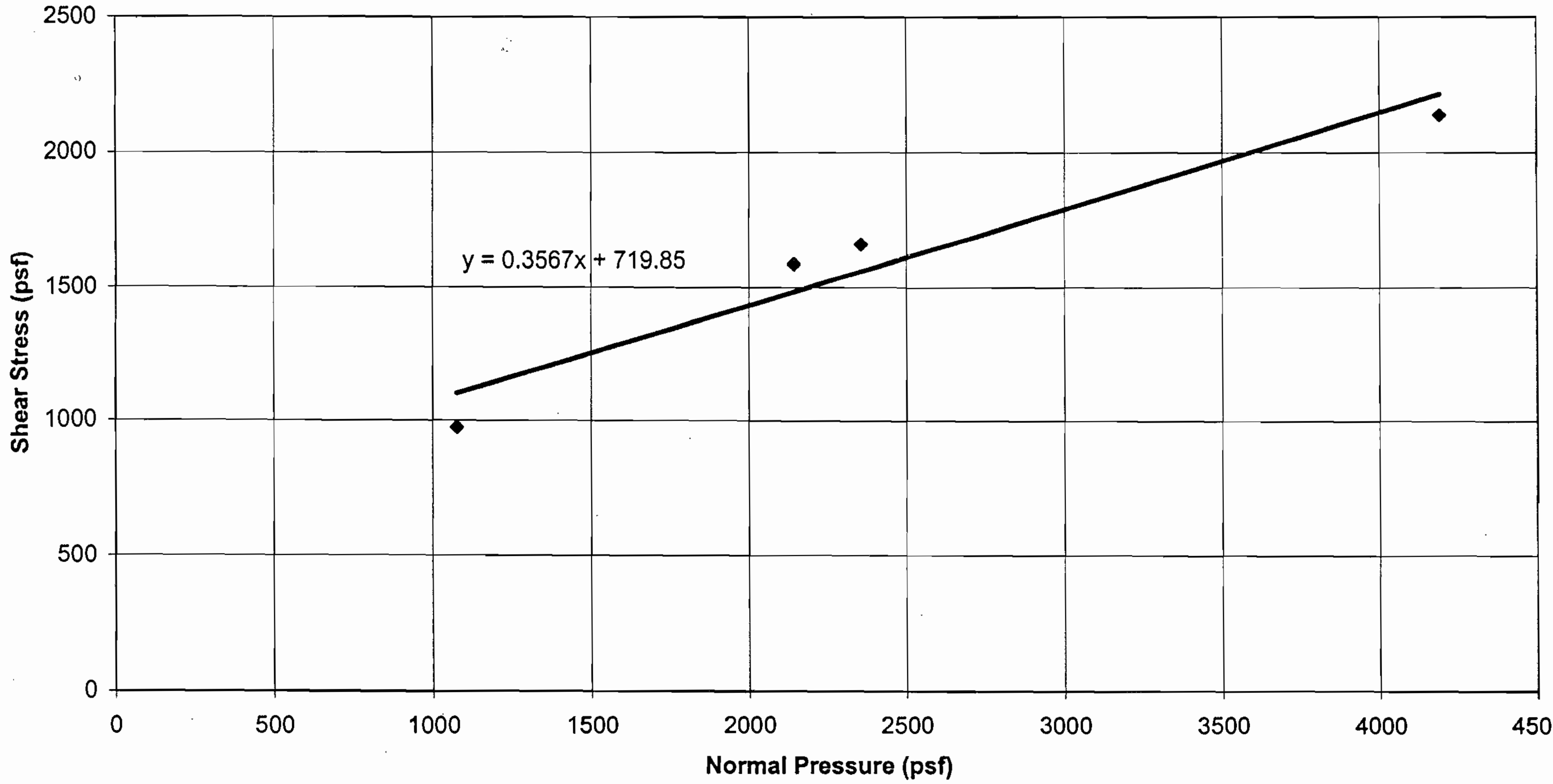
F-300

CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)	CHANGE IN HEIGHT (IN)	PROVING RING READ. (DIV)
0.01	29	0.26	257
0.02	40	0.27	261
0.03	51	0.28	265
0.04	64	0.29	269
0.05	78	0.30	273
0.06	93	0.31	276
0.07	109	0.32	279
0.08	123	0.33	282
0.09	136	0.34	284
0.10	148	0.35	285
0.11	158	0.36	285
0.12	169	0.37	284
0.13	178	0.38	283
0.14	187	0.39	279
0.15	195	0.40	273
0.16	202	0.41	265
0.17	209	0.42	254
0.18	215	0.43	242
0.19	221	0.44	228
0.20	226	0.45	
0.21	231	0.46	
0.22	237	0.47	
0.23	242	0.48	
0.24	247	0.49	
0.25	252	0.50	

Sketch of Sample After Test:

Comments: 10YR 4/4 DK YEL BRN

DIRECT SHEAR RESULTS (Peak)
Vasco Road, Project No. 001860
Boring B-3, Depth 47.0'
Friction Angle 19.6 deg., Cohesion 720 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Dk Gry Brn w/Olv Yel Claystone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

Project: Vasco Rd.

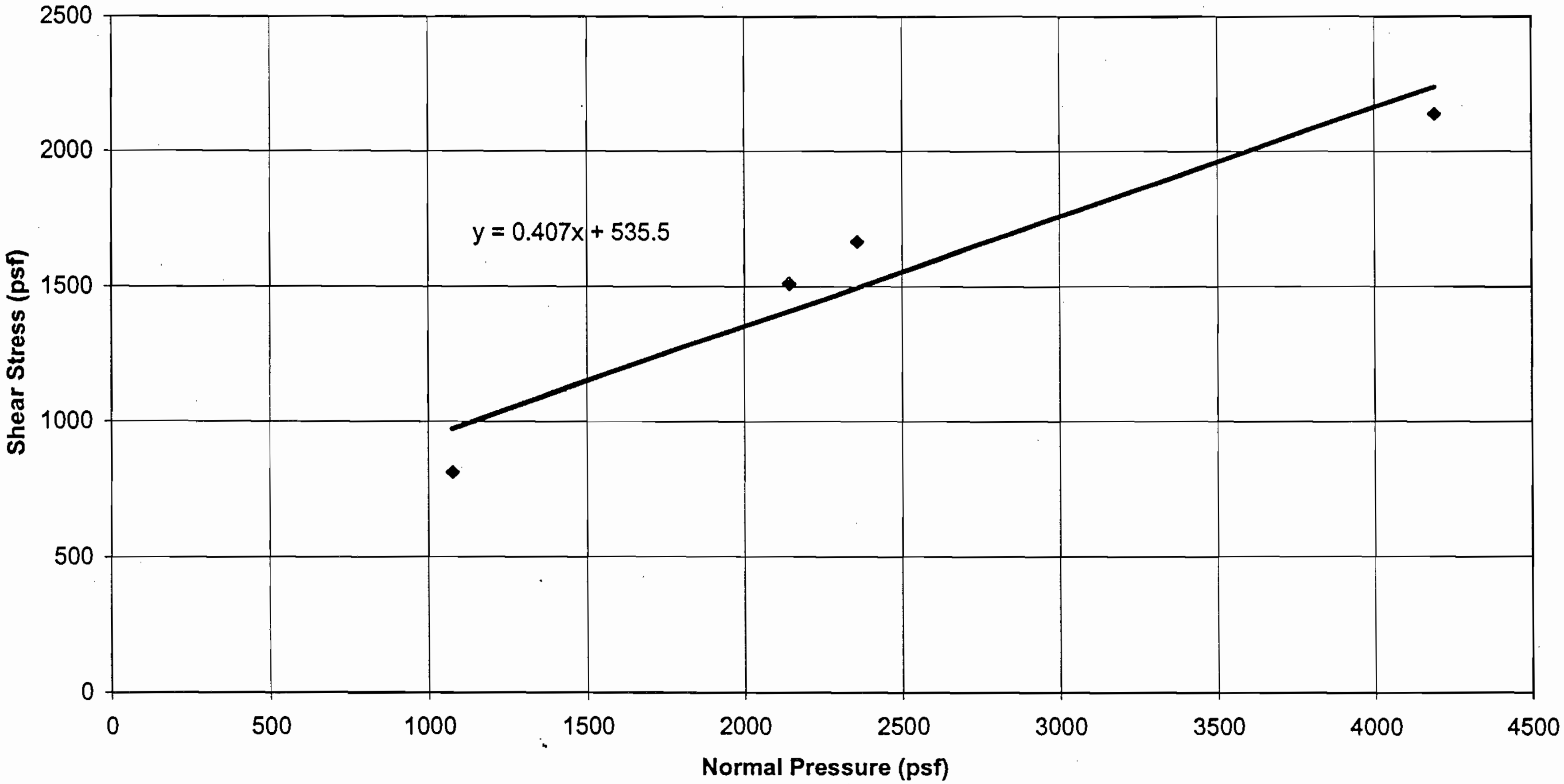
Project #: 1860

Boring: B-3 Depth: 47.0'

1075	975
2142	1588
2356	1662
4190	2137

DIRECT SHEAR RESULTS (Ultimate)

Vasco Road, Project No. 001860
Boring B-3, Depth 47.0'
Friction Angle 22.1 deg., Cohesion 536 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Dk Gry Brn w/Olv Yel Claystone



CLIENT: CAL Engineering and Geology

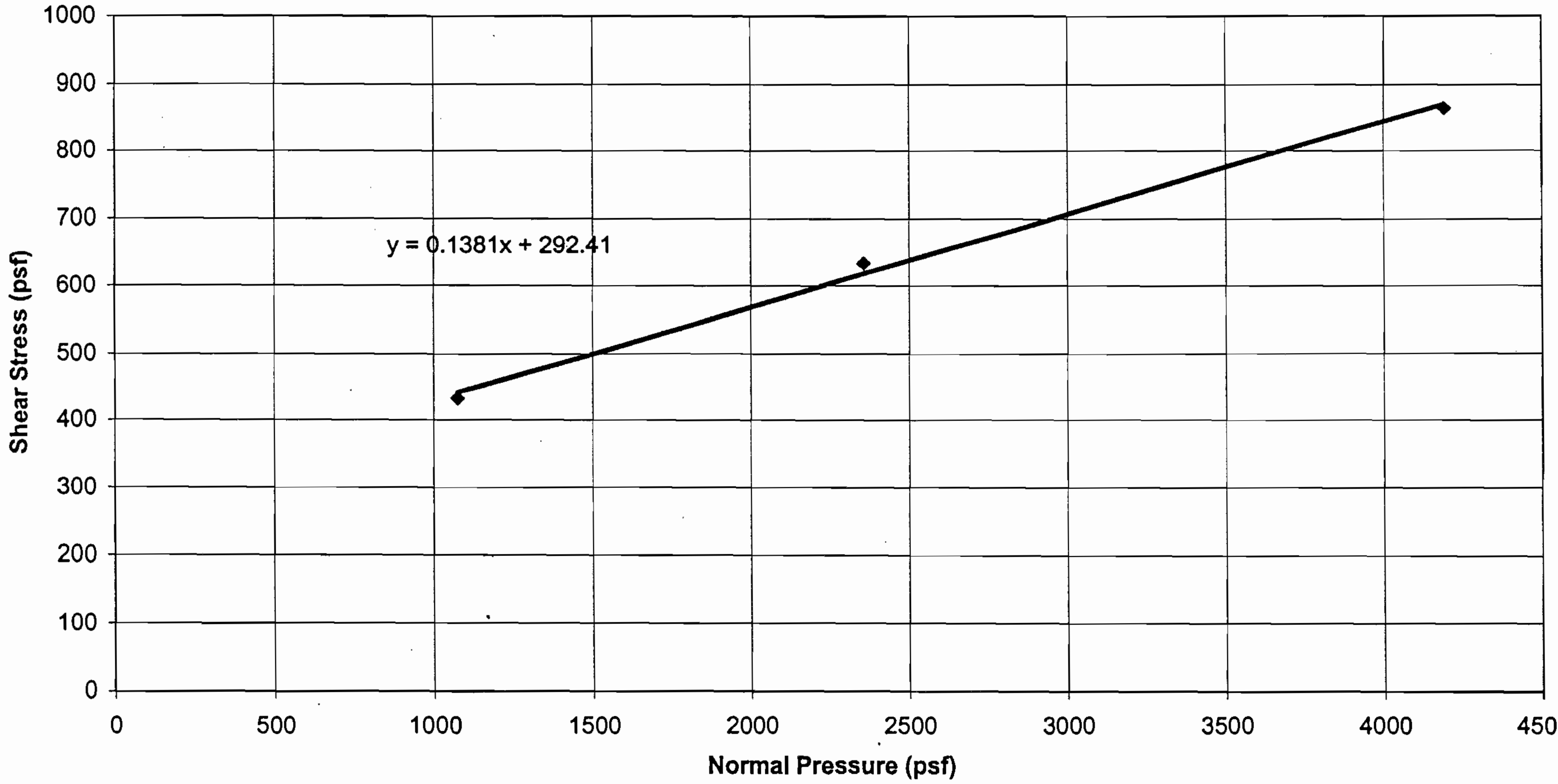
RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Ultimate)
Project: Vasco Rd.
Project #: 1860
Boring: B-3 Depth: 47.0'

1075	807
2142	1510
2356	1662
4190	2137

DIRECT SHEAR RESULTS (Residual - 4 Cycles)

Vasco Road, Project No. 001860
Boring B-3, Depth 47.0'
Friction Angle 7.9 deg., Cohesion 292 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Dk Gry Brn w/Olv Yel Claystone

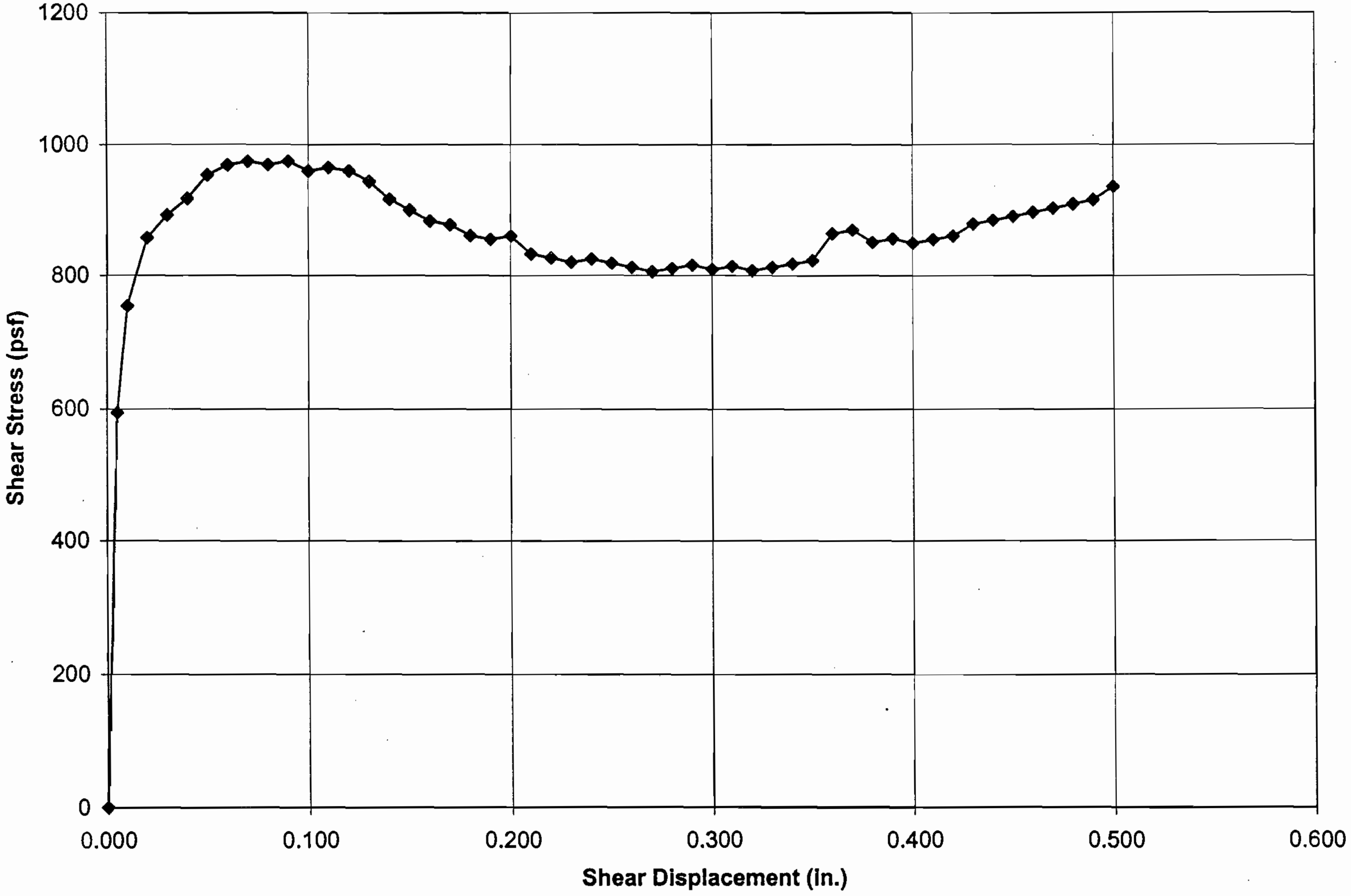


CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

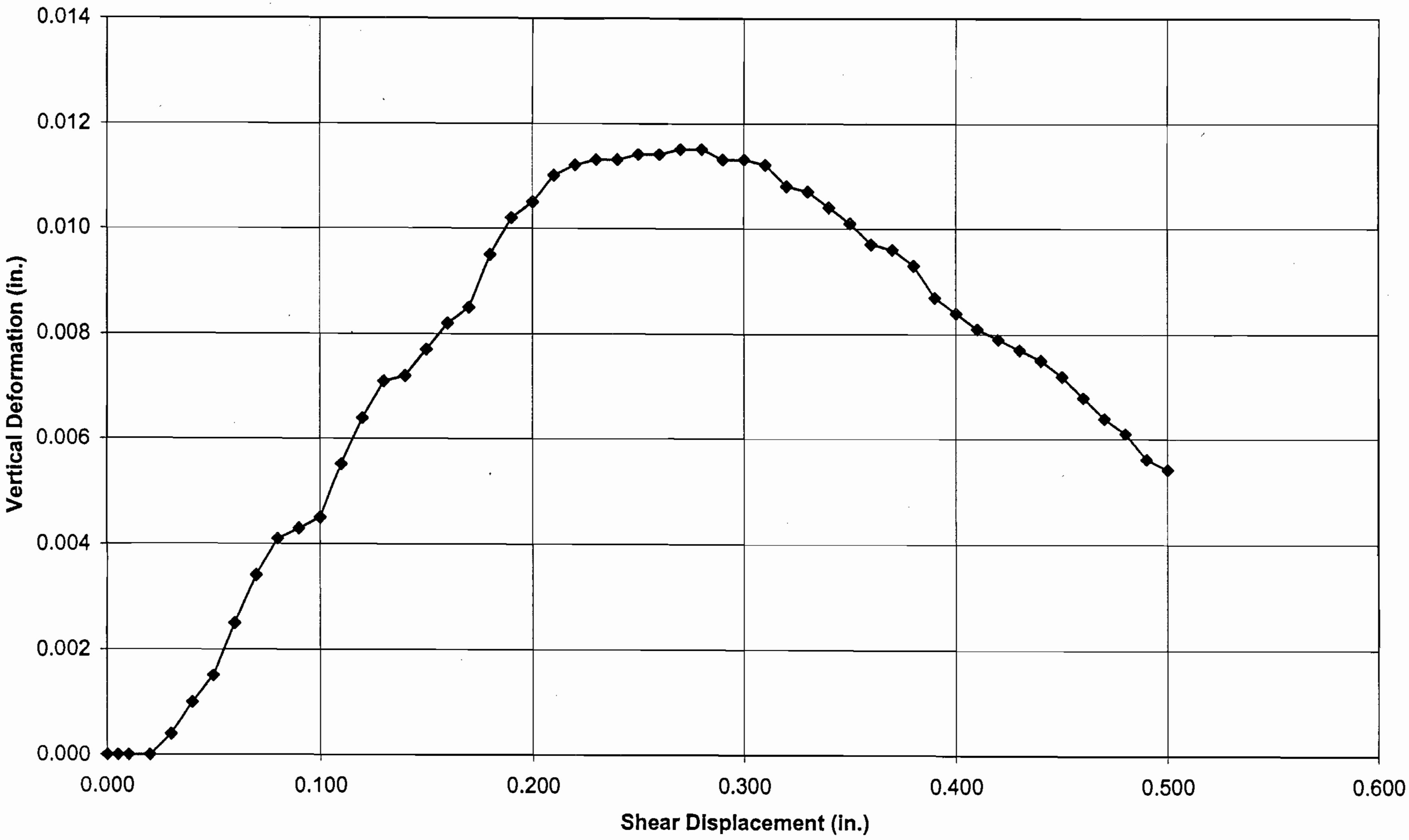
Direct Shear Envelope Plot (Residual)
Project: Vasco Rd.
Project #: 1860
Boring: B-3 Depth: 47.0'

1075	432	Values at 5% horizontal strain.
2356	633	
4190	865	
2142	411	This point plots too far of the line of best fit.



Shear Stress vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #1, Vertical Load 1075 psf

Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #1, Vertical Load 1075 psf



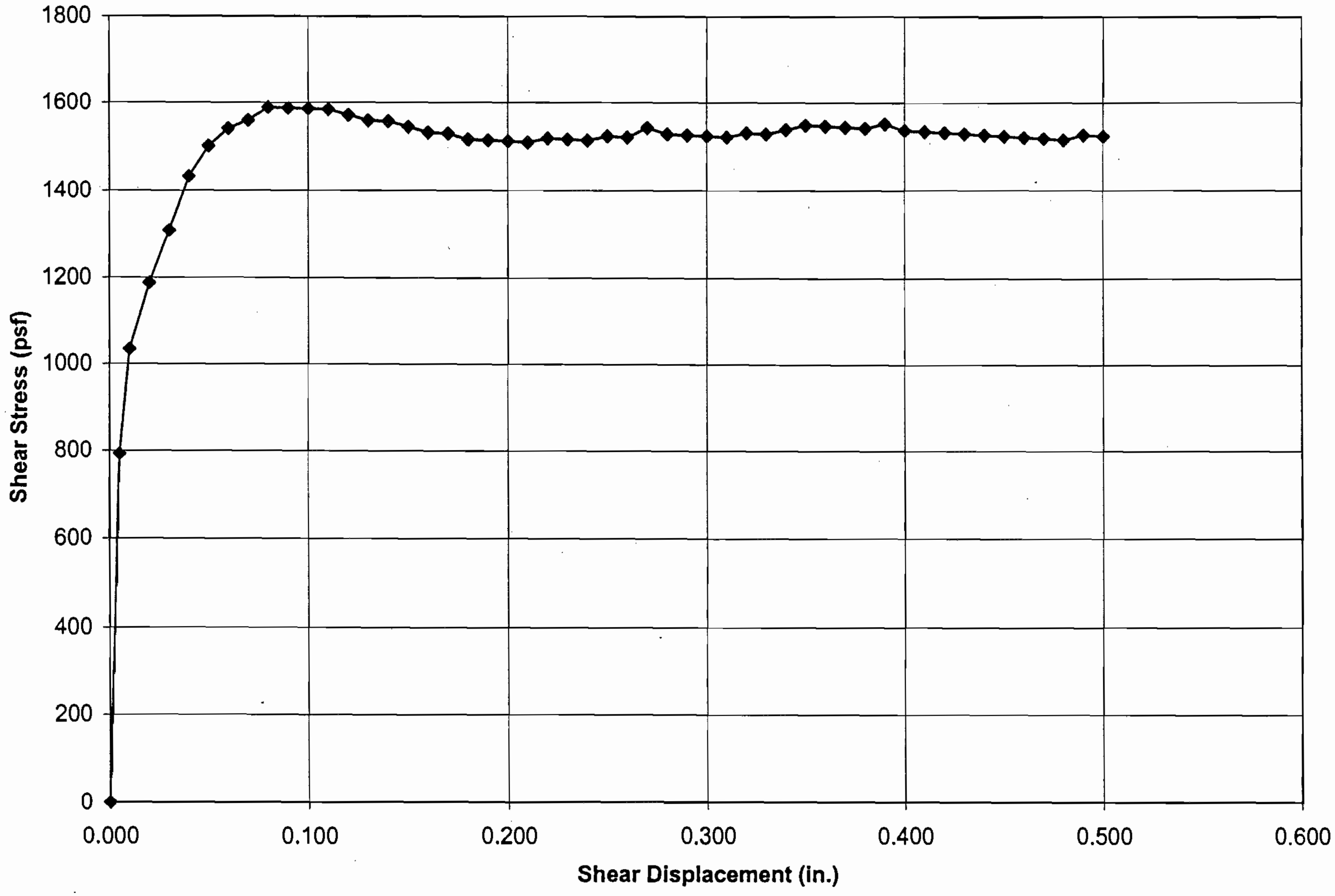
DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology							Ring Constant = 0.3156 lb/div				
PROJECT:	Vasco Road							Sample Diameter (in.):			2.42	
PROJ. # :	001860		TEST DATE:		01/07/2001			Init. Sample Height (in.):			1.20	
BORING:	B-3		DEPTH:		47.0'			Init.Horz. Dial Reading:			0	
SAMPLE #:	1							Vertical Pressure (psf):			1075	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.											

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	2494	2494	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	2494	2494	60	18.94	4.588	0.005	594	0.005	0.000	0.3
2.42	10	0.4	2494	2494	76	23.99	4.575	0.010	755	0.010	0.000	0.5
2.42	20	0.8	2494	2494	86	27.14	4.551	0.020	859	0.020	0.000	1.1
2.42	30	1.2	2498	2494	89	28.09	4.527	0.030	893	0.030	0.000	1.6
2.42	40	1.7	2504	2494	91	28.72	4.503	0.040	918	0.040	0.001	2.1
2.42	50	2.1	2509	2494	94	29.67	4.479	0.050	954	0.050	0.002	2.6
2.42	60	2.5	2519	2494	95	29.98	4.454	0.060	969	0.060	0.003	3.2
2.42	70	2.9	2528	2494	95	29.98	4.430	0.070	975	0.070	0.003	3.7
2.42	80	3.3	2535	2494	94	29.67	4.406	0.080	970	0.080	0.004	4.2
2.42	90	3.7	2537	2494	94	29.67	4.382	0.090	975	0.090	0.004	4.7
2.42	100	4.1	2539	2494	92	29.04	4.358	0.100	959	0.100	0.005	5.3
2.42	110	4.5	2549	2494	92	29.04	4.333	0.110	965	0.110	0.006	5.8
2.42	120	5.0	2558	2494	91	28.72	4.309	0.120	960	0.120	0.006	6.3
2.42	130	5.4	2565	2494	89	28.09	4.285	0.130	944	0.130	0.007	6.8
2.42	140	5.8	2566	2494	86	27.14	4.261	0.140	917	0.140	0.007	7.4
2.42	150	6.2	2571	2494	84	26.51	4.237	0.150	901	0.150	0.008	7.9
2.42	160	6.6	2576	2494	82	25.88	4.213	0.160	885	0.160	0.008	8.4
2.42	170	7.0	2579	2494	81	25.56	4.189	0.170	879	0.170	0.009	8.9
2.42	180	7.4	2589	2494	79	24.93	4.164	0.180	862	0.180	0.010	9.5
2.42	190	7.9	2596	2494	78	24.62	4.140	0.190	856	0.190	0.010	10.0
2.42	200	8.3	2599	2494	78	24.62	4.116	0.200	861	0.200	0.011	10.5
2.42	210	8.7	2604	2494	75	23.67	4.092	0.210	833	0.210	0.011	11.0
2.42	220	9.1	2606	2494	74	23.35	4.068	0.220	827	0.220	0.011	11.6
2.42	230	9.5	2607	2494	73	23.04	4.044	0.230	820	0.230	0.011	12.1
2.42	240	9.9	2607	2494	73	23.04	4.020	0.240	825	0.240	0.011	12.6
2.42	250	10.3	2608	2494	72	22.72	3.996	0.250	819	0.250	0.011	13.1
2.42	260	10.7	2608	2494	71	22.41	3.972	0.260	812	0.260	0.011	13.7
2.42	270	11.2	2609	2494	70	22.09	3.948	0.270	806	0.270	0.012	14.2
2.42	280	11.6	2609	2494	70	22.09	3.924	0.280	811	0.280	0.012	14.7
2.42	290	12.0	2607	2494	70	22.09	3.899	0.290	816	0.290	0.011	15.2
2.42	300	12.4	2607	2494	69	21.78	3.875	0.300	809	0.300	0.011	15.7
2.42	310	12.8	2606	2494	69	21.78	3.851	0.310	814	0.310	0.011	16.3
2.42	320	13.2	2602	2494	68	21.46	3.827	0.320	807	0.320	0.011	16.8
2.42	330	13.6	2601	2494	68	21.46	3.803	0.330	813	0.330	0.011	17.3
2.42	340	14.0	2598	2494	68	21.46	3.780	0.340	818	0.340	0.010	17.8
2.42	350	14.5	2595	2494	68	21.46	3.756	0.350	823	0.350	0.010	18.4
2.42	360	14.9	2591	2494	71	22.41	3.732	0.360	865	0.360	0.010	18.9
2.42	370	15.3	2590	2494	71	22.41	3.708	0.370	870	0.370	0.010	19.4
2.42	380	15.7	2587	2494	69	21.78	3.684	0.380	851	0.380	0.009	19.9
2.42	390	16.1	2581	2494	69	21.78	3.660	0.390	857	0.390	0.009	20.4
2.42	400	16.5	2578	2494	68	21.46	3.636	0.400	850	0.400	0.008	20.9

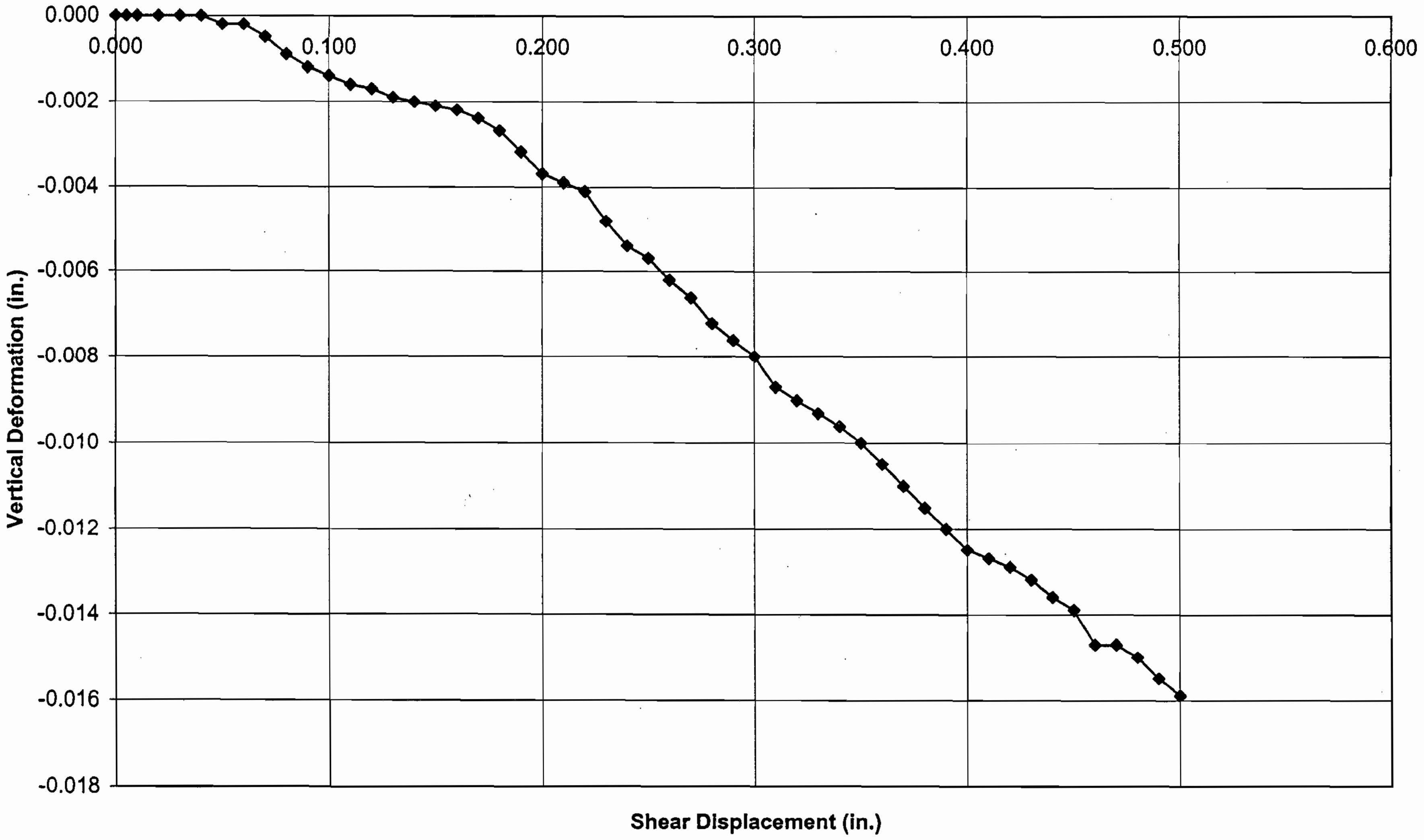
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	2575	2494	68	21.46	3.612	0.410	856	0.410	0.008	21.5
2.42	420	17.4	2573	2494	68	21.46	3.588	0.420	861	0.420	0.008	22.0
2.42	430	17.8	2571	2494	69	21.78	3.565	0.430	880	0.430	0.008	22.5
2.42	440	18.2	2569	2494	69	21.78	3.541	0.440	886	0.440	0.008	23.0
2.42	450	18.6	2566	2494	69	21.78	3.517	0.450	892	0.450	0.007	23.5
2.42	460	19.0	2562	2494	69	21.78	3.493	0.460	898	0.460	0.007	24.1
2.42	470	19.4	2558	2494	69	21.78	3.469	0.470	904	0.470	0.006	24.6
2.42	480	19.8	2555	2494	69	21.78	3.446	0.480	910	0.480	0.006	25.1
2.42	490	20.2	2550	2494	69	21.78	3.422	0.490	916	0.490	0.006	25.6
2.42	500	20.7	2548	2494	70	22.09	3.398	0.500	936	0.500	0.005	26.1



Shear Stress vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #2, Vertical Load 2142 psf

Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #2, Vertical Load 2142 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology						Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road						Sample Diameter (in.):	2.42
PROJ. # :	001860		TEST DATE:	01/07/2001			Init. Sample Height (in.):	1.20
BORING:	B-3		DEPTH:	47.0'			Init.Horz. Dial Reading:	0
SAMPLE #:	2						Vertical Pressure (psf):	2142

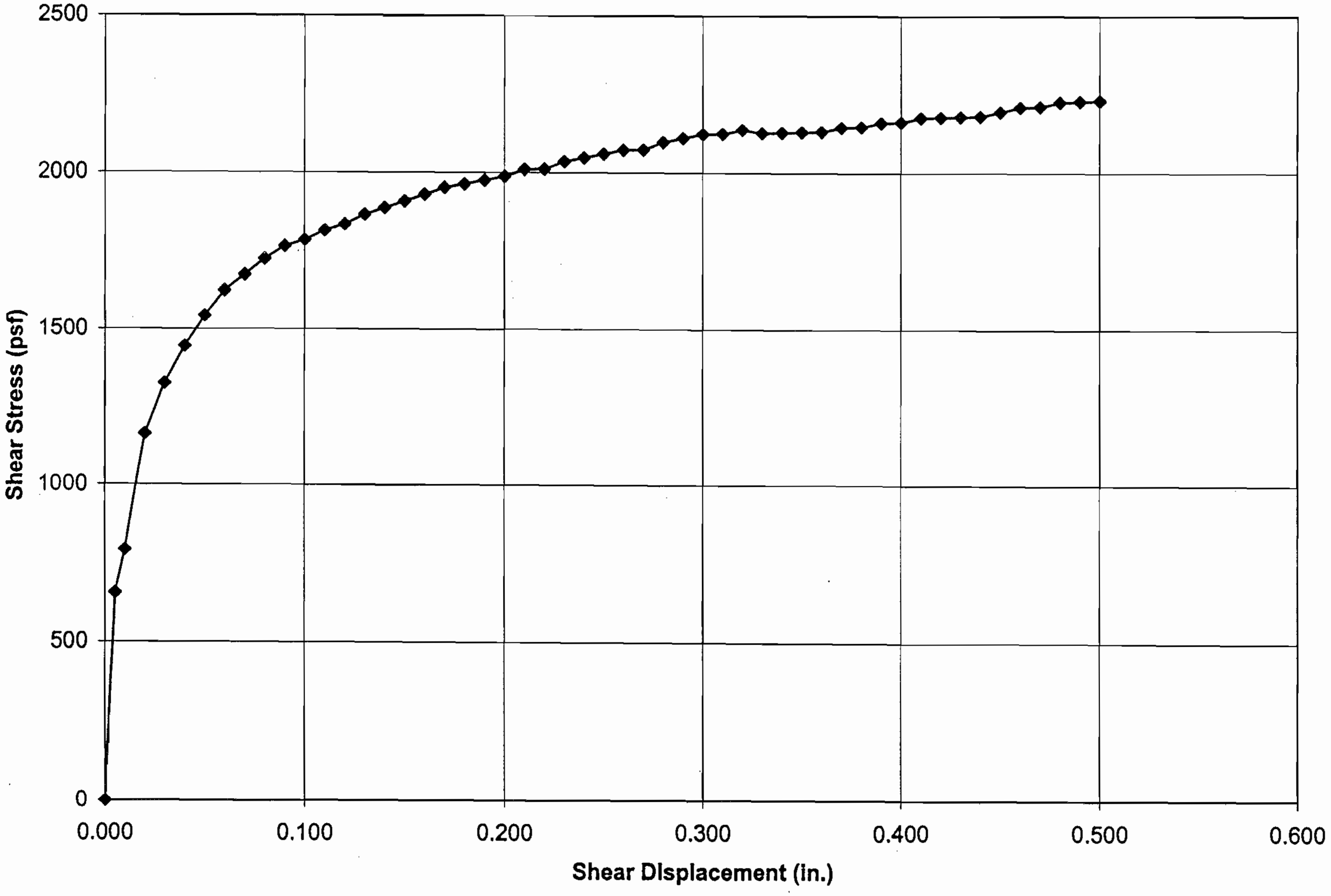
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1590	1590	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1590	1590	80	25.25	4.588	0.005	793	0.005	0.000	0.3
2.42	10	0.4	1590	1590	104	32.82	4.575	0.010	1033	0.010	0.000	0.5
2.42	20	0.8	1590	1590	119	37.56	4.551	0.020	1188	0.020	0.000	1.1
2.42	30	1.2	1590	1590	130	41.03	4.527	0.030	1305	0.030	0.000	1.6
2.42	40	1.7	1590	1590	142	44.82	4.503	0.040	1433	0.040	0.000	2.1
2.42	50	2.1	1588	1590	148	46.71	4.479	0.050	1502	0.050	0.000	2.6
2.42	60	2.5	1588	1590	151	47.66	4.454	0.060	1541	0.060	0.000	3.2
2.42	70	2.9	1585	1590	152	47.97	4.430	0.070	1559	0.070	-0.001	3.7
2.42	80	3.3	1581	1590	154	48.60	4.406	0.080	1588	0.080	-0.001	4.2
2.42	90	3.7	1578	1590	153	48.29	4.382	0.090	1587	0.090	-0.001	4.7
2.42	100	4.1	1576	1590	152	47.97	4.358	0.100	1585	0.100	-0.001	5.3
2.42	110	4.5	1574	1590	151	47.66	4.333	0.110	1584	0.110	-0.002	5.8
2.42	120	5.0	1573	1590	149	47.02	4.309	0.120	1571	0.120	-0.002	6.3
2.42	130	5.4	1571	1590	147	46.39	4.285	0.130	1559	0.130	-0.002	6.8
2.42	140	5.8	1570	1590	146	46.08	4.261	0.140	1557	0.140	-0.002	7.4
2.42	150	6.2	1569	1590	144	45.45	4.237	0.150	1545	0.150	-0.002	7.9
2.42	160	6.6	1568	1590	142	44.82	4.213	0.160	1532	0.160	-0.002	8.4
2.42	170	7.0	1566	1590	141	44.50	4.189	0.170	1530	0.170	-0.002	8.9
2.42	180	7.4	1563	1590	139	43.87	4.164	0.180	1517	0.180	-0.003	9.5
2.42	190	7.9	1558	1590	138	43.55	4.140	0.190	1515	0.190	-0.003	10.0
2.42	200	8.3	1553	1590	137	43.24	4.116	0.200	1513	0.200	-0.004	10.5
2.42	210	8.7	1551	1590	136	42.92	4.092	0.210	1510	0.210	-0.004	11.0
2.42	220	9.1	1549	1590	136	42.92	4.068	0.220	1519	0.220	-0.004	11.6
2.42	230	9.5	1542	1590	135	42.61	4.044	0.230	1517	0.230	-0.005	12.1
2.42	240	9.9	1536	1590	134	42.29	4.020	0.240	1515	0.240	-0.005	12.6
2.42	250	10.3	1533	1590	134	42.29	3.996	0.250	1524	0.250	-0.006	13.1
2.42	260	10.7	1528	1590	133	41.97	3.972	0.260	1522	0.260	-0.006	13.7
2.42	270	11.2	1524	1590	134	42.29	3.948	0.270	1543	0.270	-0.007	14.2
2.42	280	11.6	1518	1590	132	41.66	3.924	0.280	1529	0.280	-0.007	14.7
2.42	290	12.0	1514	1590	131	41.34	3.899	0.290	1527	0.290	-0.008	15.2
2.42	300	12.4	1510	1590	130	41.03	3.875	0.300	1524	0.300	-0.008	15.7
2.42	310	12.8	1503	1590	129	40.71	3.851	0.310	1522	0.310	-0.009	16.3
2.42	320	13.2	1500	1590	129	40.71	3.827	0.320	1532	0.320	-0.009	16.8
2.42	330	13.6	1497	1590	128	40.40	3.803	0.330	1529	0.330	-0.009	17.3
2.42	340	14.0	1494	1590	128	40.40	3.780	0.340	1539	0.340	-0.010	17.8
2.42	350	14.5	1490	1590	128	40.40	3.756	0.350	1549	0.350	-0.010	18.4
2.42	360	14.9	1485	1590	127	40.08	3.732	0.360	1547	0.360	-0.011	18.9
2.42	370	15.3	1480	1590	126	39.77	3.708	0.370	1544	0.370	-0.011	19.4
2.42	380	15.7	1475	1590	125	39.45	3.684	0.380	1542	0.380	-0.012	19.9
2.42	390	16.1	1470	1590	125	39.45	3.660	0.390	1552	0.390	-0.012	20.4
2.42	400	16.5	1465	1590	123	38.82	3.636	0.400	1537	0.400	-0.013	20.9

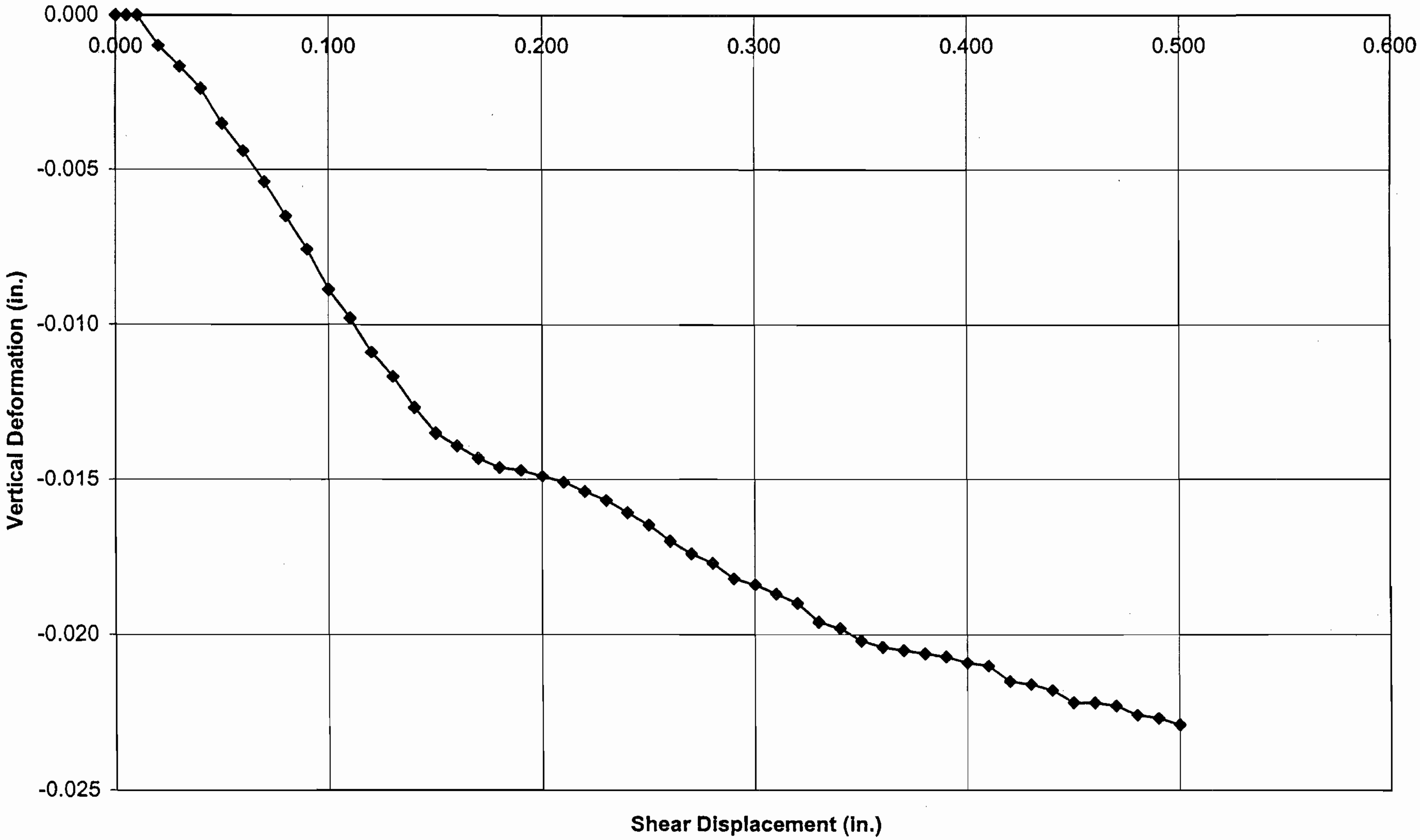
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1463	1590	122	38.50	3.612	0.410	1535	0.410	-0.013	21.5
2.42	420	17.4	1461	1590	121	38.19	3.588	0.420	1532	0.420	-0.013	22.0
2.42	430	17.8	1458	1590	120	37.87	3.565	0.430	1530	0.430	-0.013	22.5
2.42	440	18.2	1454	1590	119	37.56	3.541	0.440	1527	0.440	-0.014	23.0
2.42	450	18.6	1451	1590	118	37.24	3.517	0.450	1525	0.450	-0.014	23.5
2.42	460	19.0	1443	1590	117	36.93	3.493	0.460	1522	0.460	-0.015	24.1
2.42	470	19.4	1443	1590	116	36.61	3.469	0.470	1520	0.470	-0.015	24.6
2.42	480	19.8	1440	1590	115	36.29	3.446	0.480	1517	0.480	-0.015	25.1
2.42	490	20.2	1435	1590	115	36.29	3.422	0.490	1527	0.490	-0.016	25.6
2.42	500	20.7	1431	1590	114	35.98	3.398	0.500	1525	0.500	-0.016	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #3, Vertical Load 4190 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #3, Vertical Load 4190 psf



Sheet1

DIRECT SHEAR
DATA SHEET

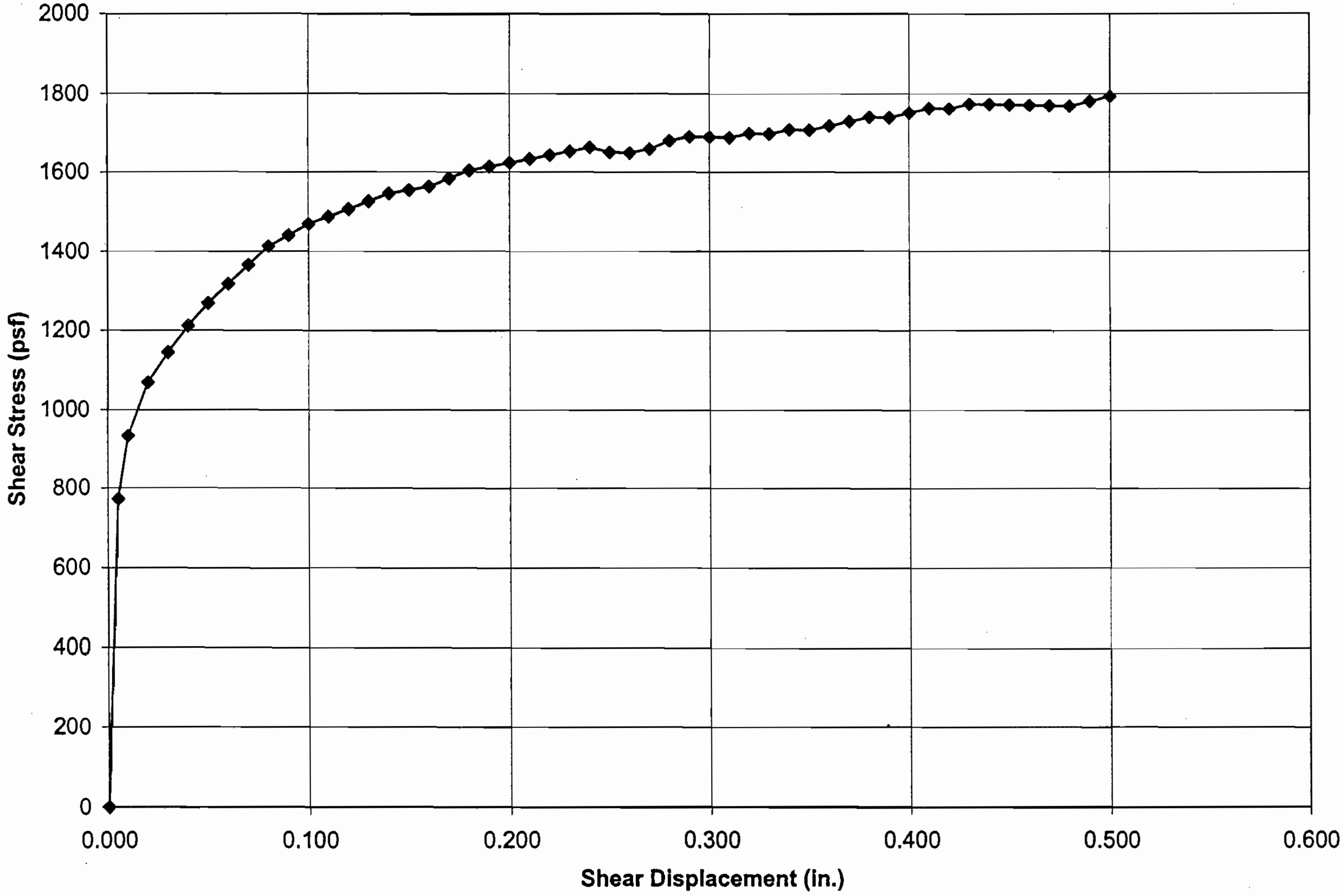
CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-3	DEPTH:	47.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	3			Vertical Pressure (psf):	4190
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.				

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1497	1497	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1497	1497	66	20.83	4.588	0.005	654	0.005	0.000	0.3
2.42	10	0.4	1497	1497	80	25.25	4.575	0.010	795	0.010	0.000	0.5
2.42	20	0.8	1487	1497	117	36.93	4.551	0.020	1168	0.020	-0.001	1.1
2.42	30	1.2	1480	1497	132	41.66	4.527	0.030	1325	0.030	-0.002	1.6
2.42	40	1.7	1473	1497	143	45.13	4.503	0.040	1443	0.040	-0.002	2.1
2.42	50	2.1	1462	1497	152	47.97	4.479	0.050	1542	0.050	-0.004	2.6
2.42	60	2.5	1453	1497	159	50.18	4.454	0.060	1622	0.060	-0.004	3.2
2.42	70	2.9	1443	1497	163	51.44	4.430	0.070	1672	0.070	-0.005	3.7
2.42	80	3.3	1432	1497	167	52.71	4.406	0.080	1723	0.080	-0.007	4.2
2.42	90	3.7	1421	1497	170	53.65	4.382	0.090	1763	0.090	-0.008	4.7
2.42	100	4.1	1408	1497	171	53.97	4.358	0.100	1783	0.100	-0.009	5.3
2.42	110	4.5	1399	1497	173	54.60	4.333	0.110	1814	0.110	-0.010	5.8
2.42	120	5.0	1388	1497	174	54.91	4.309	0.120	1835	0.120	-0.011	6.3
2.42	130	5.4	1380	1497	176	55.55	4.285	0.130	1867	0.130	-0.012	6.8
2.42	140	5.8	1370	1497	177	55.86	4.261	0.140	1888	0.140	-0.013	7.4
2.42	150	6.2	1362	1497	178	56.18	4.237	0.150	1909	0.150	-0.014	7.9
2.42	160	6.6	1358	1497	179	56.49	4.213	0.160	1931	0.160	-0.014	8.4
2.42	170	7.0	1354	1497	180	56.81	4.189	0.170	1953	0.170	-0.014	8.9
2.42	180	7.4	1351	1497	180	56.81	4.164	0.180	1964	0.180	-0.015	9.5
2.42	190	7.9	1350	1497	180	56.81	4.140	0.190	1976	0.190	-0.015	10.0
2.42	200	8.3	1348	1497	180	56.81	4.116	0.200	1987	0.200	-0.015	10.5
2.42	210	8.7	1346	1497	181	57.12	4.092	0.210	2010	0.210	-0.015	11.0
2.42	220	9.1	1343	1497	180	56.81	4.068	0.220	2011	0.220	-0.015	11.6
2.42	230	9.5	1340	1497	181	57.12	4.044	0.230	2034	0.230	-0.016	12.1
2.42	240	9.9	1336	1497	181	57.12	4.020	0.240	2046	0.240	-0.016	12.6
2.42	250	10.3	1332	1497	181	57.12	3.996	0.250	2059	0.250	-0.017	13.1
2.42	260	10.7	1327	1497	181	57.12	3.972	0.260	2071	0.260	-0.017	13.7
2.42	270	11.2	1323	1497	180	56.81	3.948	0.270	2072	0.270	-0.017	14.2
2.42	280	11.6	1320	1497	181	57.12	3.924	0.280	2097	0.280	-0.018	14.7
2.42	290	12.0	1315	1497	181	57.12	3.899	0.290	2109	0.290	-0.018	15.2
2.42	300	12.4	1313	1497	181	57.12	3.875	0.300	2123	0.300	-0.018	15.7
2.42	310	12.8	1310	1497	180	56.81	3.851	0.310	2124	0.310	-0.019	16.3
2.42	320	13.2	1307	1497	180	56.81	3.827	0.320	2137	0.320	-0.019	16.8
2.42	330	13.6	1301	1497	178	56.18	3.803	0.330	2127	0.330	-0.020	17.3
2.42	340	14.0	1299	1497	177	55.86	3.780	0.340	2128	0.340	-0.020	17.8
2.42	350	14.5	1295	1497	176	55.55	3.756	0.350	2130	0.350	-0.020	18.4
2.42	360	14.9	1293	1497	175	55.23	3.732	0.360	2131	0.360	-0.020	18.9
2.42	370	15.3	1292	1497	175	55.23	3.708	0.370	2145	0.370	-0.021	19.4
2.42	380	15.7	1291	1497	174	54.91	3.684	0.380	2147	0.380	-0.021	19.9
2.42	390	16.1	1290	1497	174	54.91	3.660	0.390	2161	0.390	-0.021	20.4
2.42	400	16.5	1288	1497	173	54.60	3.636	0.400	2162	0.400	-0.021	20.9

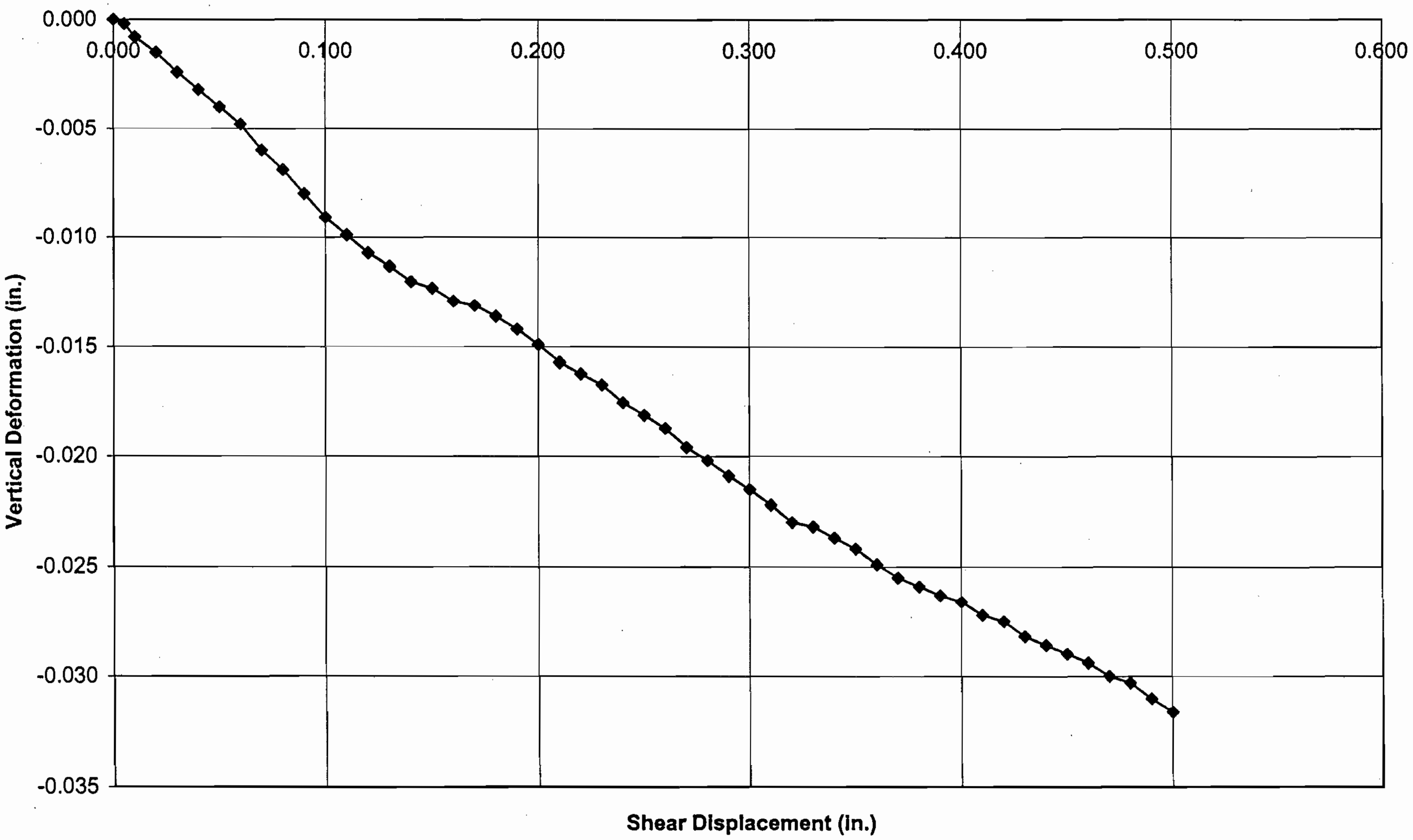
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1287	1497	173	54.60	3.612	0.410	2177	0.410	-0.021	21.5
2.42	420	17.4	1282	1497	172	54.28	3.588	0.420	2178	0.420	-0.022	22.0
2.42	430	17.8	1281	1497	171	53.97	3.565	0.430	2180	0.430	-0.022	22.5
2.42	440	18.2	1279	1497	170	53.65	3.541	0.440	2182	0.440	-0.022	23.0
2.42	450	18.6	1275	1497	170	53.65	3.517	0.450	2197	0.450	-0.022	23.5
2.42	460	19.0	1275	1497	170	53.65	3.493	0.460	2212	0.460	-0.022	24.1
2.42	470	19.4	1274	1497	169	53.34	3.469	0.470	2214	0.470	-0.022	24.6
2.42	480	19.8	1271	1497	169	53.34	3.446	0.480	2229	0.480	-0.023	25.1
2.42	490	20.2	1270	1497	168	53.02	3.422	0.490	2231	0.490	-0.023	25.6
2.42	500	20.7	1268	1497	167	52.71	3.398	0.500	2233	0.500	-0.023	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #4, Vertical Load 2356 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #4, Vertical Load 2356 psf



Sheet1

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001		Init. Sample Height (in.):	1.20
BORING:	B-3	DEPTH:	47.0'		Init.Horz. Dial Reading:	0
SAMPLE #:	4				Vertical Pressure (psf):	2356

Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1697	1697	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1695	1697	78	24.62	4.588	0.005	773	0.005	0.000	0.3
2.42	10	0.4	1689	1697	94	29.67	4.575	0.010	934	0.010	-0.001	0.5
2.42	20	0.8	1682	1697	107	33.77	4.551	0.020	1068	0.020	-0.002	1.1
2.42	30	1.2	1673	1697	114	35.98	4.527	0.030	1144	0.030	-0.002	1.6
2.42	40	1.7	1665	1697	120	37.87	4.503	0.040	1211	0.040	-0.003	2.1
2.42	50	2.1	1657	1697	125	39.45	4.479	0.050	1268	0.050	-0.004	2.6
2.42	60	2.5	1649	1697	129	40.71	4.454	0.060	1316	0.060	-0.005	3.2
2.42	70	2.9	1637	1697	133	41.97	4.430	0.070	1364	0.070	-0.006	3.7
2.42	80	3.3	1628	1697	137	43.24	4.406	0.080	1413	0.080	-0.007	4.2
2.42	90	3.7	1617	1697	139	43.87	4.382	0.090	1442	0.090	-0.008	4.7
2.42	100	4.1	1606	1697	141	44.50	4.358	0.100	1470	0.100	-0.009	5.3
2.42	110	4.5	1598	1697	142	44.82	4.333	0.110	1489	0.110	-0.010	5.8
2.42	120	5.0	1590	1697	143	45.13	4.309	0.120	1508	0.120	-0.011	6.3
2.42	130	5.4	1584	1697	144	45.45	4.285	0.130	1527	0.130	-0.011	6.8
2.42	140	5.8	1577	1697	145	45.76	4.261	0.140	1547	0.140	-0.012	7.4
2.42	150	6.2	1574	1697	145	45.76	4.237	0.150	1555	0.150	-0.012	7.9
2.42	160	6.6	1568	1697	145	45.76	4.213	0.160	1564	0.160	-0.013	8.4
2.42	170	7.0	1566	1697	146	46.08	4.189	0.170	1584	0.170	-0.013	8.9
2.42	180	7.4	1561	1697	147	46.39	4.164	0.180	1604	0.180	-0.014	9.5
2.42	190	7.9	1555	1697	147	46.39	4.140	0.190	1614	0.190	-0.014	10.0
2.42	200	8.3	1548	1697	147	46.39	4.116	0.200	1623	0.200	-0.015	10.5
2.42	210	8.7	1540	1697	147	46.39	4.092	0.210	1633	0.210	-0.016	11.0
2.42	220	9.1	1535	1697	147	46.39	4.068	0.220	1642	0.220	-0.016	11.6
2.42	230	9.5	1530	1697	147	46.39	4.044	0.230	1652	0.230	-0.017	12.1
2.42	240	9.9	1522	1697	147	46.39	4.020	0.240	1662	0.240	-0.018	12.6
2.42	250	10.3	1516	1697	145	45.76	3.996	0.250	1649	0.250	-0.018	13.1
2.42	260	10.7	1510	1697	144	45.45	3.972	0.260	1648	0.260	-0.019	13.7
2.42	270	11.2	1501	1697	144	45.45	3.948	0.270	1658	0.270	-0.020	14.2
2.42	280	11.6	1495	1697	145	45.76	3.924	0.280	1680	0.280	-0.020	14.7
2.42	290	12.0	1488	1697	145	45.76	3.899	0.290	1690	0.290	-0.021	15.2
2.42	300	12.4	1482	1697	144	45.45	3.875	0.300	1689	0.300	-0.022	15.7
2.42	310	12.8	1475	1697	143	45.13	3.851	0.310	1687	0.310	-0.022	16.3
2.42	320	13.2	1467	1697	143	45.13	3.827	0.320	1698	0.320	-0.023	16.8
2.42	330	13.6	1465	1697	142	44.82	3.803	0.330	1697	0.330	-0.023	17.3
2.42	340	14.0	1460	1697	142	44.82	3.780	0.340	1707	0.340	-0.024	17.8
2.42	350	14.5	1455	1697	141	44.50	3.756	0.350	1706	0.350	-0.024	18.4
2.42	360	14.9	1448	1697	141	44.50	3.732	0.360	1717	0.360	-0.025	18.9
2.42	370	15.3	1442	1697	141	44.50	3.708	0.370	1728	0.370	-0.026	19.4
2.42	380	15.7	1438	1697	141	44.50	3.684	0.380	1739	0.380	-0.026	19.9
2.42	390	16.1	1434	1697	140	44.18	3.660	0.390	1738	0.390	-0.026	20.4
2.42	400	16.5	1431	1697	140	44.18	3.636	0.400	1750	0.400	-0.027	20.9

DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1425	1697	140	44.18	3.612	0.410	1761	0.410	-0.027	21.5
2.42	420	17.4	1422	1697	139	43.87	3.588	0.420	1760	0.420	-0.028	22.0
2.42	430	17.8	1415	1697	139	43.87	3.565	0.430	1772	0.430	-0.028	22.5
2.42	440	18.2	1411	1697	138	43.55	3.541	0.440	1771	0.440	-0.029	23.0
2.42	450	18.6	1407	1697	137	43.24	3.517	0.450	1770	0.450	-0.029	23.5
2.42	460	19.0	1403	1697	136	42.92	3.493	0.460	1769	0.460	-0.029	24.1
2.42	470	19.4	1397	1697	135	42.61	3.469	0.470	1768	0.470	-0.030	24.6
2.42	480	19.8	1394	1697	134	42.29	3.446	0.480	1767	0.480	-0.030	25.1
2.42	490	20.2	1387	1697	134	42.29	3.422	0.490	1780	0.490	-0.031	25.6
2.42	500	20.7	1381	1697	134	42.29	3.398	0.500	1792	0.500	-0.032	26.1

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road		**Residual/4th cycle**	Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-3	DEPTH:	47.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	1			Vertical Pressure (psf):	1075

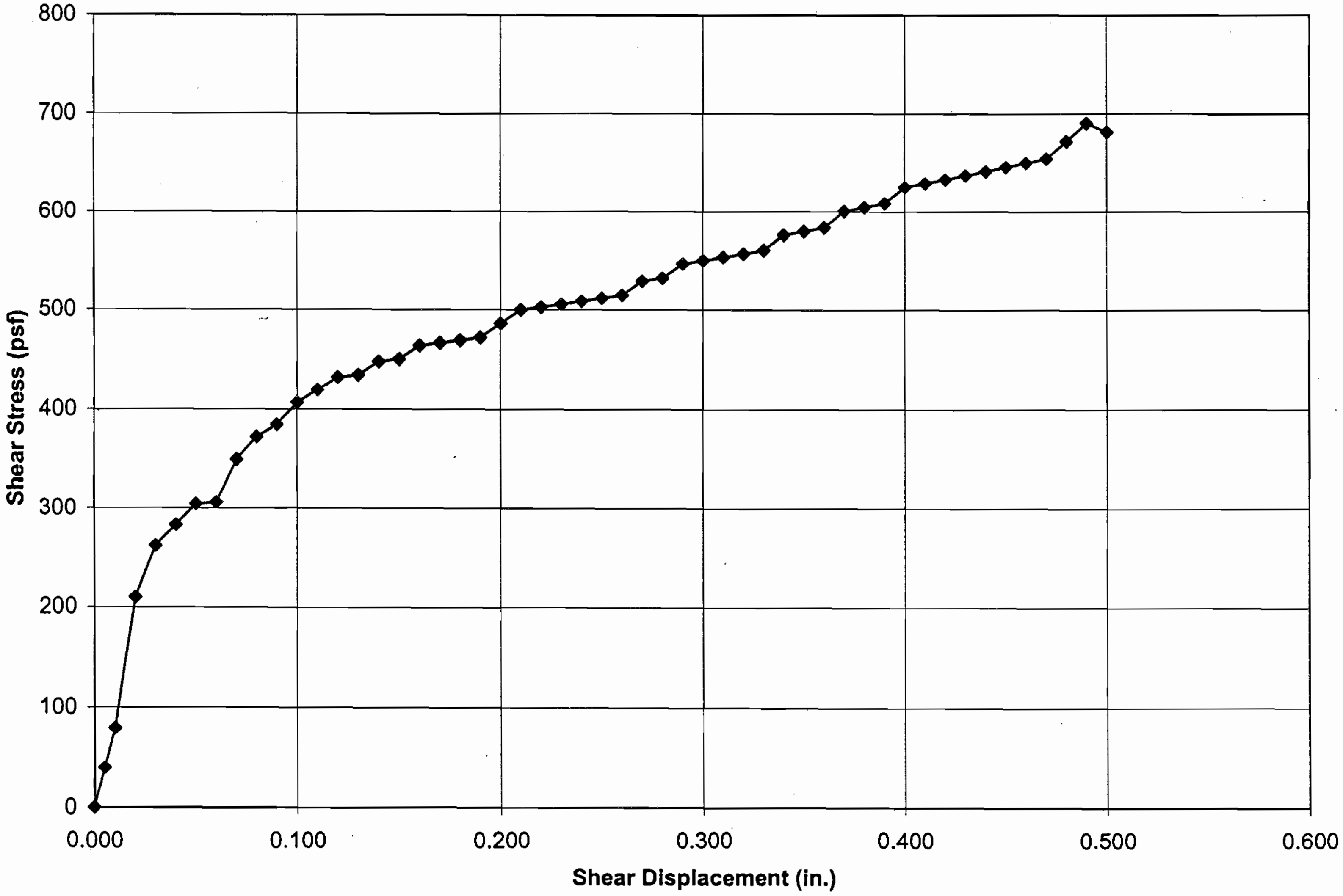
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1721	1721	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1721	1721	4	1.26	4.588	0.005	40	0.005	0.000	0.3
2.42	10	0.4	1721	1721	8	2.52	4.575	0.010	79	0.010	0.000	0.5
2.42	20	0.8	1721	1721	21	6.63	4.551	0.020	210	0.020	0.000	1.1
2.42	30	1.2	1721	1721	26	8.21	4.527	0.030	261	0.030	0.000	1.6
2.42	40	1.7	1721	1721	28	8.84	4.503	0.040	283	0.040	0.000	2.1
2.42	50	2.1	1721	1721	30	9.47	4.479	0.050	304	0.050	0.000	2.6
2.42	60	2.5	1721	1721	30	9.47	4.454	0.060	306	0.060	0.000	3.2
2.42	70	2.9	1721	1721	34	10.73	4.430	0.070	349	0.070	0.000	3.7
2.42	80	3.3	1721	1721	36	11.36	4.406	0.080	371	0.080	0.000	4.2
2.42	90	3.7	1719	1721	37	11.68	4.382	0.090	384	0.090	0.000	4.7
2.42	100	4.1	1716	1721	39	12.31	4.358	0.100	407	0.100	-0.001	5.3
2.42	110	4.5	1712	1721	40	12.62	4.333	0.110	419	0.110	-0.001	5.8
2.42	120	5.0	1708	1721	41	12.94	4.309	0.120	432	0.120	-0.001	6.3
2.42	130	5.4	1704	1721	41	12.94	4.285	0.130	435	0.130	-0.002	6.8
2.42	140	5.8	1701	1721	42	13.26	4.261	0.140	448	0.140	-0.002	7.4
2.42	150	6.2	1699	1721	42	13.26	4.237	0.150	451	0.150	-0.002	7.9
2.42	160	6.6	1698	1721	43	13.57	4.213	0.160	464	0.160	-0.002	8.4
2.42	170	7.0	1698	1721	43	13.57	4.189	0.170	467	0.170	-0.002	8.9
2.42	180	7.4	1698	1721	43	13.57	4.164	0.180	469	0.180	-0.002	9.5
2.42	190	7.9	1698	1721	43	13.57	4.140	0.190	472	0.190	-0.002	10.0
2.42	200	8.3	1698	1721	44	13.89	4.116	0.200	486	0.200	-0.002	10.5
2.42	210	8.7	1698	1721	45	14.20	4.092	0.210	500	0.210	-0.002	11.0
2.42	220	9.1	1698	1721	45	14.20	4.068	0.220	503	0.220	-0.002	11.6
2.42	230	9.5	1698	1721	45	14.20	4.044	0.230	506	0.230	-0.002	12.1
2.42	240	9.9	1698	1721	45	14.20	4.020	0.240	509	0.240	-0.002	12.6
2.42	250	10.3	1698	1721	45	14.20	3.996	0.250	512	0.250	-0.002	13.1
2.42	260	10.7	1698	1721	45	14.20	3.972	0.260	515	0.260	-0.002	13.7
2.42	270	11.2	1698	1721	46	14.52	3.948	0.270	530	0.270	-0.002	14.2
2.42	280	11.6	1698	1721	46	14.52	3.924	0.280	533	0.280	-0.002	14.7
2.42	290	12.0	1698	1721	47	14.83	3.899	0.290	548	0.290	-0.002	15.2
2.42	300	12.4	1698	1721	47	14.83	3.875	0.300	551	0.300	-0.002	15.7
2.42	310	12.8	1698	1721	47	14.83	3.851	0.310	555	0.310	-0.002	16.3
2.42	320	13.2	1698	1721	47	14.83	3.827	0.320	558	0.320	-0.002	16.8
2.42	330	13.6	1698	1721	47	14.83	3.803	0.330	562	0.330	-0.002	17.3
2.42	340	14.0	1698	1721	48	15.15	3.780	0.340	577	0.340	-0.002	17.8
2.42	350	14.5	1698	1721	48	15.15	3.756	0.350	581	0.350	-0.002	18.4
2.42	360	14.9	1698	1721	48	15.15	3.732	0.360	585	0.360	-0.002	18.9
2.42	370	15.3	1698	1721	49	15.46	3.708	0.370	601	0.370	-0.002	19.4
2.42	380	15.7	1698	1721	49	15.46	3.684	0.380	605	0.380	-0.002	19.9
2.42	390	16.1	1698	1721	49	15.46	3.660	0.390	608	0.390	-0.002	20.4
2.42	400	16.5	1698	1721	50	15.78	3.636	0.400	625	0.400	-0.002	20.9

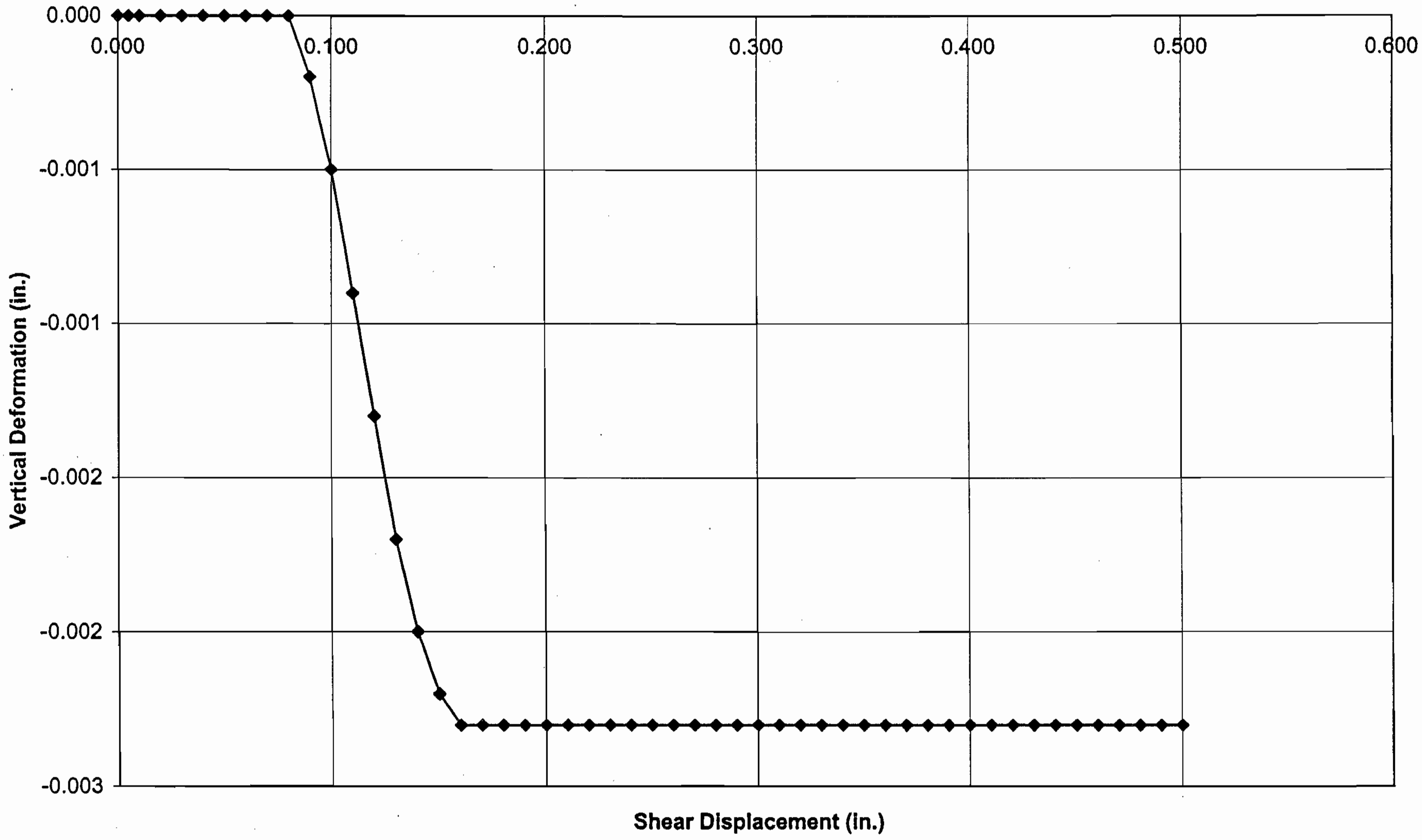
DIRECT SHEAR
DATA SHEET

Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.42	410	16.9	1698	1721	50	15.78	3.612	0.410	629	0.410	-0.002	21.5
2.42	420	17.4	1698	1721	50	15.78	3.588	0.420	633	0.420	-0.002	22.0
2.42	430	17.8	1698	1721	50	15.78	3.565	0.430	637	0.430	-0.002	22.5
2.42	440	18.2	1698	1721	50	15.78	3.541	0.440	642	0.440	-0.002	23.0
2.42	450	18.6	1698	1721	50	15.78	3.517	0.450	646	0.450	-0.002	23.5
2.42	460	19.0	1698	1721	50	15.78	3.493	0.460	651	0.460	-0.002	24.1
2.42	470	19.4	1698	1721	50	15.78	3.469	0.470	655	0.470	-0.002	24.6
2.42	480	19.8	1698	1721	51	16.10	3.446	0.480	673	0.480	-0.002	25.1
2.42	490	20.2	1698	1721	52	16.41	3.422	0.490	691	0.490	-0.002	25.6
2.42	500	20.7	1698	1721	51	16.10	3.398	0.500	682	0.500	-0.002	26.1

Shear Stress vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #1, Vertical Load 1075 psf



Vertical Deformation vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #1, Vertical Load 1075 psf



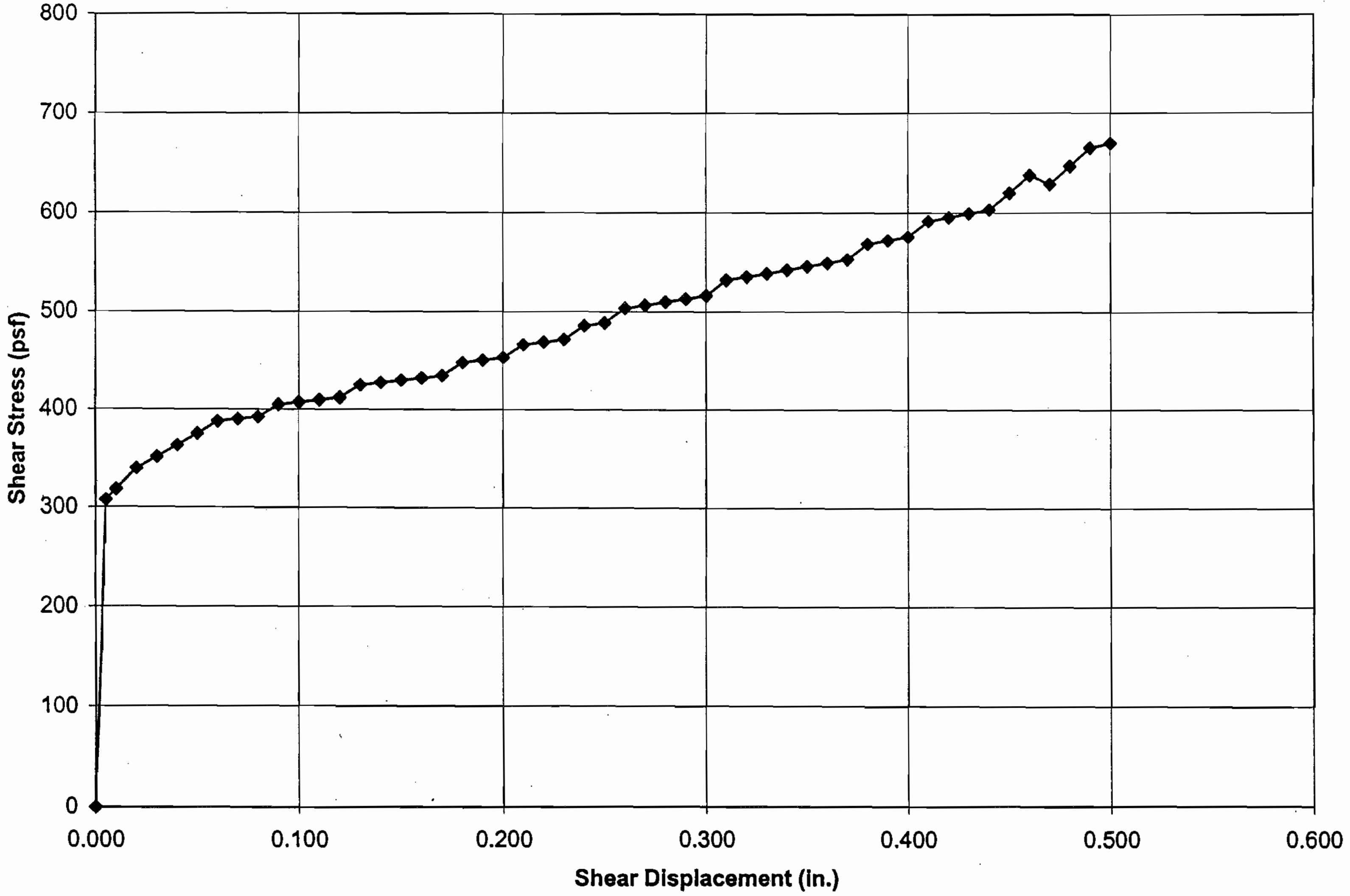
DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology					Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			**Residual/4th cycle**		Sample Diameter (in.):	2.42
PROJ. # :	001860		TEST DATE:	01/07/2001		Init. Sample Height (in.):	1.20
BORING:	B-3		DEPTH:	47.0'		Init.Horz. Dial Reading:	0
SAMPLE #:	2					Vertical Pressure (psf):	2142
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.						

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	603	603	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	603	603	31	9.78	4.588	0.005	307	0.005	0.000	0.3
2.42	10	0.4	603	603	32	10.10	4.575	0.010	318	0.010	0.000	0.5
2.42	20	0.8	603	603	34	10.73	4.551	0.020	340	0.020	0.000	1.1
2.42	30	1.2	603	603	35	11.05	4.527	0.030	351	0.030	0.000	1.6
2.42	40	1.7	603	603	36	11.36	4.503	0.040	363	0.040	0.000	2.1
2.42	50	2.1	603	603	37	11.68	4.479	0.050	375	0.050	0.000	2.6
2.42	60	2.5	603	603	38	11.99	4.454	0.060	388	0.060	0.000	3.2
2.42	70	2.9	603	603	38	11.99	4.430	0.070	390	0.070	0.000	3.7
2.42	80	3.3	603	603	38	11.99	4.406	0.080	392	0.080	0.000	4.2
2.42	90	3.7	603	603	39	12.31	4.382	0.090	404	0.090	0.000	4.7
2.42	100	4.1	600	603	39	12.31	4.358	0.100	407	0.100	0.000	5.3
2.42	110	4.5	599	603	39	12.31	4.333	0.110	409	0.110	0.000	5.8
2.42	120	5.0	598	603	39	12.31	4.309	0.120	411	0.120	-0.001	6.3
2.42	130	5.4	596	603	40	12.62	4.285	0.130	424	0.130	-0.001	6.8
2.42	140	5.8	596	603	40	12.62	4.261	0.140	427	0.140	-0.001	7.4
2.42	150	6.2	596	603	40	12.62	4.237	0.150	429	0.150	-0.001	7.9
2.42	160	6.6	596	603	40	12.62	4.213	0.160	432	0.160	-0.001	8.4
2.42	170	7.0	597	603	40	12.62	4.189	0.170	434	0.170	-0.001	8.9
2.42	180	7.4	598	603	41	12.94	4.164	0.180	447	0.180	-0.001	9.5
2.42	190	7.9	599	603	41	12.94	4.140	0.190	450	0.190	0.000	10.0
2.42	200	8.3	603	603	41	12.94	4.116	0.200	453	0.200	0.000	10.5
2.42	210	8.7	606	603	42	13.26	4.092	0.210	466	0.210	0.000	11.0
2.42	220	9.1	608	603	42	13.26	4.068	0.220	469	0.220	0.001	11.6
2.42	230	9.5	609	603	42	13.26	4.044	0.230	472	0.230	0.001	12.1
2.42	240	9.9	609	603	43	13.57	4.020	0.240	486	0.240	0.001	12.6
2.42	250	10.3	609	603	43	13.57	3.996	0.250	489	0.250	0.001	13.1
2.42	260	10.7	609	603	44	13.89	3.972	0.260	503	0.260	0.001	13.7
2.42	270	11.2	609	603	44	13.89	3.948	0.270	507	0.270	0.001	14.2
2.42	280	11.6	609	603	44	13.89	3.924	0.280	510	0.280	0.001	14.7
2.42	290	12.0	609	603	44	13.89	3.899	0.290	513	0.290	0.001	15.2
2.42	300	12.4	617	603	44	13.89	3.875	0.300	516	0.300	0.001	15.7
2.42	310	12.8	618	603	45	14.20	3.851	0.310	531	0.310	0.002	16.3
2.42	320	13.2	618	603	45	14.20	3.827	0.320	534	0.320	0.002	16.8
2.42	330	13.6	619	603	45	14.20	3.803	0.330	538	0.330	0.002	17.3
2.42	340	14.0	619	603	45	14.20	3.780	0.340	541	0.340	0.002	17.8
2.42	350	14.5	619	603	45	14.20	3.756	0.350	545	0.350	0.002	18.4
2.42	360	14.9	622	603	45	14.20	3.732	0.360	548	0.360	0.002	18.9
2.42	370	15.3	628	603	45	14.20	3.708	0.370	552	0.370	0.003	19.4
2.42	380	15.7	628	603	46	14.52	3.684	0.380	567	0.380	0.003	19.9
2.42	390	16.1	629	603	46	14.52	3.660	0.390	571	0.390	0.003	20.4
2.42	400	16.5	632	603	46	14.52	3.636	0.400	575	0.400	0.003	20.9

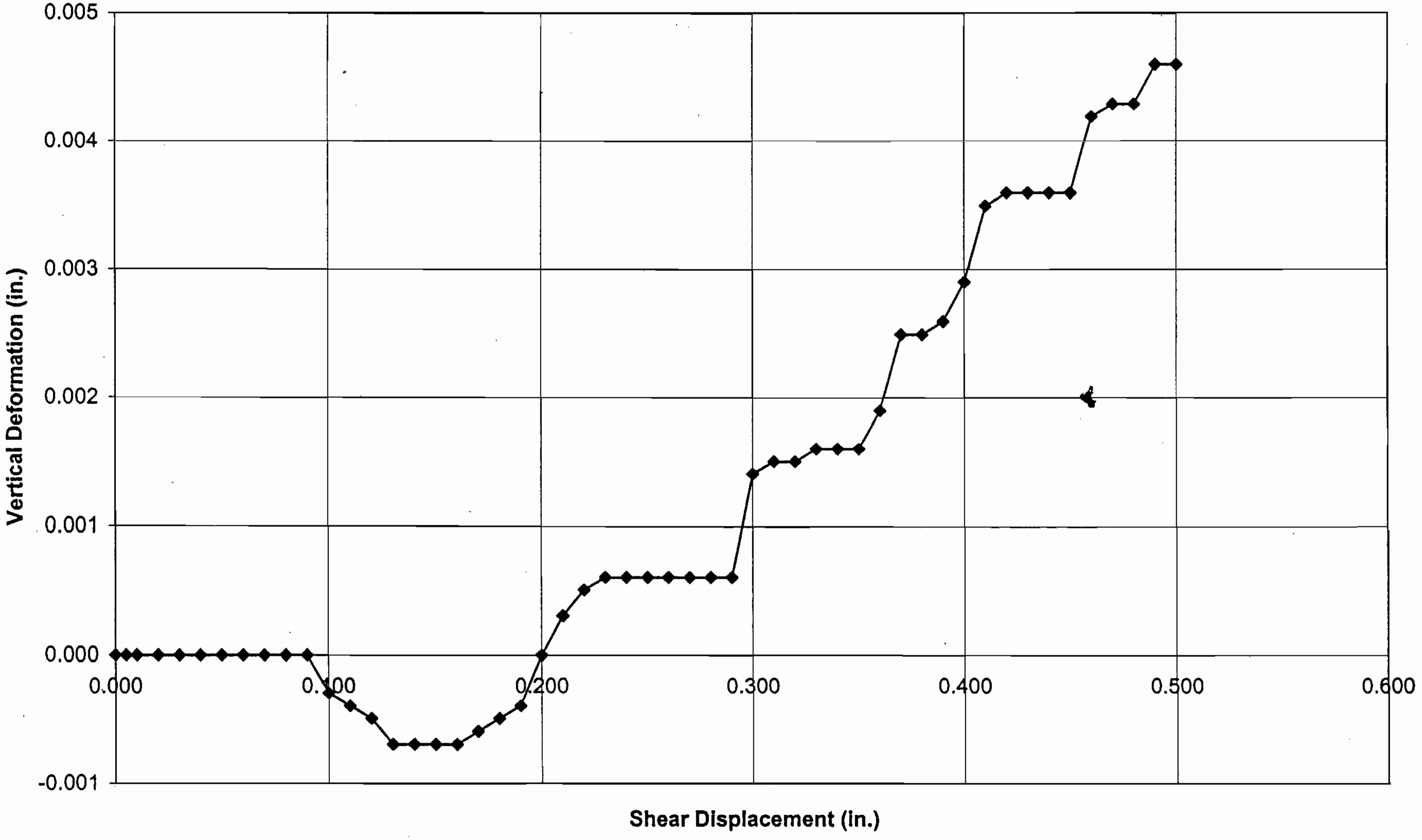
DIRECT SHEAR
DATA SHEET

Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.42	410	16.9	638	603	47	14.83	3.612	0.410	591	0.410	0.004	21.5
2.42	420	17.4	639	603	47	14.83	3.588	0.420	595	0.420	0.004	22.0
2.42	430	17.8	639	603	47	14.83	3.565	0.430	599	0.430	0.004	22.5
2.42	440	18.2	639	603	47	14.83	3.541	0.440	603	0.440	0.004	23.0
2.42	450	18.6	639	603	48	15.15	3.517	0.450	620	0.450	0.004	23.5
2.42	460	19.0	645	603	49	15.46	3.493	0.460	637	0.460	0.004	24.1
2.42	470	19.4	646	603	48	15.15	3.469	0.470	629	0.470	0.004	24.6
2.42	480	19.8	646	603	49	15.46	3.446	0.480	646	0.480	0.004	25.1
2.42	490	20.2	649	603	50	15.78	3.422	0.490	664	0.490	0.005	25.6
2.42	500	20.7	649	603	50	15.78	3.398	0.500	669	0.500	0.005	26.1



Shear Stress vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #2, Vertical Load 2142 psf

Vertical Deformation vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #2, Vertical Load 2142 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology		Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road	**Residual/4th cycle**	Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE: 01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-3	DEPTH: 47.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	3		Vertical Pressure (psf):	4190

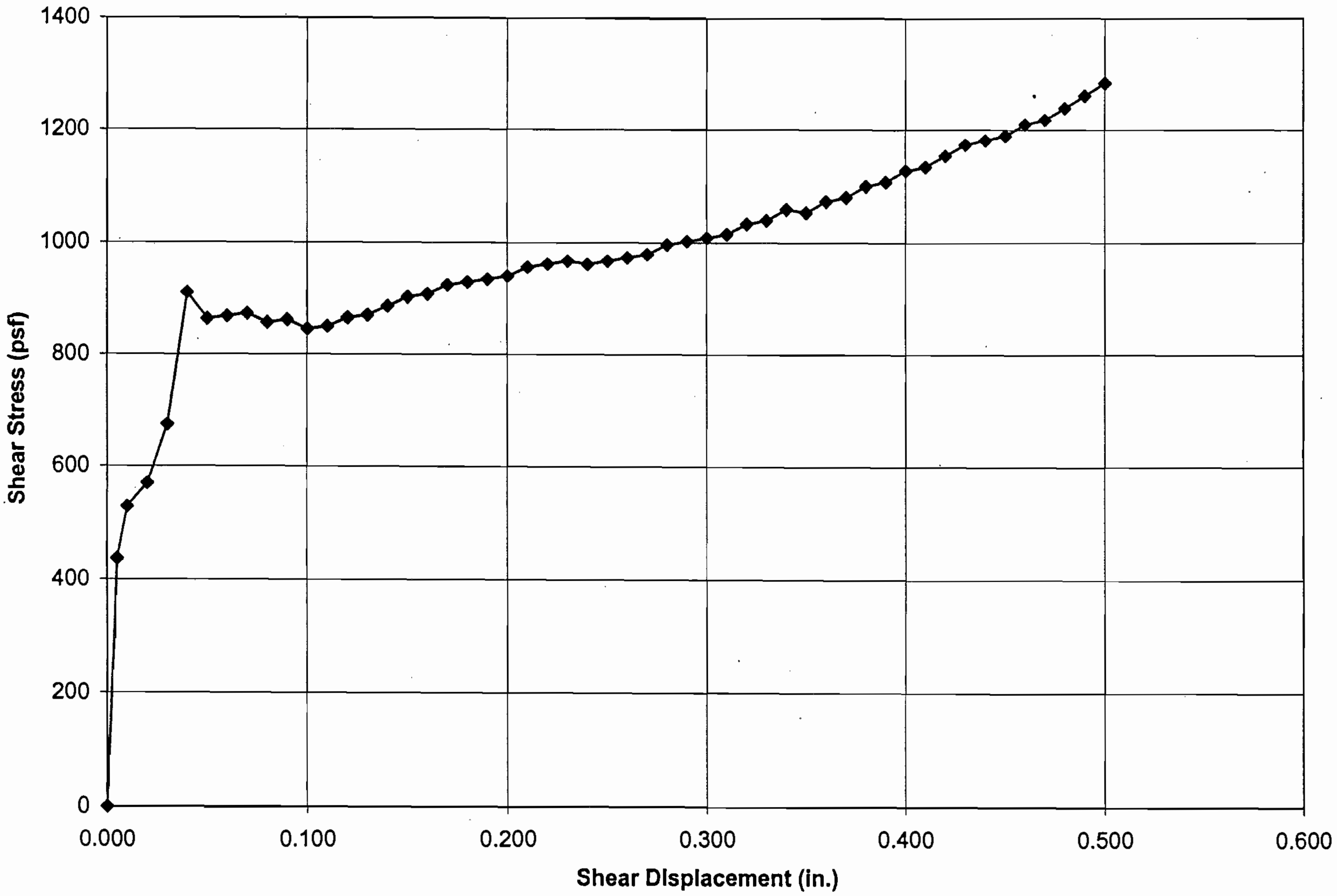
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.42	0	0.0	701	701	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	701	701	44	13.89	4.588	0.005	436	0.005	0.000	0.3
2.42	10	0.4	701	701	53	16.73	4.575	0.010	526	0.010	0.000	0.5
2.42	20	0.8	701	701	57	17.99	4.551	0.020	569	0.020	0.000	1.1
2.42	30	1.2	701	701	67	21.15	4.527	0.030	673	0.030	0.000	1.6
2.42	40	1.7	701	701	90	28.40	4.503	0.040	908	0.040	0.000	2.1
2.42	50	2.1	701	701	85	26.83	4.479	0.050	863	0.050	0.000	2.6
2.42	60	2.5	701	701	85	26.83	4.454	0.060	867	0.060	0.000	3.2
2.42	70	2.9	701	701	85	26.83	4.430	0.070	872	0.070	0.000	3.7
2.42	80	3.3	701	701	83	26.19	4.406	0.080	856	0.080	0.000	4.2
2.42	90	3.7	701	701	83	26.19	4.382	0.090	861	0.090	0.000	4.7
2.42	100	4.1	701	701	81	25.56	4.358	0.100	845	0.100	0.000	5.3
2.42	110	4.5	701	701	81	25.56	4.333	0.110	849	0.110	0.000	5.8
2.42	120	5.0	701	701	82	25.88	4.309	0.120	865	0.120	0.000	6.3
2.42	130	5.4	701	701	82	25.88	4.285	0.130	870	0.130	0.000	6.8
2.42	140	5.8	701	701	83	26.19	4.261	0.140	885	0.140	0.000	7.4
2.42	150	6.2	702	701	84	26.51	4.237	0.150	901	0.150	0.000	7.9
2.42	160	6.6	702	701	84	26.51	4.213	0.160	906	0.160	0.000	8.4
2.42	170	7.0	702	701	85	26.83	4.189	0.170	922	0.170	0.000	8.9
2.42	180	7.4	705	701	85	26.83	4.164	0.180	928	0.180	0.000	9.5
2.42	190	7.9	709	701	85	26.83	4.140	0.190	933	0.190	0.001	10.0
2.42	200	8.3	717	701	85	26.83	4.116	0.200	938	0.200	0.002	10.5
2.42	210	8.7	719	701	86	27.14	4.092	0.210	955	0.210	0.002	11.0
2.42	220	9.1	727	701	86	27.14	4.068	0.220	961	0.220	0.003	11.6
2.42	230	9.5	729	701	86	27.14	4.044	0.230	967	0.230	0.003	12.1
2.42	240	9.9	732	701	85	26.83	4.020	0.240	961	0.240	0.003	12.6
2.42	250	10.3	735	701	85	26.83	3.996	0.250	967	0.250	0.003	13.1
2.42	260	10.7	737	701	85	26.83	3.972	0.260	973	0.260	0.004	13.7
2.42	270	11.2	738	701	85	26.83	3.948	0.270	979	0.270	0.004	14.2
2.42	280	11.6	739	701	86	27.14	3.924	0.280	996	0.280	0.004	14.7
2.42	290	12.0	744	701	86	27.14	3.899	0.290	1002	0.290	0.004	15.2
2.42	300	12.4	746	701	86	27.14	3.875	0.300	1008	0.300	0.005	15.7
2.42	310	12.8	746	701	86	27.14	3.851	0.310	1015	0.310	0.005	16.3
2.42	320	13.2	748	701	87	27.46	3.827	0.320	1033	0.320	0.005	16.8
2.42	330	13.6	749	701	87	27.46	3.803	0.330	1040	0.330	0.005	17.3
2.42	340	14.0	750	701	88	27.77	3.780	0.340	1058	0.340	0.005	17.8
2.42	350	14.5	753	701	87	27.46	3.756	0.350	1053	0.350	0.005	18.4
2.42	360	14.9	754	701	88	27.77	3.732	0.360	1072	0.360	0.005	18.9
2.42	370	15.3	756	701	88	27.77	3.708	0.370	1079	0.370	0.006	19.4
2.42	380	15.7	756	701	89	28.09	3.684	0.380	1098	0.380	0.006	19.9
2.42	390	16.1	758	701	89	28.09	3.660	0.390	1105	0.390	0.006	20.4
2.42	400	16.5	759	701	90	28.40	3.636	0.400	1125	0.400	0.006	20.9

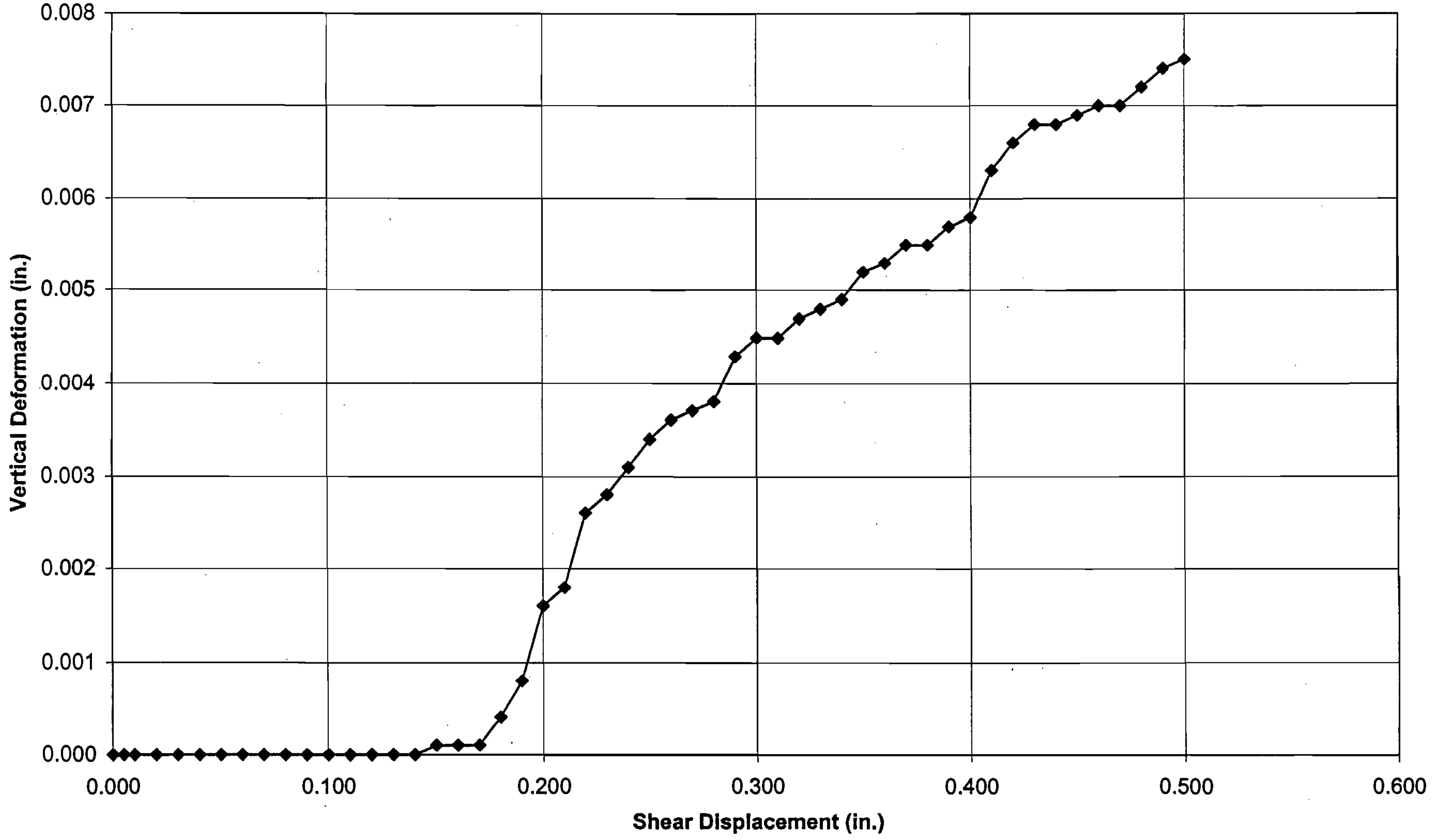
DIRECT SHEAR
DATA SHEET

Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.42	410	16.9	764	701	90	28.40	3.612	0.410	1132	0.410	0.006	21.5
2.42	420	17.4	767	701	91	28.72	3.588	0.420	1153	0.420	0.007	22.0
2.42	430	17.8	769	701	92	29.04	3.565	0.430	1173	0.430	0.007	22.5
2.42	440	18.2	769	701	92	29.04	3.541	0.440	1181	0.440	0.007	23.0
2.42	450	18.6	770	701	92	29.04	3.517	0.450	1189	0.450	0.007	23.5
2.42	460	19.0	771	701	93	29.35	3.493	0.460	1210	0.460	0.007	24.1
2.42	470	19.4	771	701	93	29.35	3.469	0.470	1218	0.470	0.007	24.6
2.42	480	19.8	773	701	94	29.67	3.446	0.480	1240	0.480	0.007	25.1
2.42	490	20.2	775	701	95	29.98	3.422	0.490	1262	0.490	0.007	25.6
2.42	500	20.7	776	701	96	30.30	3.398	0.500	1284	0.500	0.008	26.1

Shear Stress vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #3, Vertical Load 4190 psf



Vertical Deformation vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #3, Vertical Load 4190 psf



DIRECT SHEAR
DATA SHEET

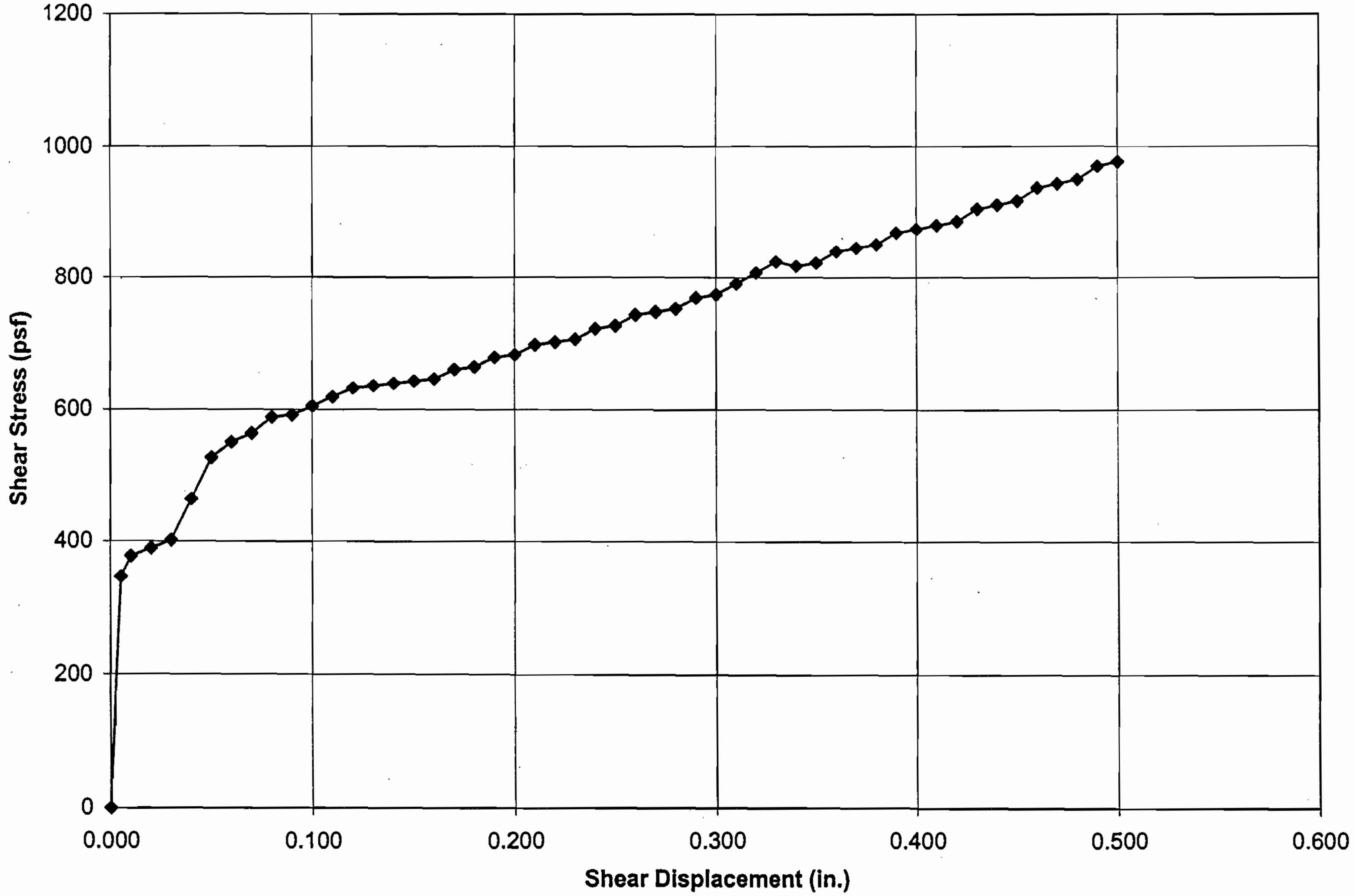
CLIENT:	Cal Engineering and Geology							Ring Constant = 0.3156 lb/div				
PROJECT:	Vasco Road				**Residual/4th cycle**			Sample Diameter (in.):			2.42	
PROJ. # :	001860		TEST DATE:		01/07/2001			Init. Sample Height (in.):			1.20	
BORING:	B-3		DEPTH:		47.0'			Init.Horz. Dial Reading:			0	
SAMPLE #:	4							Vertical Pressure (psf):			2356	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.											

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1385	1385	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1385	1385	35	11.05	4.588	0.005	347	0.005	0.000	0.3
2.42	10	0.4	1385	1385	38	11.99	4.575	0.010	377	0.010	0.000	0.5
2.42	20	0.8	1385	1385	39	12.31	4.551	0.020	389	0.020	0.000	1.1
2.42	30	1.2	1385	1385	40	12.62	4.527	0.030	402	0.030	0.000	1.6
2.42	40	1.7	1382	1385	46	14.52	4.503	0.040	464	0.040	0.000	2.1
2.42	50	2.1	1378	1385	52	16.41	4.479	0.050	528	0.050	-0.001	2.6
2.42	60	2.5	1374	1385	54	17.04	4.454	0.060	551	0.060	-0.001	3.2
2.42	70	2.9	1370	1385	55	17.36	4.430	0.070	564	0.070	-0.002	3.7
2.42	80	3.3	1362	1385	57	17.99	4.406	0.080	588	0.080	-0.002	4.2
2.42	90	3.7	1359	1385	57	17.99	4.382	0.090	591	0.090	-0.003	4.7
2.42	100	4.1	1352	1385	58	18.30	4.358	0.100	605	0.100	-0.003	5.3
2.42	110	4.5	1350	1385	59	18.62	4.333	0.110	619	0.110	-0.004	5.8
2.42	120	5.0	1348	1385	60	18.94	4.309	0.120	633	0.120	-0.004	6.3
2.42	130	5.4	1347	1385	60	18.94	4.285	0.130	636	0.130	-0.004	6.8
2.42	140	5.8	1349	1385	60	18.94	4.261	0.140	640	0.140	-0.004	7.4
2.42	150	6.2	1349	1385	60	18.94	4.237	0.150	644	0.150	-0.004	7.9
2.42	160	6.6	1349	1385	60	18.94	4.213	0.160	647	0.160	-0.004	8.4
2.42	170	7.0	1356	1385	61	19.25	4.189	0.170	662	0.170	-0.003	8.9
2.42	180	7.4	1358	1385	61	19.25	4.164	0.180	666	0.180	-0.003	9.5
2.42	190	7.9	1360	1385	62	19.57	4.140	0.190	681	0.190	-0.003	10.0
2.42	200	8.3	1362	1385	62	19.57	4.116	0.200	685	0.200	-0.002	10.5
2.42	210	8.7	1365	1385	63	19.88	4.092	0.210	700	0.210	-0.002	11.0
2.42	220	9.1	1367	1385	63	19.88	4.068	0.220	704	0.220	-0.002	11.6
2.42	230	9.5	1368	1385	63	19.88	4.044	0.230	708	0.230	-0.002	12.1
2.42	240	9.9	1367	1385	64	20.20	4.020	0.240	724	0.240	-0.002	12.6
2.42	250	10.3	1369	1385	64	20.20	3.996	0.250	728	0.250	-0.002	13.1
2.42	260	10.7	1369	1385	65	20.51	3.972	0.260	744	0.260	-0.002	13.7
2.42	270	11.2	1369	1385	65	20.51	3.948	0.270	748	0.270	-0.002	14.2
2.42	280	11.6	1369	1385	65	20.51	3.924	0.280	753	0.280	-0.002	14.7
2.42	290	12.0	1369	1385	66	20.83	3.899	0.290	769	0.290	-0.002	15.2
2.42	300	12.4	1367	1385	66	20.83	3.875	0.300	774	0.300	-0.002	15.7
2.42	310	12.8	1367	1385	67	21.15	3.851	0.310	791	0.310	-0.002	16.3
2.42	320	13.2	1367	1385	68	21.46	3.827	0.320	807	0.320	-0.002	16.8
2.42	330	13.6	1367	1385	69	21.78	3.803	0.330	824	0.330	-0.002	17.3
2.42	340	14.0	1367	1385	68	21.46	3.780	0.340	818	0.340	-0.002	17.8
2.42	350	14.5	1367	1385	68	21.46	3.756	0.350	823	0.350	-0.002	18.4
2.42	360	14.9	1367	1385	69	21.78	3.732	0.360	840	0.360	-0.002	18.9
2.42	370	15.3	1368	1385	69	21.78	3.708	0.370	846	0.370	-0.002	19.4
2.42	380	15.7	1368	1385	69	21.78	3.684	0.380	851	0.380	-0.002	19.9
2.42	390	16.1	1368	1385	70	22.09	3.660	0.390	869	0.390	-0.002	20.4
2.42	400	16.5	1368	1385	70	22.09	3.636	0.400	875	0.400	-0.002	20.9

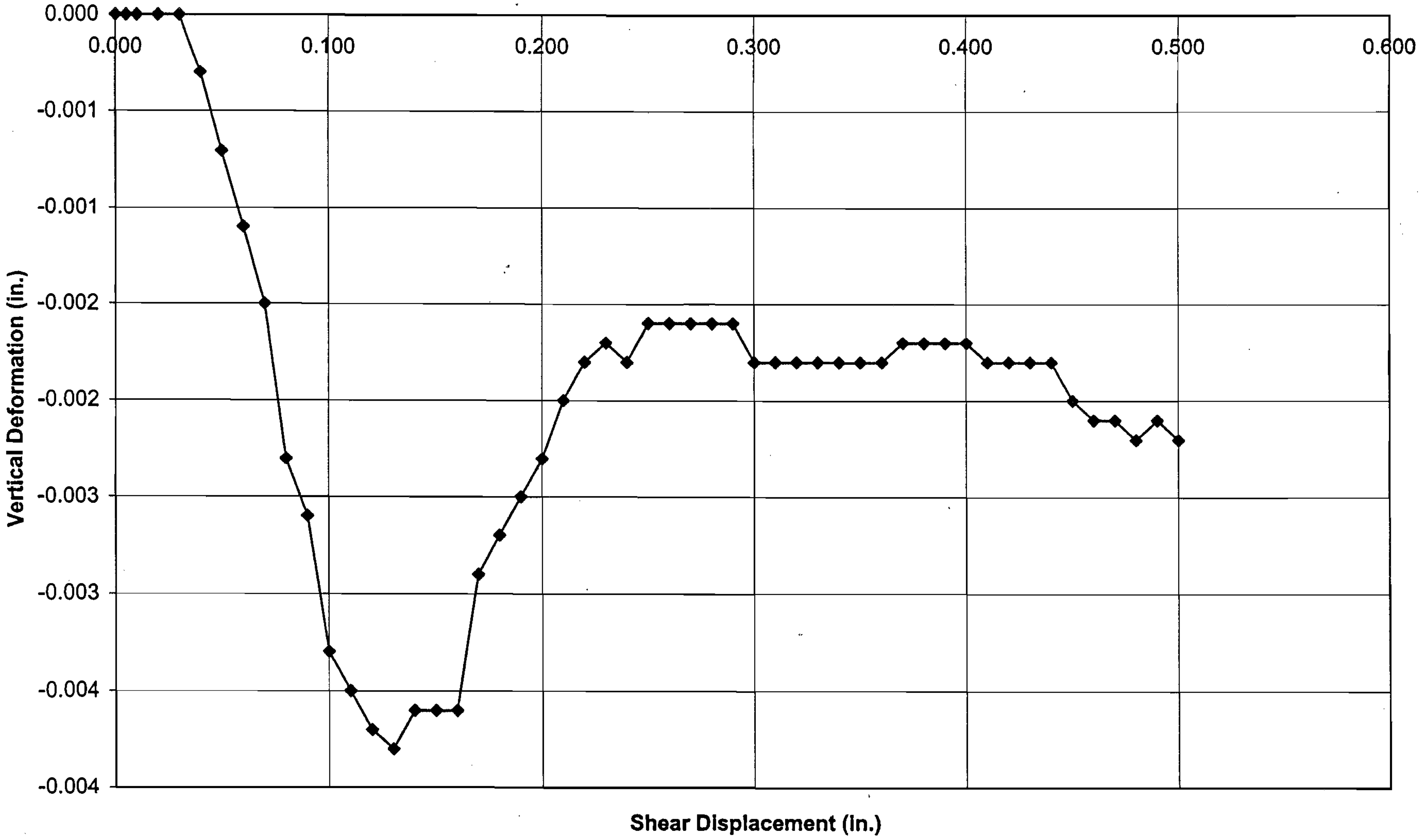
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1367	1385	70	22.09	3.612	0.410	881	0.410	-0.002	21.5
2.42	420	17.4	1367	1385	70	22.09	3.588	0.420	887	0.420	-0.002	22.0
2.42	430	17.8	1367	1385	71	22.41	3.565	0.430	905	0.430	-0.002	22.5
2.42	440	18.2	1367	1385	71	22.41	3.541	0.440	911	0.440	-0.002	23.0
2.42	450	18.6	1365	1385	71	22.41	3.517	0.450	917	0.450	-0.002	23.5
2.42	460	19.0	1364	1385	72	22.72	3.493	0.460	937	0.460	-0.002	24.1
2.42	470	19.4	1364	1385	72	22.72	3.469	0.470	943	0.470	-0.002	24.6
2.42	480	19.8	1363	1385	72	22.72	3.446	0.480	950	0.480	-0.002	25.1
2.42	490	20.2	1364	1385	73	23.04	3.422	0.490	969	0.490	-0.002	25.6
2.42	500	20.7	1363	1385	73	23.04	3.398	0.500	976	0.500	-0.002	26.1

Shear Stress vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #4, Vertical Load 2356 psf



Vertical Deformation vs. *Residual* Shear Displacement, Project 001860
Boring B-3, Depth 47.0', Sample #4, Vertical Load 2356 psf



DIRECT SHEAR RESULTS (Peak)

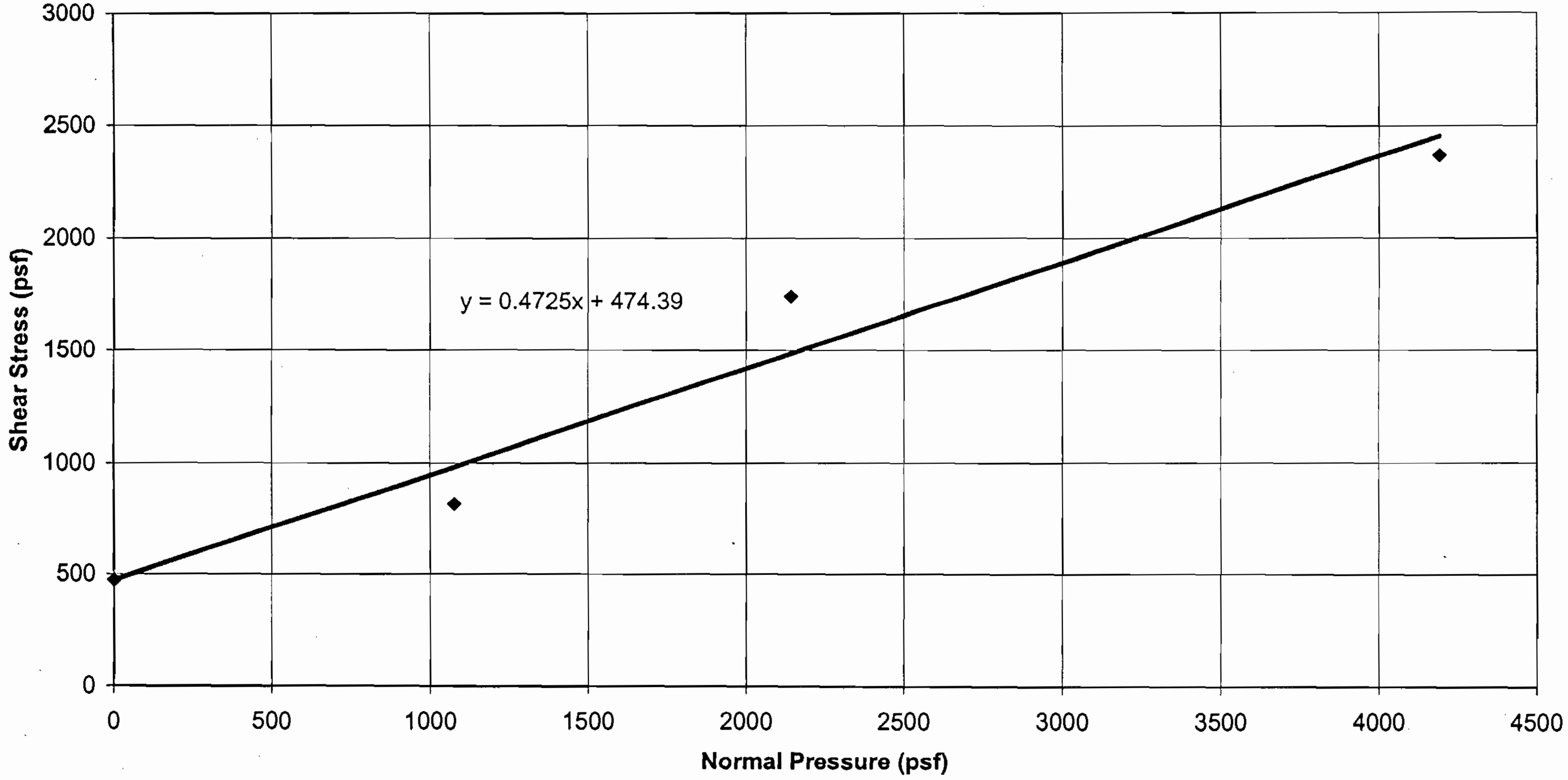
Vasco Road, Project No. 001860

Boring B-4, Depth 28.0'

Friction Angle 25.3 deg., Cohesion 474 psf

Test Type CU , Inundation Time 24 hrs.

Sample Type Weathered Yel Brn and Gry Brn Claystone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

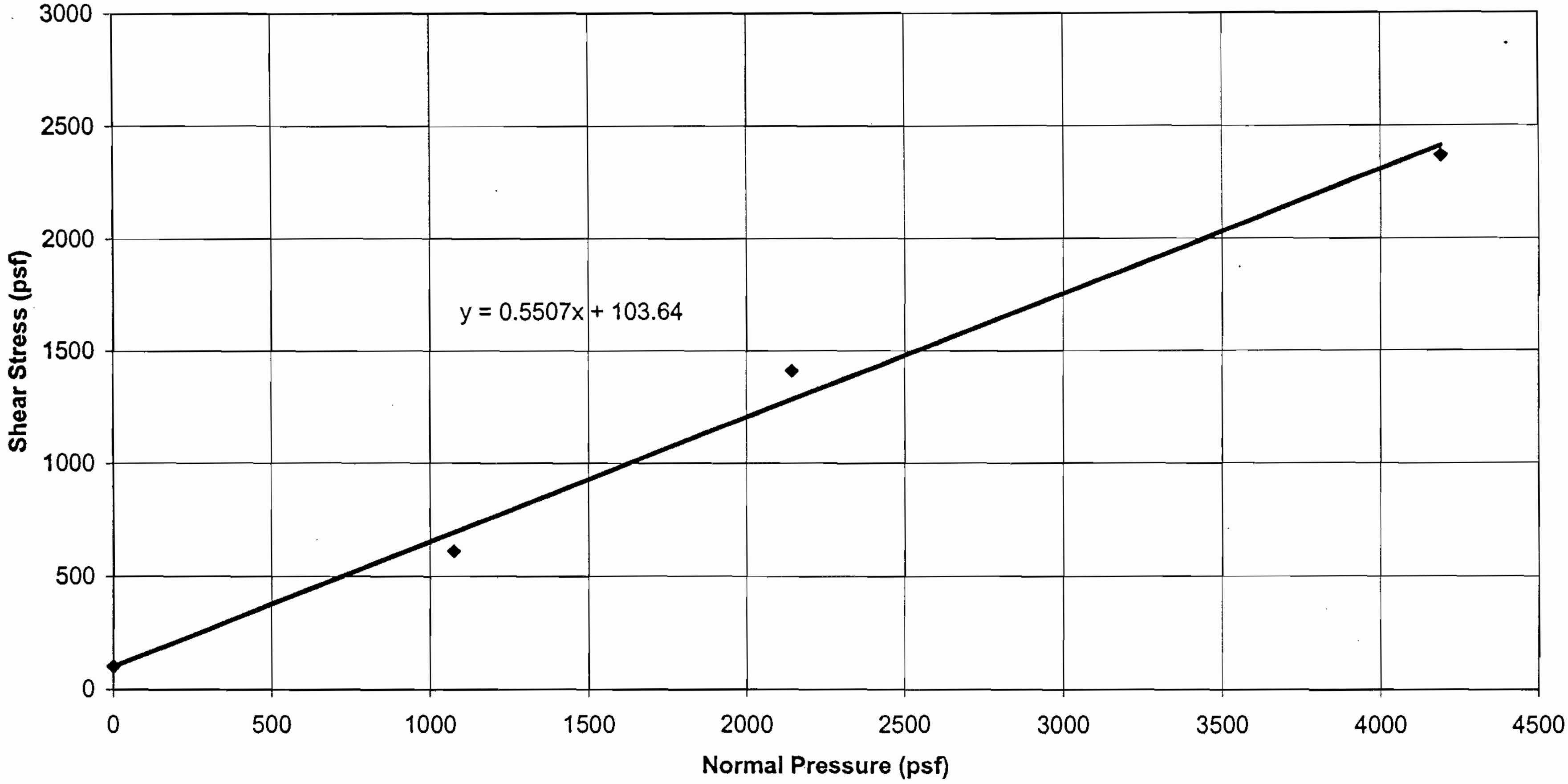
Direct Shear Envelope Plot (Peak) Project: Vasco Rd.

Project #: 1860

Boring: B-4 Depth: 28

0	474.39
1075	815
2142	1741
4190	2367

DIRECT SHEAR RESULTS (Ultimate)
Vasco Road, Project No. 001860
Boring B-4, Depth 28.0'
Friction Angle 28.8 deg., Cohesion 104 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Yel Brn and Gry Brn Claystone



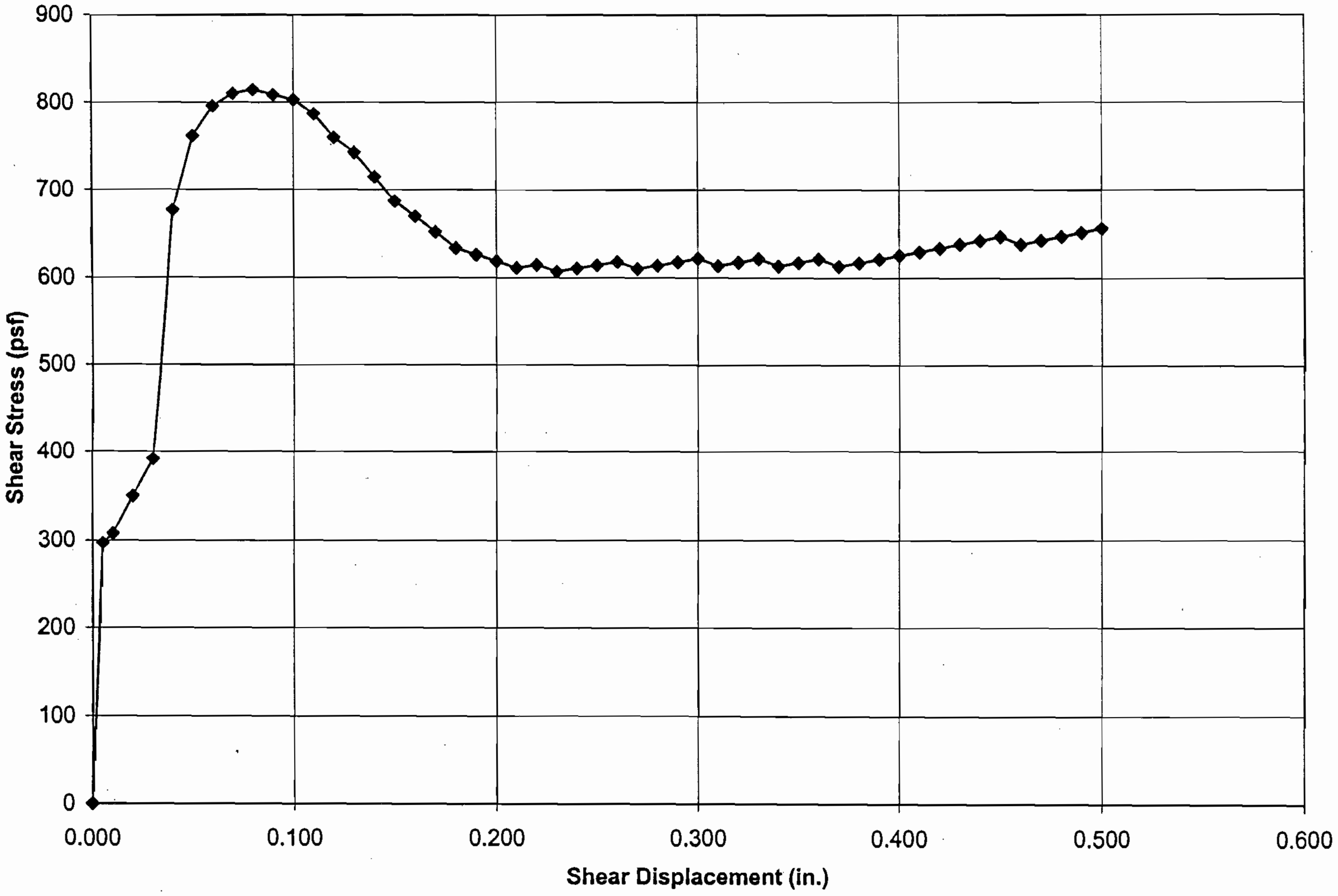
CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

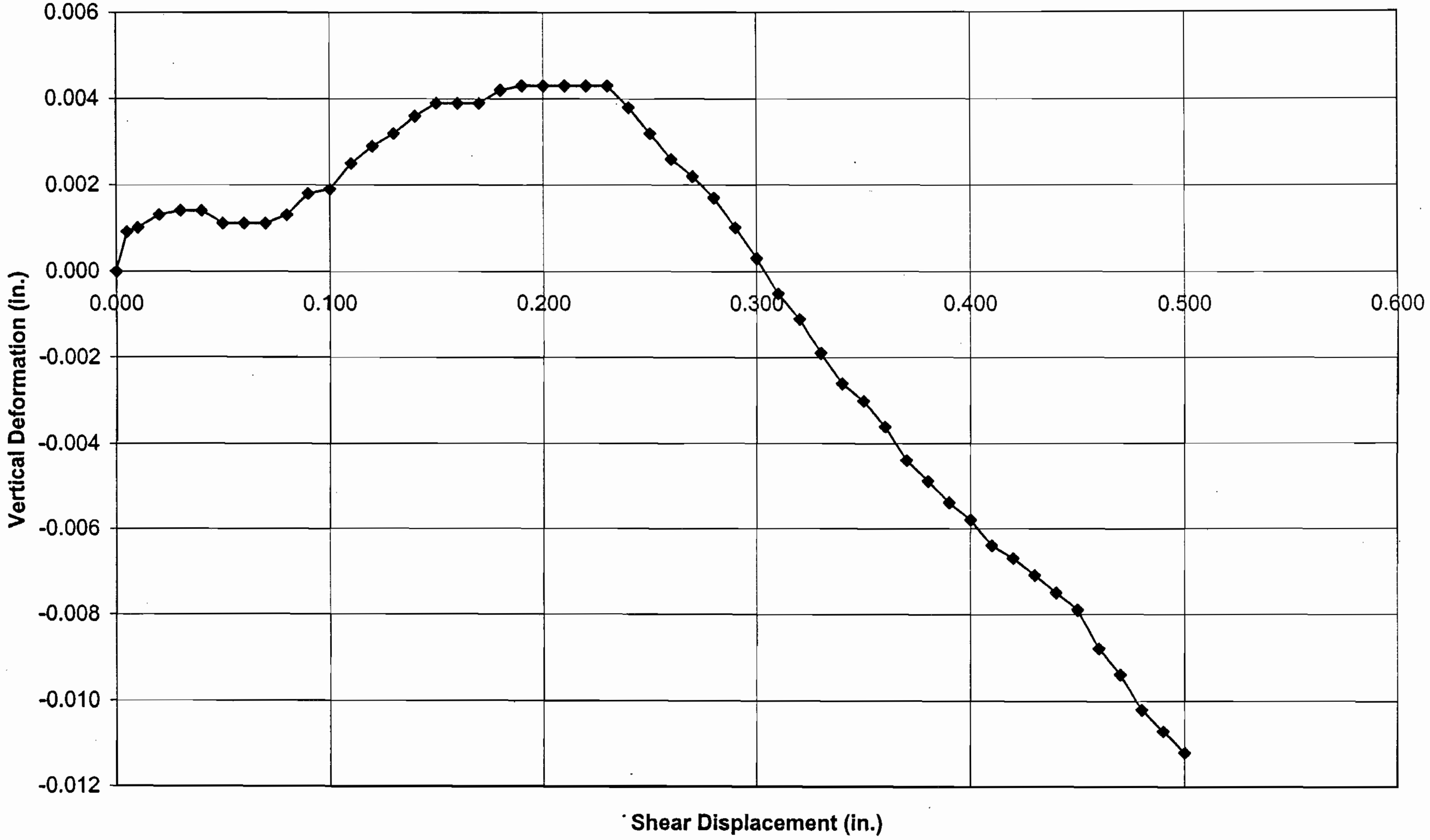
Direct Shear Envelope Plot (Ultimate) Project: Vasco Rd.
Project #: 1860
Boring: B-4 Depth: 28

0	103.64
1075	611
2142	1412
4190	2367

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #3, Vertical Load 1075 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #3, Vertical Load 1075 psf



DIRECT SHEAR
DATA SHEET

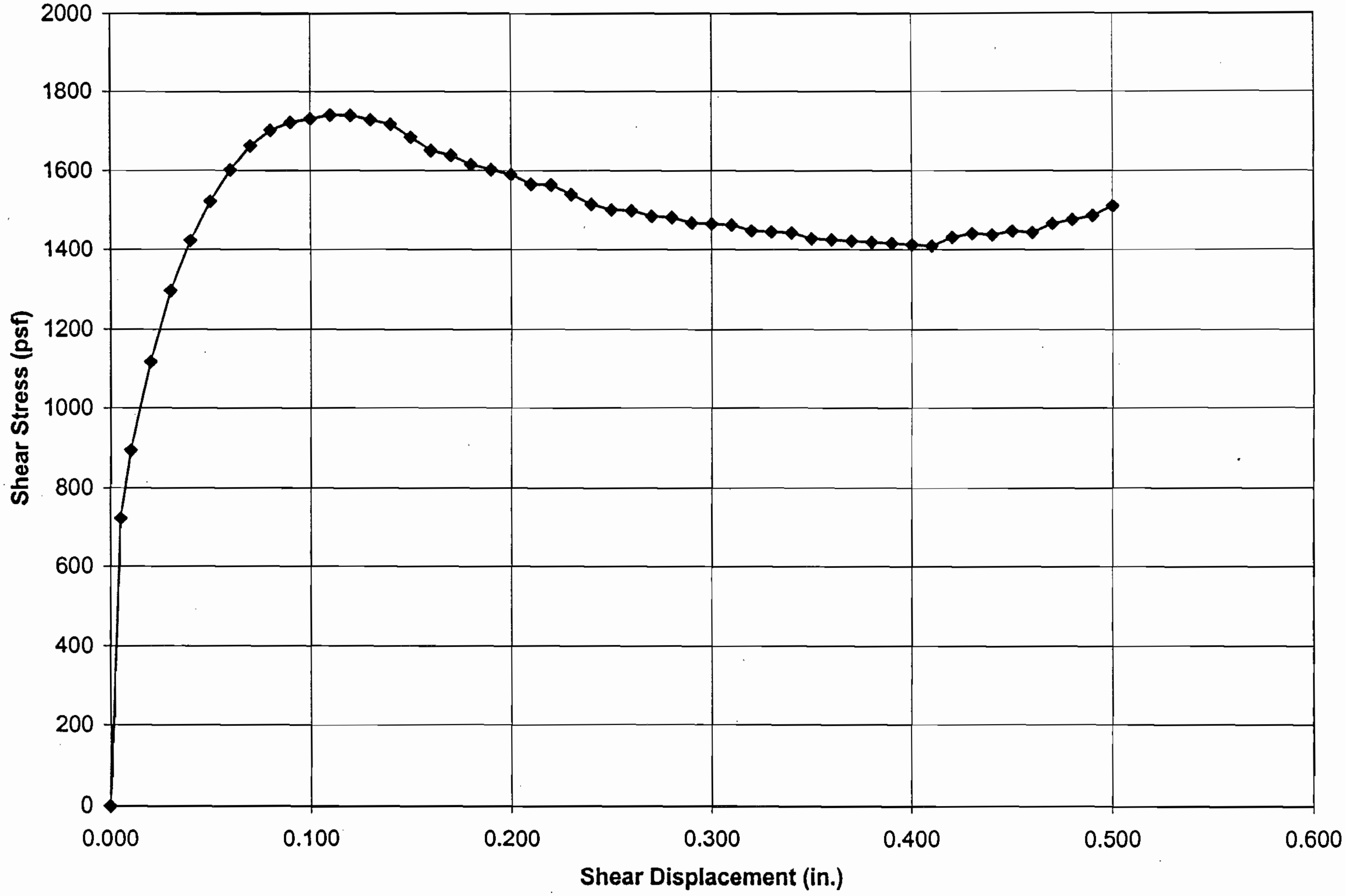
CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. # :	001860		TEST DATE:	01/11/2001	Init. Sample Height (in.):	1.20
BORING:	B-4		DEPTH:	28.0	Init.Horz. Dial Reading:	0
SAMPLE #:	3				Vertical Pressure (psf):	1075

Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1910	1910	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1919	1910	30	9.47	4.588	0.005	297	0.005	0.001	0.3
2.42	10	0.4	1920	1910	31	9.78	4.575	0.010	308	0.010	0.001	0.5
2.42	20	0.8	1923	1910	35	11.05	4.551	0.020	349	0.020	0.001	1.1
2.42	30	1.2	1924	1910	39	12.31	4.527	0.030	392	0.030	0.001	1.6
2.42	40	1.7	1924	1910	67	21.15	4.503	0.040	676	0.040	0.001	2.1
2.42	50	2.1	1921	1910	75	23.67	4.479	0.050	761	0.050	0.001	2.6
2.42	60	2.5	1921	1910	78	24.62	4.454	0.060	796	0.060	0.001	3.2
2.42	70	2.9	1921	1910	79	24.93	4.430	0.070	810	0.070	0.001	3.7
2.42	80	3.3	1923	1910	79	24.93	4.406	0.080	815	0.080	0.001	4.2
2.42	90	3.7	1928	1910	78	24.62	4.382	0.090	809	0.090	0.002	4.7
2.42	100	4.1	1929	1910	77	24.30	4.358	0.100	803	0.100	0.002	5.3
2.42	110	4.5	1935	1910	75	23.67	4.333	0.110	787	0.110	0.003	5.8
2.42	120	5.0	1939	1910	72	22.72	4.309	0.120	759	0.120	0.003	6.3
2.42	130	5.4	1942	1910	70	22.09	4.285	0.130	742	0.130	0.003	6.8
2.42	140	5.8	1946	1910	67	21.15	4.261	0.140	715	0.140	0.004	7.4
2.42	150	6.2	1949	1910	64	20.20	4.237	0.150	686	0.150	0.004	7.9
2.42	160	6.6	1949	1910	62	19.57	4.213	0.160	669	0.160	0.004	8.4
2.42	170	7.0	1949	1910	60	18.94	4.189	0.170	651	0.170	0.004	8.9
2.42	180	7.4	1952	1910	58	18.30	4.164	0.180	633	0.180	0.004	9.5
2.42	190	7.9	1953	1910	57	17.99	4.140	0.190	626	0.190	0.004	10.0
2.42	200	8.3	1953	1910	56	17.67	4.116	0.200	618	0.200	0.004	10.5
2.42	210	8.7	1953	1910	55	17.36	4.092	0.210	611	0.210	0.004	11.0
2.42	220	9.1	1953	1910	55	17.36	4.068	0.220	614	0.220	0.004	11.6
2.42	230	9.5	1953	1910	54	17.04	4.044	0.230	607	0.230	0.004	12.1
2.42	240	9.9	1948	1910	54	17.04	4.020	0.240	611	0.240	0.004	12.6
2.42	250	10.3	1942	1910	54	17.04	3.996	0.250	614	0.250	0.003	13.1
2.42	260	10.7	1936	1910	54	17.04	3.972	0.260	618	0.260	0.003	13.7
2.42	270	11.2	1932	1910	53	16.73	3.948	0.270	610	0.270	0.002	14.2
2.42	280	11.6	1927	1910	53	16.73	3.924	0.280	614	0.280	0.002	14.7
2.42	290	12.0	1920	1910	53	16.73	3.899	0.290	618	0.290	0.001	15.2
2.42	300	12.4	1913	1910	53	16.73	3.875	0.300	622	0.300	0.000	15.7
2.42	310	12.8	1905	1910	52	16.41	3.851	0.310	614	0.310	-0.001	16.3
2.42	320	13.2	1899	1910	52	16.41	3.827	0.320	617	0.320	-0.001	16.8
2.42	330	13.6	1891	1910	52	16.41	3.803	0.330	621	0.330	-0.002	17.3
2.42	340	14.0	1884	1910	51	16.10	3.780	0.340	613	0.340	-0.003	17.8
2.42	350	14.5	1880	1910	51	16.10	3.756	0.350	617	0.350	-0.003	18.4
2.42	360	14.9	1874	1910	51	16.10	3.732	0.360	621	0.360	-0.004	18.9
2.42	370	15.3	1866	1910	50	15.78	3.708	0.370	613	0.370	-0.004	19.4
2.42	380	15.7	1861	1910	50	15.78	3.684	0.380	617	0.380	-0.005	19.9
2.42	390	16.1	1856	1910	50	15.78	3.660	0.390	621	0.390	-0.005	20.4
2.42	400	16.5	1852	1910	50	15.78	3.636	0.400	625	0.400	-0.006	20.9

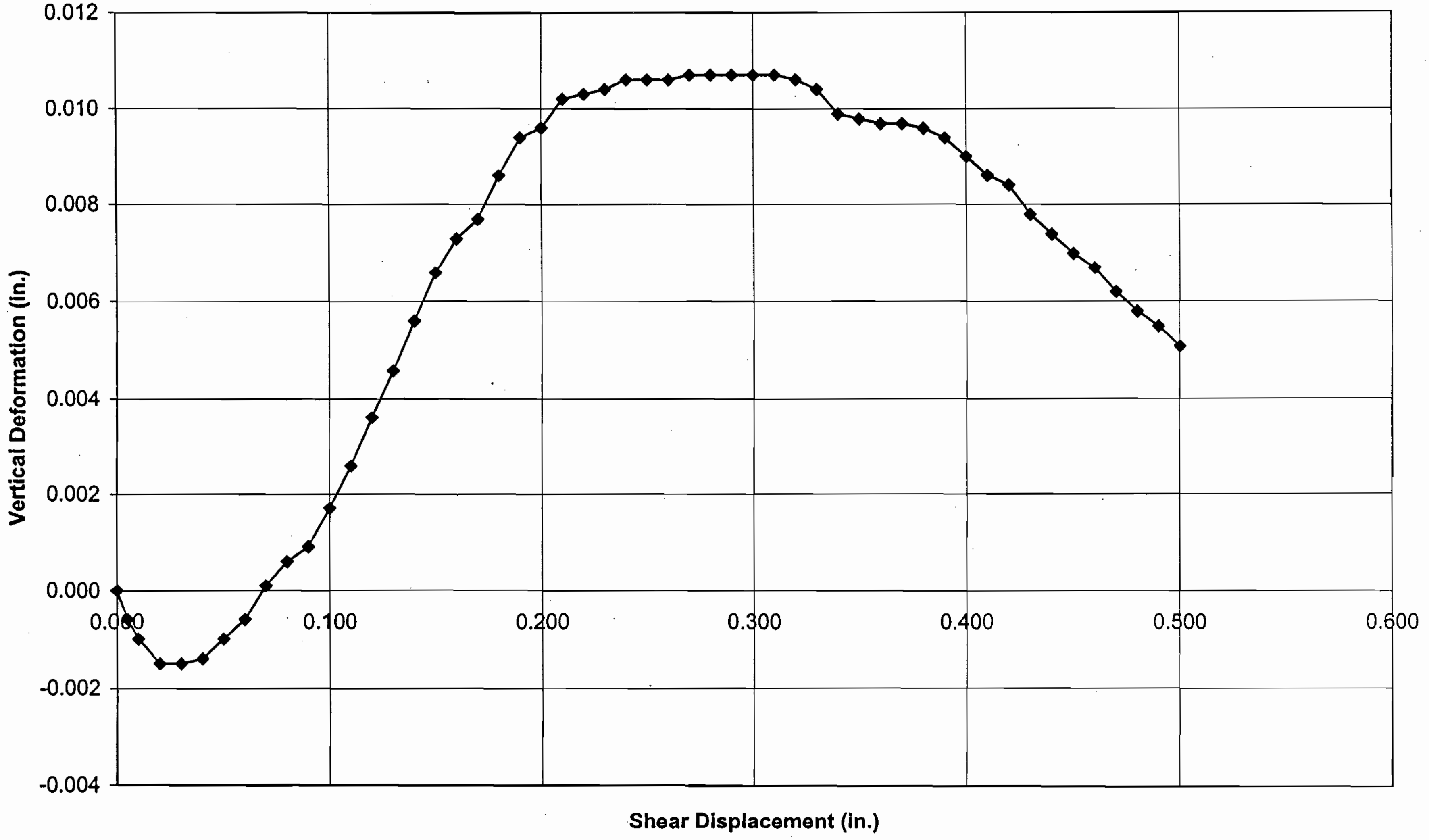
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1846	1910	50	15.78	3.612	0.410	629	0.410	-0.006	21.5
2.42	420	17.4	1843	1910	50	15.78	3.588	0.420	633	0.420	-0.007	22.0
2.42	430	17.8	1839	1910	50	15.78	3.565	0.430	637	0.430	-0.007	22.5
2.42	440	18.2	1835	1910	50	15.78	3.541	0.440	642	0.440	-0.008	23.0
2.42	450	18.6	1831	1910	50	15.78	3.517	0.450	646	0.450	-0.008	23.5
2.42	460	19.0	1822	1910	49	15.46	3.493	0.460	637	0.460	-0.009	24.1
2.42	470	19.4	1816	1910	49	15.46	3.469	0.470	642	0.470	-0.009	24.6
2.42	480	19.8	1808	1910	49	15.46	3.446	0.480	646	0.480	-0.010	25.1
2.42	490	20.2	1803	1910	49	15.46	3.422	0.490	651	0.490	-0.011	25.6
2.42	500	20.7	1798	1910	49	15.46	3.398	0.500	655	0.500	-0.011	26.1



Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #2, Vertical Load 2142 psf

Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #2, Vertical Load 2142 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/09/2001	Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	28.0	Init.Horz. Dial Reading:	0
SAMPLE #:	2			Vertical Pressure (psf):	2142

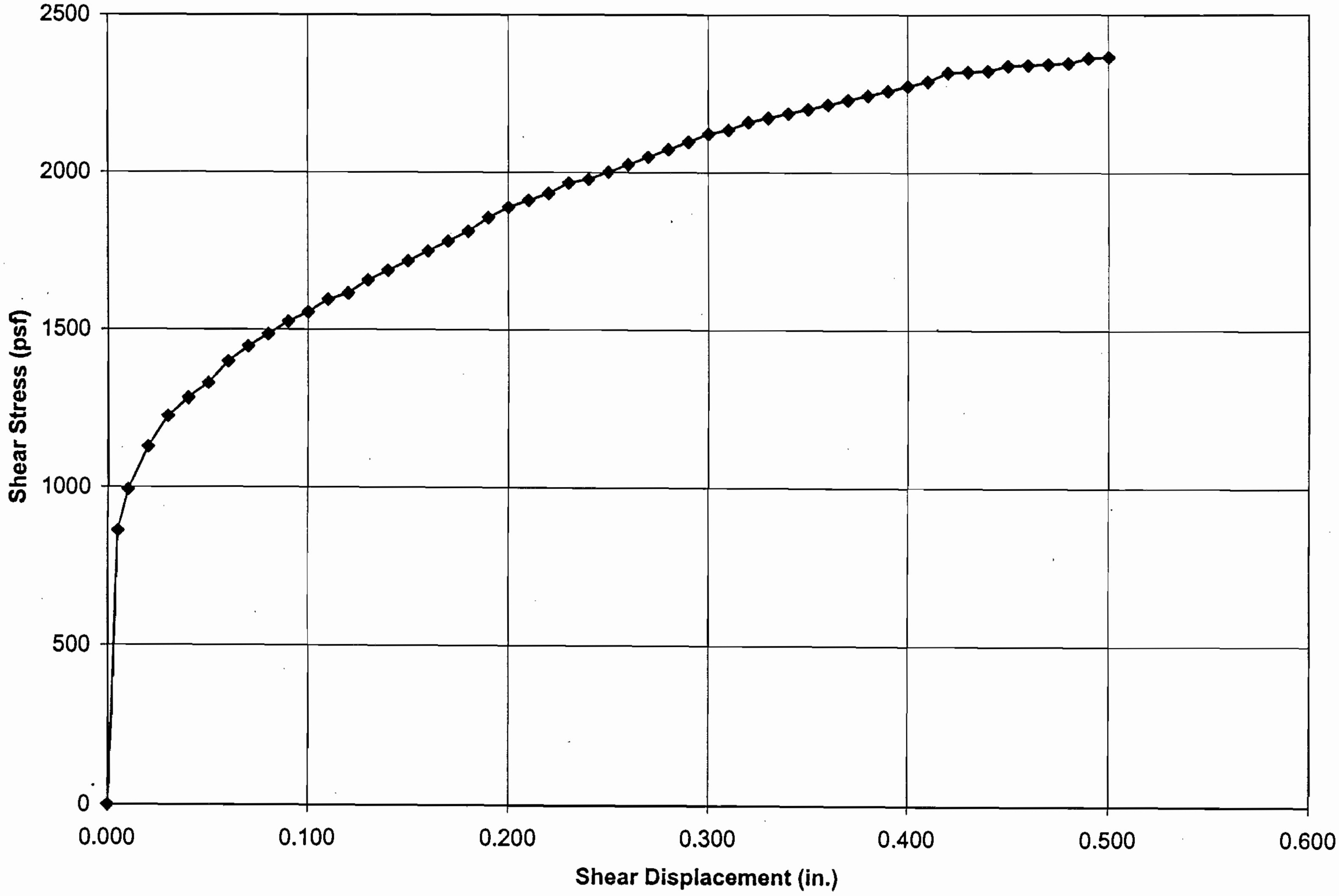
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1943	1943	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1937	1943	73	23.04	4.588	0.005	723	0.005	-0.001	0.3
2.42	10	0.4	1933	1943	90	28.40	4.575	0.010	894	0.010	-0.001	0.5
2.42	20	0.8	1928	1943	112	35.35	4.551	0.020	1118	0.020	-0.002	1.1
2.42	30	1.2	1928	1943	129	40.71	4.527	0.030	1295	0.030	-0.002	1.6
2.42	40	1.7	1929	1943	141	44.50	4.503	0.040	1423	0.040	-0.001	2.1
2.42	50	2.1	1933	1943	150	47.34	4.479	0.050	1522	0.050	-0.001	2.6
2.42	60	2.5	1937	1943	157	49.55	4.454	0.060	1602	0.060	-0.001	3.2
2.42	70	2.9	1944	1943	162	51.13	4.430	0.070	1662	0.070	0.000	3.7
2.42	80	3.3	1949	1943	165	52.07	4.406	0.080	1702	0.080	0.001	4.2
2.42	90	3.7	1952	1943	166	52.39	4.382	0.090	1722	0.090	0.001	4.7
2.42	100	4.1	1960	1943	166	52.39	4.358	0.100	1731	0.100	0.002	5.3
2.42	110	4.5	1969	1943	166	52.39	4.333	0.110	1741	0.110	0.003	5.8
2.42	120	5.0	1979	1943	165	52.07	4.309	0.120	1740	0.120	0.004	6.3
2.42	130	5.4	1989	1943	163	51.44	4.285	0.130	1729	0.130	0.005	6.8
2.42	140	5.8	1999	1943	161	50.81	4.261	0.140	1717	0.140	0.006	7.4
2.42	150	6.2	2009	1943	157	49.55	4.237	0.150	1684	0.150	0.007	7.9
2.42	160	6.6	2016	1943	153	48.29	4.213	0.160	1651	0.160	0.007	8.4
2.42	170	7.0	2020	1943	151	47.66	4.189	0.170	1638	0.170	0.008	8.9
2.42	180	7.4	2029	1943	148	46.71	4.164	0.180	1615	0.180	0.009	9.5
2.42	190	7.9	2037	1943	146	46.08	4.140	0.190	1603	0.190	0.009	10.0
2.42	200	8.3	2039	1943	144	45.45	4.116	0.200	1590	0.200	0.010	10.5
2.42	210	8.7	2045	1943	141	44.50	4.092	0.210	1566	0.210	0.010	11.0
2.42	220	9.1	2046	1943	140	44.18	4.068	0.220	1564	0.220	0.010	11.6
2.42	230	9.5	2047	1943	137	43.24	4.044	0.230	1540	0.230	0.010	12.1
2.42	240	9.9	2049	1943	134	42.29	4.020	0.240	1515	0.240	0.011	12.6
2.42	250	10.3	2049	1943	132	41.66	3.996	0.250	1501	0.250	0.011	13.1
2.42	260	10.7	2049	1943	131	41.34	3.972	0.260	1499	0.260	0.011	13.7
2.42	270	11.2	2050	1943	129	40.71	3.948	0.270	1485	0.270	0.011	14.2
2.42	280	11.6	2050	1943	128	40.40	3.924	0.280	1483	0.280	0.011	14.7
2.42	290	12.0	2050	1943	126	39.77	3.899	0.290	1468	0.290	0.011	15.2
2.42	300	12.4	2050	1943	125	39.45	3.875	0.300	1466	0.300	0.011	15.7
2.42	310	12.8	2050	1943	124	39.13	3.851	0.310	1463	0.310	0.011	16.3
2.42	320	13.2	2049	1943	122	38.50	3.827	0.320	1449	0.320	0.011	16.8
2.42	330	13.6	2047	1943	121	38.19	3.803	0.330	1446	0.330	0.010	17.3
2.42	340	14.0	2042	1943	120	37.87	3.780	0.340	1443	0.340	0.010	17.8
2.42	350	14.5	2041	1943	118	37.24	3.756	0.350	1428	0.350	0.010	18.4
2.42	360	14.9	2040	1943	117	36.93	3.732	0.360	1425	0.360	0.010	18.9
2.42	370	15.3	2040	1943	116	36.61	3.708	0.370	1422	0.370	0.010	19.4
2.42	380	15.7	2039	1943	115	36.29	3.684	0.380	1419	0.380	0.010	19.9
2.42	390	16.1	2037	1943	114	35.98	3.660	0.390	1416	0.390	0.009	20.4
2.42	400	16.5	2033	1943	113	35.66	3.636	0.400	1412	0.400	0.009	20.9

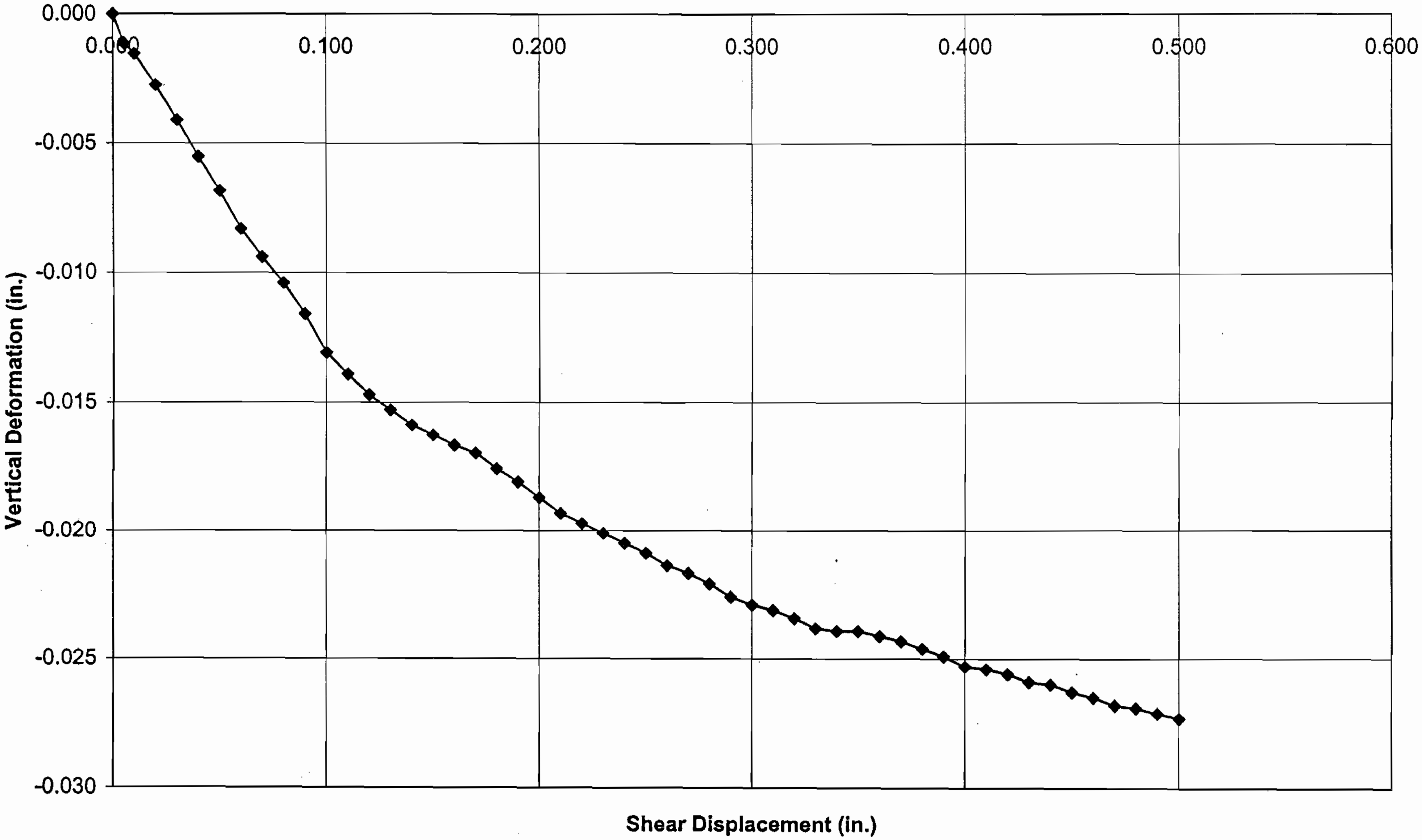
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	2029	1943	112	35.35	3.612	0.410	1409	0.410	0.009	21.5
2.42	420	17.4	2027	1943	113	35.66	3.588	0.420	1431	0.420	0.008	22.0
2.42	430	17.8	2021	1943	113	35.66	3.565	0.430	1441	0.430	0.008	22.5
2.42	440	18.2	2017	1943	112	35.35	3.541	0.440	1438	0.440	0.007	23.0
2.42	450	18.6	2013	1943	112	35.35	3.517	0.450	1447	0.450	0.007	23.5
2.42	460	19.0	2010	1943	111	35.03	3.493	0.460	1444	0.460	0.007	24.1
2.42	470	19.4	2005	1943	112	35.35	3.469	0.470	1467	0.470	0.006	24.6
2.42	480	19.8	2001	1943	112	35.35	3.446	0.480	1477	0.480	0.006	25.1
2.42	490	20.2	1998	1943	112	35.35	3.422	0.490	1487	0.490	0.006	25.6
2.42	500	20.7	1994	1943	113	35.66	3.398	0.500	1511	0.500	0.005	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #1, Vertical Load 4190 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 28.0', Sample #1, Vertical Load 4190 psf



DIRECT SHEAR
DATA SHEET

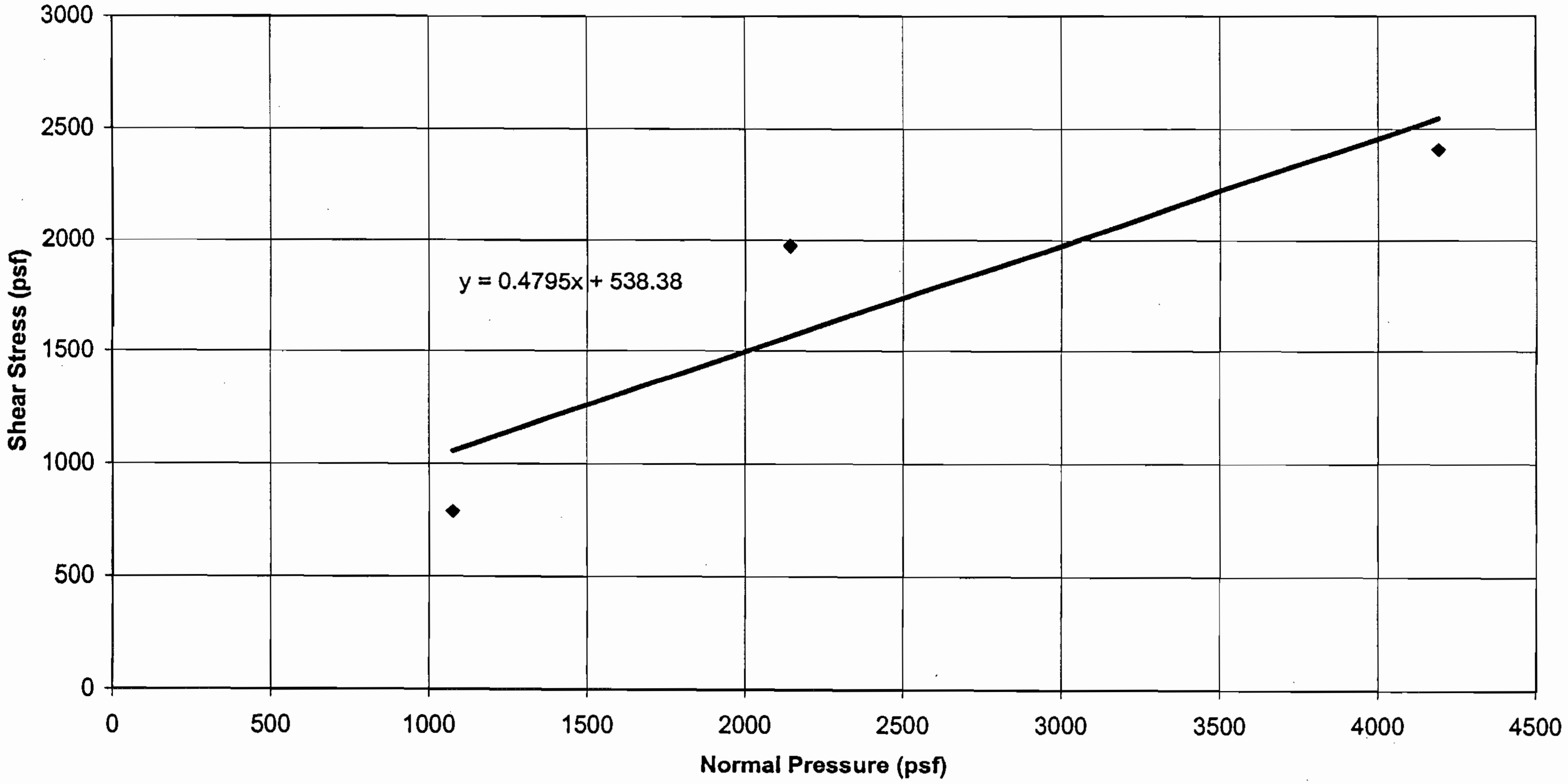
CLIENT:	Cal Engineering and Geology							Ring Constant = 0.3156 lb/div				
PROJECT:	Vasco Road							Sample Diameter (in.):			2.42	
PROJ. # :	001860		TEST DATE:		01/07/2001			Init. Sample Height (in.):			1.20	
BORING:	B-4		DEPTH:		28.0			Init.Horz. Dial Reading:			0	
SAMPLE #:	1							Vertical Pressure (psf):			4190	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.											
Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1270	1270	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1259	1270	87	27.46	4.588	0.005	862	0.005	-0.001	0.3
2.42	10	0.4	1255	1270	100	31.56	4.575	0.010	993	0.010	-0.002	0.5
2.42	20	0.8	1243	1270	113	35.66	4.551	0.020	1128	0.020	-0.003	1.1
2.42	30	1.2	1229	1270	122	38.50	4.527	0.030	1225	0.030	-0.004	1.6
2.42	40	1.7	1215	1270	127	40.08	4.503	0.040	1282	0.040	-0.006	2.1
2.42	50	2.1	1202	1270	131	41.34	4.479	0.050	1329	0.050	-0.007	2.6
2.42	60	2.5	1187	1270	137	43.24	4.454	0.060	1398	0.060	-0.008	3.2
2.42	70	2.9	1176	1270	141	44.50	4.430	0.070	1446	0.070	-0.009	3.7
2.42	80	3.3	1166	1270	144	45.45	4.406	0.080	1485	0.080	-0.010	4.2
2.42	90	3.7	1154	1270	147	46.39	4.382	0.090	1525	0.090	-0.012	4.7
2.42	100	4.1	1139	1270	149	47.02	4.358	0.100	1554	0.100	-0.013	5.3
2.42	110	4.5	1131	1270	152	47.97	4.333	0.110	1594	0.110	-0.014	5.8
2.42	120	5.0	1123	1270	153	48.29	4.309	0.120	1614	0.120	-0.015	6.3
2.42	130	5.4	1117	1270	156	49.23	4.285	0.130	1654	0.130	-0.015	6.8
2.42	140	5.8	1111	1270	158	49.86	4.261	0.140	1685	0.140	-0.016	7.4
2.42	150	6.2	1107	1270	160	50.50	4.237	0.150	1716	0.150	-0.016	7.9
2.42	160	6.6	1103	1270	162	51.13	4.213	0.160	1748	0.160	-0.017	8.4
2.42	170	7.0	1100	1270	164	51.76	4.189	0.170	1779	0.170	-0.017	8.9
2.42	180	7.4	1094	1270	166	52.39	4.164	0.180	1812	0.180	-0.018	9.5
2.42	190	7.9	1089	1270	169	53.34	4.140	0.190	1855	0.190	-0.018	10.0
2.42	200	8.3	1083	1270	171	53.97	4.116	0.200	1888	0.200	-0.019	10.5
2.42	210	8.7	1077	1270	172	54.28	4.092	0.210	1910	0.210	-0.019	11.0
2.42	220	9.1	1073	1270	173	54.60	4.068	0.220	1933	0.220	-0.020	11.6
2.42	230	9.5	1069	1270	175	55.23	4.044	0.230	1967	0.230	-0.020	12.1
2.42	240	9.9	1065	1270	175	55.23	4.020	0.240	1979	0.240	-0.021	12.6
2.42	250	10.3	1061	1270	176	55.55	3.996	0.250	2002	0.250	-0.021	13.1
2.42	260	10.7	1056	1270	177	55.86	3.972	0.260	2025	0.260	-0.021	13.7
2.42	270	11.2	1053	1270	178	56.18	3.948	0.270	2049	0.270	-0.022	14.2
2.42	280	11.6	1049	1270	179	56.49	3.924	0.280	2073	0.280	-0.022	14.7
2.42	290	12.0	1044	1270	180	56.81	3.899	0.290	2098	0.290	-0.023	15.2
2.42	300	12.4	1041	1270	181	57.12	3.875	0.300	2123	0.300	-0.023	15.7
2.42	310	12.8	1039	1270	181	57.12	3.851	0.310	2136	0.310	-0.023	16.3
2.42	320	13.2	1036	1270	182	57.44	3.827	0.320	2161	0.320	-0.023	16.8
2.42	330	13.6	1032	1270	182	57.44	3.803	0.330	2175	0.330	-0.024	17.3
2.42	340	14.0	1031	1270	182	57.44	3.780	0.340	2188	0.340	-0.024	17.8
2.42	350	14.5	1031	1270	182	57.44	3.756	0.350	2202	0.350	-0.024	18.4
2.42	360	14.9	1029	1270	182	57.44	3.732	0.360	2217	0.360	-0.024	18.9
2.42	370	15.3	1027	1270	182	57.44	3.708	0.370	2231	0.370	-0.024	19.4
2.42	380	15.7	1024	1270	182	57.44	3.684	0.380	2245	0.380	-0.025	19.9
2.42	390	16.1	1021	1270	182	57.44	3.660	0.390	2260	0.390	-0.025	20.4
2.42	400	16.5	1017	1270	182	57.44	3.636	0.400	2275	0.400	-0.025	20.9

DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1016	1270	182	57.44	3.612	0.410	2290	0.410	-0.025	21.5
2.42	420	17.4	1014	1270	183	57.75	3.588	0.420	2318	0.420	-0.026	22.0
2.42	430	17.8	1011	1270	182	57.44	3.565	0.430	2320	0.430	-0.026	22.5
2.42	440	18.2	1010	1270	181	57.12	3.541	0.440	2323	0.440	-0.026	23.0
2.42	450	18.6	1007	1270	181	57.12	3.517	0.450	2339	0.450	-0.026	23.5
2.42	460	19.0	1005	1270	180	56.81	3.493	0.460	2342	0.460	-0.027	24.1
2.42	470	19.4	1002	1270	179	56.49	3.469	0.470	2345	0.470	-0.027	24.6
2.42	480	19.8	1001	1270	178	56.18	3.446	0.480	2348	0.480	-0.027	25.1
2.42	490	20.2	999	1270	178	56.18	3.422	0.490	2364	0.490	-0.027	25.6
2.42	500	20.7	997	1270	177	55.86	3.398	0.500	2367	0.500	-0.027	26.1

DIRECT SHEAR RESULTS (Peak and Ultimate)

Vasco Road, Project No. 001860
Boring B-4, Depth 40.0'
Friction Angle 25.6 deg., Cohesion 538 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Dk Gry Claystone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak and Ultimate)

Project: Vasco Rd.
Project #: 1860
Boring: B-4 Depth: 40.0'

1075	784
2142	1976
4190	2407

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	40.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	3			Vertical Pressure (psf):	1075

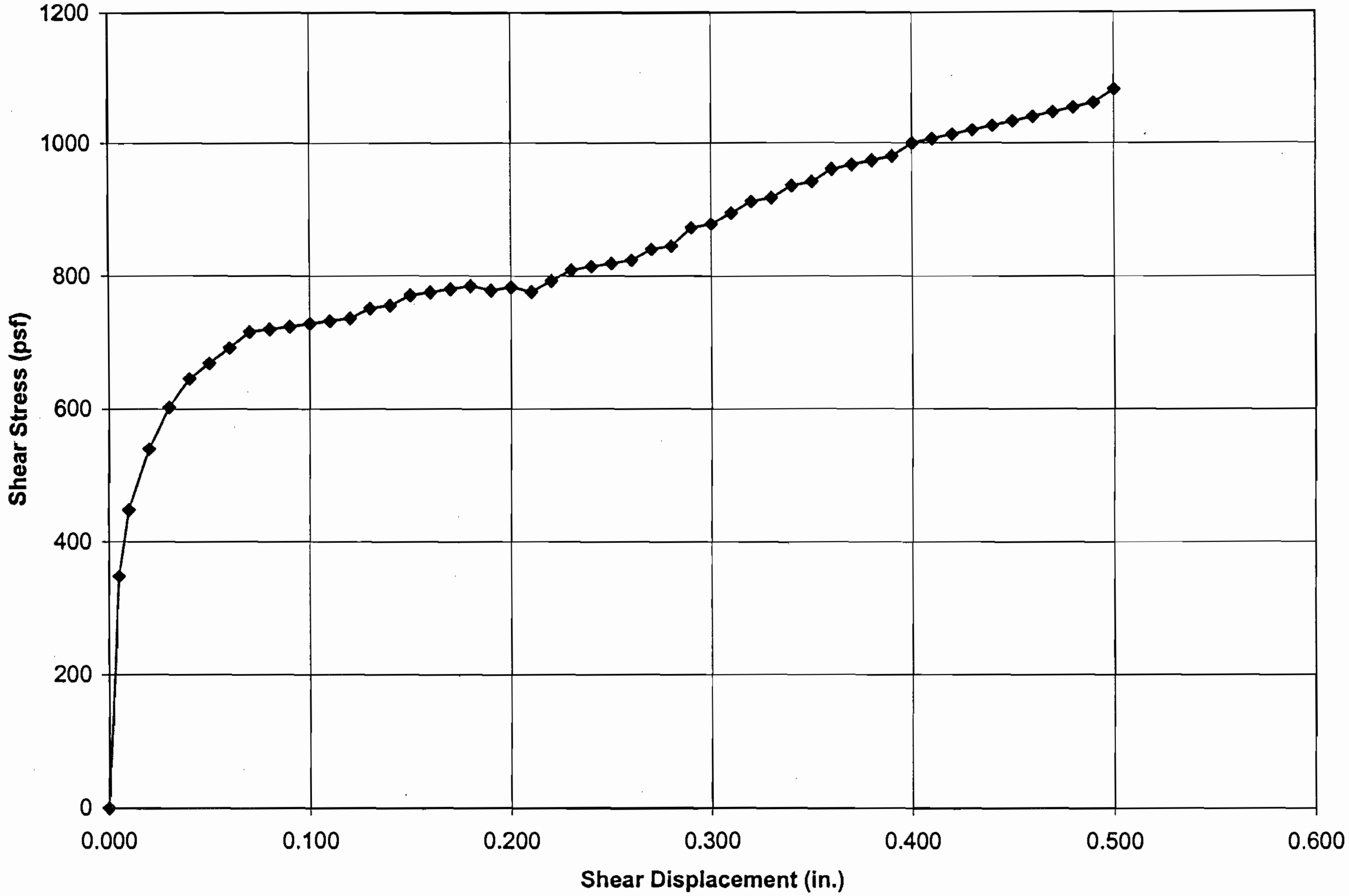
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

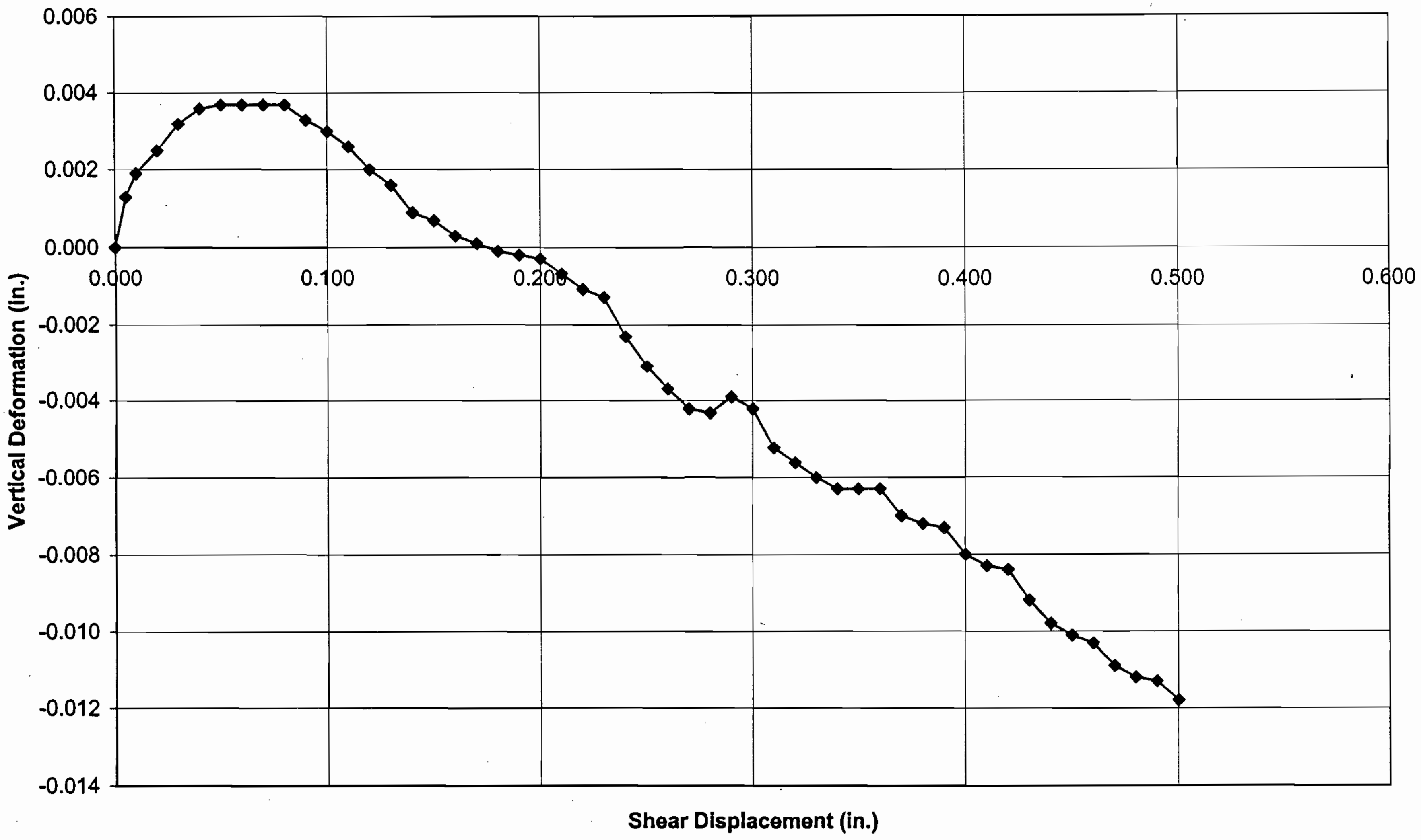
Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1416	1416	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1416	1403	35	11.05	4.588	0.005	347	0.005	0.001	0.3
2.42	10	0.4	1416	1397	45	14.20	4.575	0.010	447	0.010	0.002	0.5
2.42	20	0.8	1416	1391	54	17.04	4.551	0.020	539	0.020	0.003	1.1
2.42	30	1.2	1416	1384	60	18.94	4.527	0.030	602	0.030	0.003	1.6
2.42	40	1.7	1416	1380	64	20.20	4.503	0.040	646	0.040	0.004	2.1
2.42	50	2.1	1416	1379	66	20.83	4.479	0.050	670	0.050	0.004	2.6
2.42	60	2.5	1416	1379	68	21.46	4.454	0.060	694	0.060	0.004	3.2
2.42	70	2.9	1416	1379	70	22.09	4.430	0.070	718	0.070	0.004	3.7
2.42	80	3.3	1416	1379	70	22.09	4.406	0.080	722	0.080	0.004	4.2
2.42	90	3.7	1416	1383	70	22.09	4.382	0.090	726	0.090	0.003	4.7
2.42	100	4.1	1416	1386	70	22.09	4.358	0.100	730	0.100	0.003	5.3
2.42	110	4.5	1416	1390	70	22.09	4.333	0.110	734	0.110	0.003	5.8
2.42	120	5.0	1416	1396	70	22.09	4.309	0.120	738	0.120	0.002	6.3
2.42	130	5.4	1416	1400	71	22.41	4.285	0.130	753	0.130	0.002	6.8
2.42	140	5.8	1416	1407	71	22.41	4.261	0.140	757	0.140	0.001	7.4
2.42	150	6.2	1416	1409	72	22.72	4.237	0.150	772	0.150	0.001	7.9
2.42	160	6.6	1416	1413	72	22.72	4.213	0.160	777	0.160	0.000	8.4
2.42	170	7.0	1416	1415	72	22.72	4.189	0.170	781	0.170	0.000	8.9
2.42	180	7.4	1416	1417	72	22.72	4.164	0.180	786	0.180	0.000	9.5
2.42	190	7.9	1416	1418	71	22.41	4.140	0.190	779	0.190	0.000	10.0
2.42	200	8.3	1416	1419	71	22.41	4.116	0.200	784	0.200	0.000	10.5
2.42	210	8.7	1416	1423	70	22.09	4.092	0.210	777	0.210	-0.001	11.0
2.42	220	9.1	1416	1427	71	22.41	4.068	0.220	793	0.220	-0.001	11.6
2.42	230	9.5	1416	1429	72	22.72	4.044	0.230	809	0.230	-0.001	12.1
2.42	240	9.9	1416	1439	72	22.72	4.020	0.240	814	0.240	-0.002	12.6
2.42	250	10.3	1416	1447	72	22.72	3.996	0.250	819	0.250	-0.003	13.1
2.42	260	10.7	1416	1453	72	22.72	3.972	0.260	824	0.260	-0.004	13.7
2.42	270	11.2	1416	1458	73	23.04	3.948	0.270	840	0.270	-0.004	14.2
2.42	280	11.6	1416	1459	73	23.04	3.924	0.280	846	0.280	-0.004	14.7
2.42	290	12.0	1416	1455	75	23.67	3.899	0.290	874	0.290	-0.004	15.2
2.42	300	12.4	1416	1458	75	23.67	3.875	0.300	880	0.300	-0.004	15.7
2.42	310	12.8	1416	1468	76	23.99	3.851	0.310	897	0.310	-0.005	16.3
2.42	320	13.2	1416	1472	77	24.30	3.827	0.320	914	0.320	-0.006	16.8
2.42	330	13.6	1416	1476	77	24.30	3.803	0.330	920	0.330	-0.006	17.3
2.42	340	14.0	1416	1479	78	24.62	3.780	0.340	938	0.340	-0.006	17.8
2.42	350	14.5	1416	1479	78	24.62	3.756	0.350	944	0.350	-0.006	18.4
2.42	360	14.9	1416	1479	79	24.93	3.732	0.360	962	0.360	-0.006	18.9
2.42	370	15.3	1416	1486	79	24.93	3.708	0.370	968	0.370	-0.007	19.4
2.42	380	15.7	1416	1488	79	24.93	3.684	0.380	975	0.380	-0.007	19.9
2.42	390	16.1	1416	1489	79	24.93	3.660	0.390	981	0.390	-0.007	20.4
2.42	400	16.5	1416	1496	80	25.25	3.636	0.400	1000	0.400	-0.008	20.9

DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1416	1499	80	25.25	3.612	0.410	1007	0.410	-0.008	21.5
2.42	420	17.4	1416	1500	80	25.25	3.588	0.420	1013	0.420	-0.008	22.0
2.42	430	17.8	1416	1508	80	25.25	3.565	0.430	1020	0.430	-0.009	22.5
2.42	440	18.2	1416	1514	80	25.25	3.541	0.440	1027	0.440	-0.010	23.0
2.42	450	18.6	1416	1517	80	25.25	3.517	0.450	1034	0.450	-0.010	23.5
2.42	460	19.0	1416	1519	80	25.25	3.493	0.460	1041	0.460	-0.010	24.1
2.42	470	19.4	1416	1525	80	25.25	3.469	0.470	1048	0.470	-0.011	24.6
2.42	480	19.8	1416	1528	80	25.25	3.446	0.480	1055	0.480	-0.011	25.1
2.42	490	20.2	1416	1529	80	25.25	3.422	0.490	1062	0.490	-0.011	25.6
2.42	500	20.7	1416	1534	81	25.56	3.398	0.500	1083	0.500	-0.012	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #3, Vertical Load 1075 psf





Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #3, Vertical Load 1075 psf

DIRECT SHEAR
DATA SHEET

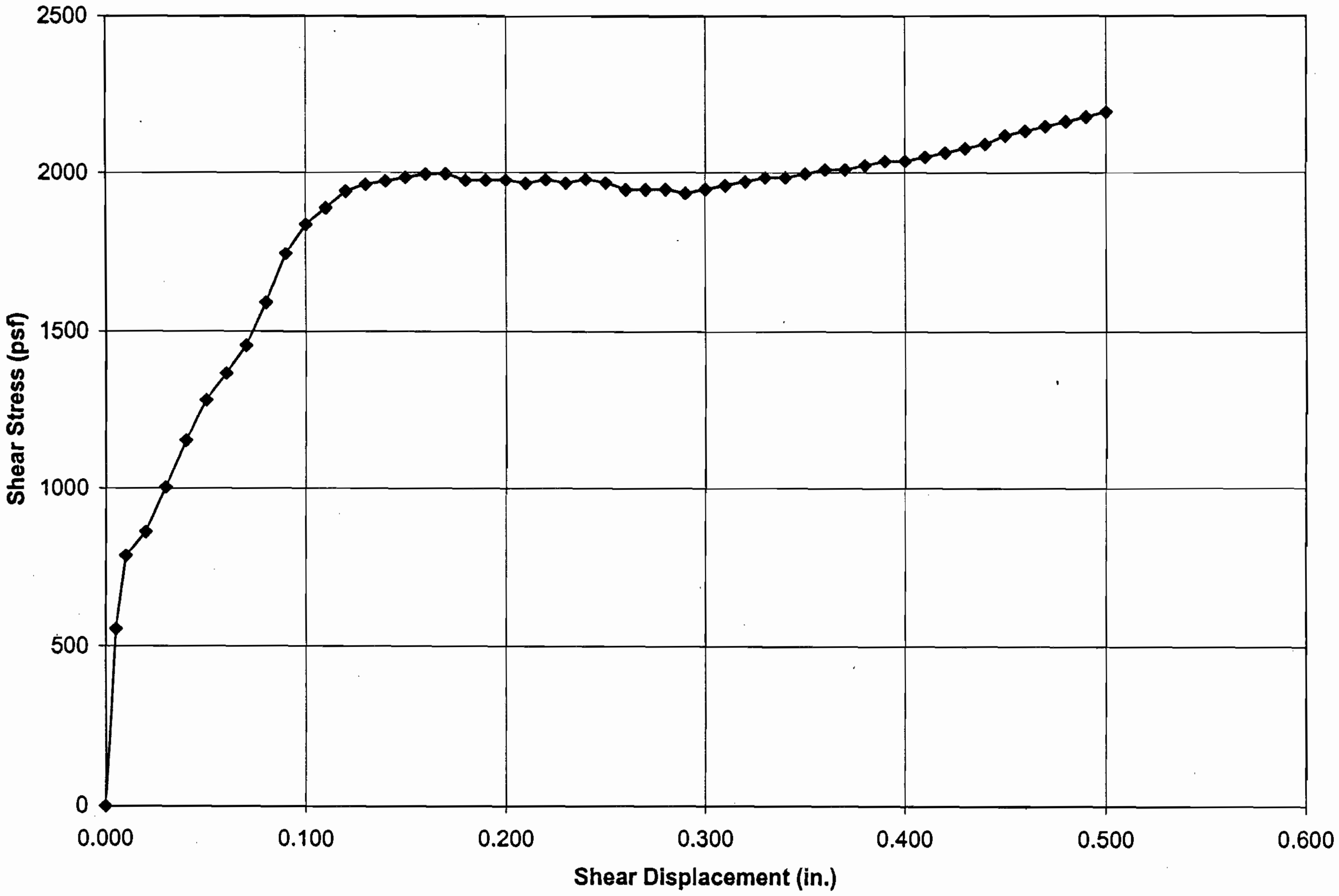
CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	40.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	2			Vertical Pressure (psf):	2142
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.				

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial. Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	2328	2328	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	2328	2318	56	17.67	4.588	0.005	555	0.005	0.001	0.3
2.42	10	0.4	2328	2309	79	24.93	4.575	0.010	785	0.010	0.002	0.5
2.42	20	0.8	2328	2294	86	27.14	4.551	0.020	859	0.020	0.003	1.1
2.42	30	1.2	2328	2281	100	31.56	4.527	0.030	1004	0.030	0.005	1.6
2.42	40	1.7	2328	2279	114	35.98	4.503	0.040	1151	0.040	0.005	2.1
2.42	50	2.1	2328	2279	126	39.77	4.479	0.050	1279	0.050	0.005	2.6
2.42	60	2.5	2328	2279	134	42.29	4.454	0.060	1367	0.060	0.005	3.2
2.42	70	2.9	2328	2286	142	44.82	4.430	0.070	1457	0.070	0.004	3.7
2.42	80	3.3	2328	2295	154	48.60	4.406	0.080	1588	0.080	0.003	4.2
2.42	90	3.7	2328	2308	168	53.02	4.382	0.090	1742	0.090	0.002	4.7
2.42	100	4.1	2328	2324	176	55.55	4.358	0.100	1836	0.100	0.000	5.3
2.42	110	4.5	2328	2346	180	56.81	4.333	0.110	1888	0.110	-0.002	5.8
2.42	120	5.0	2328	2359	184	58.07	4.309	0.120	1940	0.120	-0.003	6.3
2.42	130	5.4	2328	2384	185	58.39	4.285	0.130	1962	0.130	-0.006	6.8
2.42	140	5.8	2328	2399	185	58.39	4.261	0.140	1973	0.140	-0.007	7.4
2.42	150	6.2	2328	2419	185	58.39	4.237	0.150	1984	0.150	-0.009	7.9
2.42	160	6.6	2328	2440	185	58.39	4.213	0.160	1996	0.160	-0.011	8.4
2.42	170	7.0	2328	2460	184	58.07	4.189	0.170	1996	0.170	-0.013	8.9
2.42	180	7.4	2328	2479	181	57.12	4.164	0.180	1975	0.180	-0.015	9.5
2.42	190	7.9	2328	2500	180	56.81	4.140	0.190	1976	0.190	-0.017	10.0
2.42	200	8.3	2328	2520	179	56.49	4.116	0.200	1976	0.200	-0.019	10.5
2.42	210	8.7	2328	2539	177	55.86	4.092	0.210	1966	0.210	-0.021	11.0
2.42	220	9.1	2328	2560	177	55.86	4.068	0.220	1977	0.220	-0.023	11.6
2.42	230	9.5	2328	2580	175	55.23	4.044	0.230	1967	0.230	-0.025	12.1
2.42	240	9.9	2328	2605	175	55.23	4.020	0.240	1979	0.240	-0.028	12.6
2.42	250	10.3	2328	2626	173	54.60	3.996	0.250	1968	0.250	-0.030	13.1
2.42	260	10.7	2328	2639	170	53.65	3.972	0.260	1945	0.260	-0.031	13.7
2.42	270	11.2	2328	2655	169	53.34	3.948	0.270	1946	0.270	-0.033	14.2
2.42	280	11.6	2328	2675	168	53.02	3.924	0.280	1946	0.280	-0.035	14.7
2.42	290	12.0	2328	2697	166	52.39	3.899	0.290	1935	0.290	-0.037	15.2
2.42	300	12.4	2328	2709	166	52.39	3.875	0.300	1947	0.300	-0.038	15.7
2.42	310	12.8	2328	2729	166	52.39	3.851	0.310	1959	0.310	-0.040	16.3
2.42	320	13.2	2328	2745	166	52.39	3.827	0.320	1971	0.320	-0.042	16.8
2.42	330	13.6	2328	2758	166	52.39	3.803	0.330	1983	0.330	-0.043	17.3
2.42	340	14.0	2328	2766	165	52.07	3.780	0.340	1984	0.340	-0.044	17.8
2.42	350	14.5	2328	2779	165	52.07	3.756	0.350	1997	0.350	-0.045	18.4
2.42	360	14.9	2328	2800	165	52.07	3.732	0.360	2009	0.360	-0.047	18.9
2.42	370	15.3	2328	2819	164	51.76	3.708	0.370	2010	0.370	-0.049	19.4
2.42	380	15.7	2328	2831	164	51.76	3.684	0.380	2023	0.380	-0.050	19.9
2.42	390	16.1	2328	2846	164	51.76	3.660	0.390	2036	0.390	-0.052	20.4
2.42	400	16.5	2328	2866	163	51.44	3.636	0.400	2037	0.400	-0.054	20.9

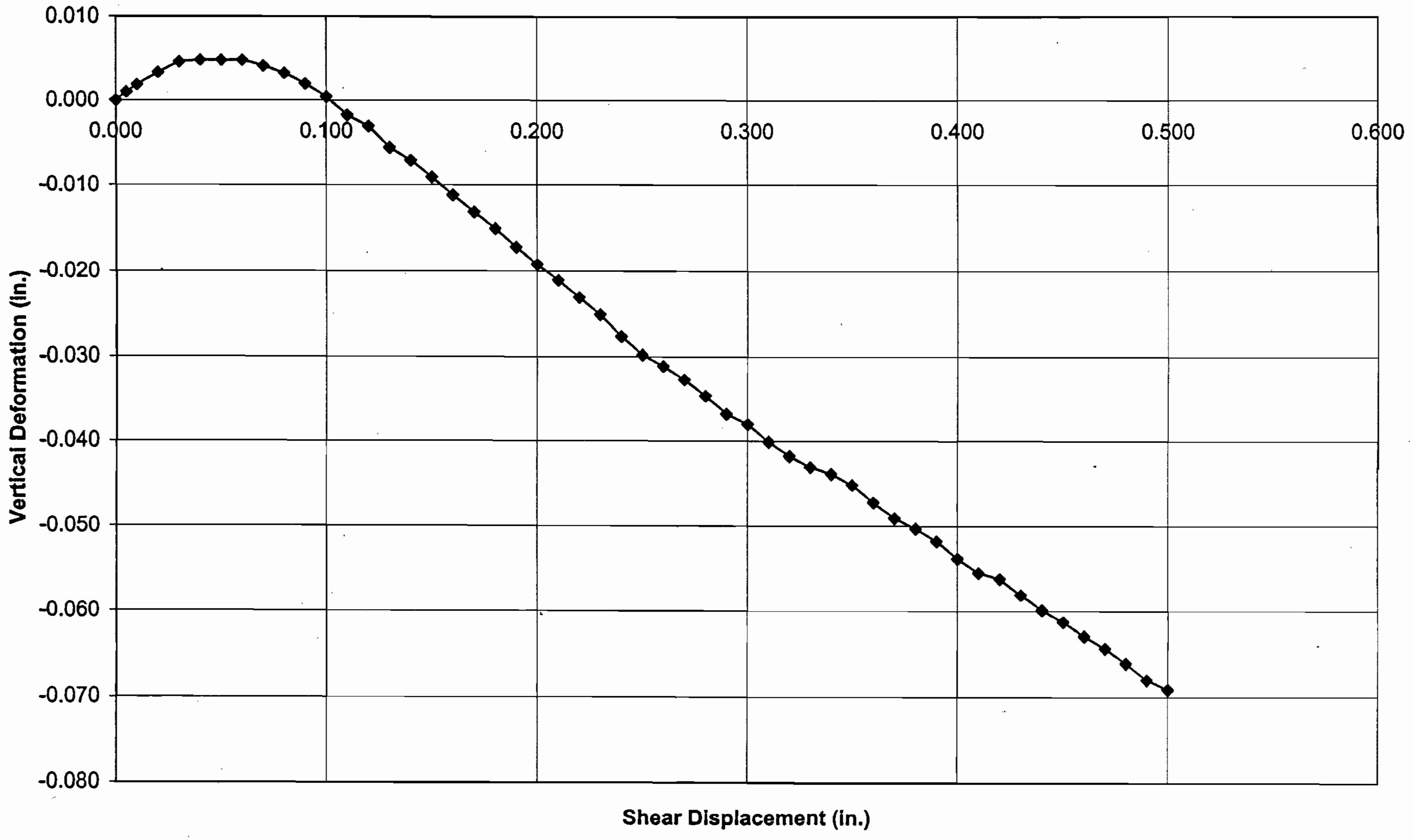
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	2328	2883	163	51.44	3.612	0.410	2051	0.410	-0.056	21.5
2.42	420	17.4	2328	2890	163	51.44	3.588	0.420	2064	0.420	-0.056	22.0
2.42	430	17.8	2328	2909	163	51.44	3.565	0.430	2078	0.430	-0.058	22.5
2.42	440	18.2	2328	2927	163	51.44	3.541	0.440	2092	0.440	-0.060	23.0
2.42	450	18.6	2328	2941	164	51.76	3.517	0.450	2119	0.450	-0.061	23.5
2.42	460	19.0	2328	2958	164	51.76	3.493	0.460	2134	0.460	-0.063	24.1
2.42	470	19.4	2328	2972	164	51.76	3.469	0.470	2148	0.470	-0.064	24.6
2.42	480	19.8	2328	2989	164	51.76	3.446	0.480	2163	0.480	-0.066	25.1
2.42	490	20.2	2328	3008	164	51.76	3.422	0.490	2178	0.490	-0.068	25.6
2.42	500	20.7	2328	3019	164	51.76	3.398	0.500	2193	0.500	-0.069	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #2, Vertical Load 2142 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #2, Vertical Load 2142 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	40.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	1			Vertical Pressure (psf):	4190

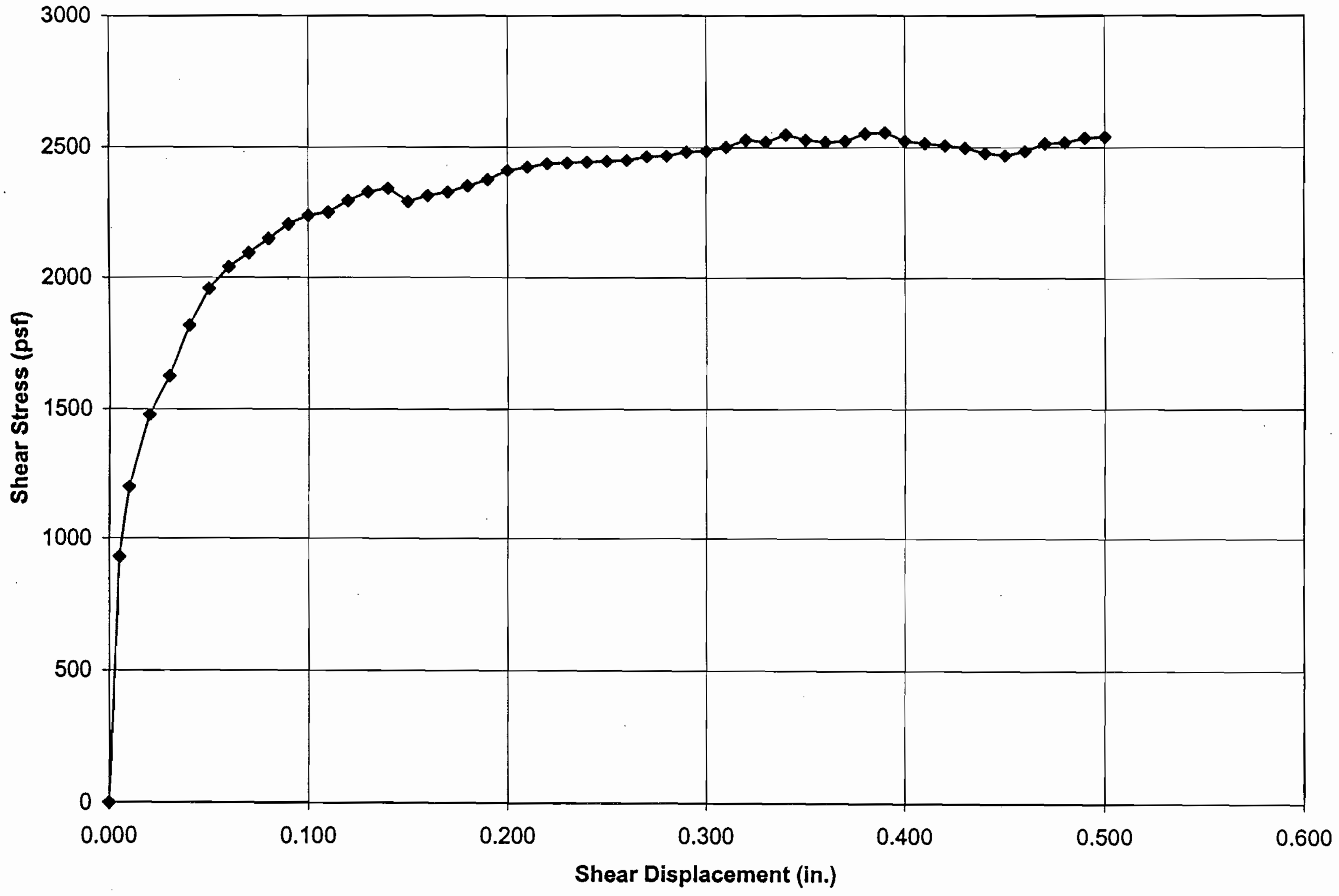
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1842	1842	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1842	1839	94	29.67	4.588	0.005	931	0.005	0.000	0.3
2.42	10	0.4	1842	1834	121	38.19	4.575	0.010	1202	0.010	0.001	0.5
2.42	20	0.8	1842	1822	148	46.71	4.551	0.020	1478	0.020	0.002	1.1
2.42	30	1.2	1842	1815	162	51.13	4.527	0.030	1626	0.030	0.003	1.6
2.42	40	1.7	1842	1804	180	56.81	4.503	0.040	1817	0.040	0.004	2.1
2.42	50	2.1	1842	1797	193	60.91	4.479	0.050	1958	0.050	0.005	2.6
2.42	60	2.5	1842	1788	200	63.12	4.454	0.060	2041	0.060	0.005	3.2
2.42	70	2.9	1842	1782	204	64.38	4.430	0.070	2093	0.070	0.006	3.7
2.42	80	3.3	1842	1774	208	65.64	4.406	0.080	2145	0.080	0.007	4.2
2.42	90	3.7	1842	1769	212	66.91	4.382	0.090	2199	0.090	0.007	4.7
2.42	100	4.1	1842	1766	214	67.54	4.358	0.100	2232	0.100	0.008	5.3
2.42	110	4.5	1842	1764	214	67.54	4.333	0.110	2244	0.110	0.008	5.8
2.42	120	5.0	1842	1763	217	68.49	4.309	0.120	2288	0.120	0.008	6.3
2.42	130	5.4	1842	1762	219	69.12	4.285	0.130	2323	0.130	0.008	6.8
2.42	140	5.8	1842	1762	219	69.12	4.261	0.140	2336	0.140	0.008	7.4
2.42	150	6.2	1842	1758	213	67.22	4.237	0.150	2285	0.150	0.008	7.9
2.42	160	6.6	1842	1754	214	67.54	4.213	0.160	2309	0.160	0.009	8.4
2.42	170	7.0	1842	1750	214	67.54	4.189	0.170	2322	0.170	0.009	8.9
2.42	180	7.4	1842	1747	215	67.85	4.164	0.180	2346	0.180	0.010	9.5
2.42	190	7.9	1842	1742	216	68.17	4.140	0.190	2371	0.190	0.010	10.0
2.42	200	8.3	1842	1736	218	68.80	4.116	0.200	2407	0.200	0.011	10.5
2.42	210	8.7	1842	1735	218	68.80	4.092	0.210	2421	0.210	0.011	11.0
2.42	220	9.1	1842	1733	218	68.80	4.068	0.220	2435	0.220	0.011	11.6
2.42	230	9.5	1842	1731	217	68.49	4.044	0.230	2439	0.230	0.011	12.1
2.42	240	9.9	1842	1727	216	68.17	4.020	0.240	2442	0.240	0.012	12.6
2.42	250	10.3	1842	1723	215	67.85	3.996	0.250	2445	0.250	0.012	13.1
2.42	260	10.7	1842	1720	214	67.54	3.972	0.260	2449	0.260	0.012	13.7
2.42	270	11.2	1842	1717	214	67.54	3.948	0.270	2464	0.270	0.013	14.2
2.42	280	11.6	1842	1715	213	67.22	3.924	0.280	2467	0.280	0.013	14.7
2.42	290	12.0	1842	1715	213	67.22	3.899	0.290	2482	0.290	0.013	15.2
2.42	300	12.4	1842	1713	212	66.91	3.875	0.300	2486	0.300	0.013	15.7
2.42	310	12.8	1842	1710	212	66.91	3.851	0.310	2502	0.310	0.013	16.3
2.42	320	13.2	1842	1707	213	67.22	3.827	0.320	2529	0.320	0.014	16.8
2.42	330	13.6	1842	1704	211	66.59	3.803	0.330	2521	0.330	0.014	17.3
2.42	340	14.0	1842	1703	212	66.91	3.780	0.340	2549	0.340	0.014	17.8
2.42	350	14.5	1842	1701	209	65.96	3.756	0.350	2529	0.350	0.014	18.4
2.42	360	14.9	1842	1697	207	65.33	3.732	0.360	2521	0.360	0.015	18.9
2.42	370	15.3	1842	1696	206	65.01	3.708	0.370	2525	0.370	0.015	19.4
2.42	380	15.7	1842	1694	207	65.33	3.684	0.380	2554	0.380	0.015	19.9
2.42	390	16.1	1842	1692	206	65.01	3.660	0.390	2558	0.390	0.015	20.4
2.42	400	16.5	1842	1692	202	63.75	3.636	0.400	2525	0.400	0.015	20.9

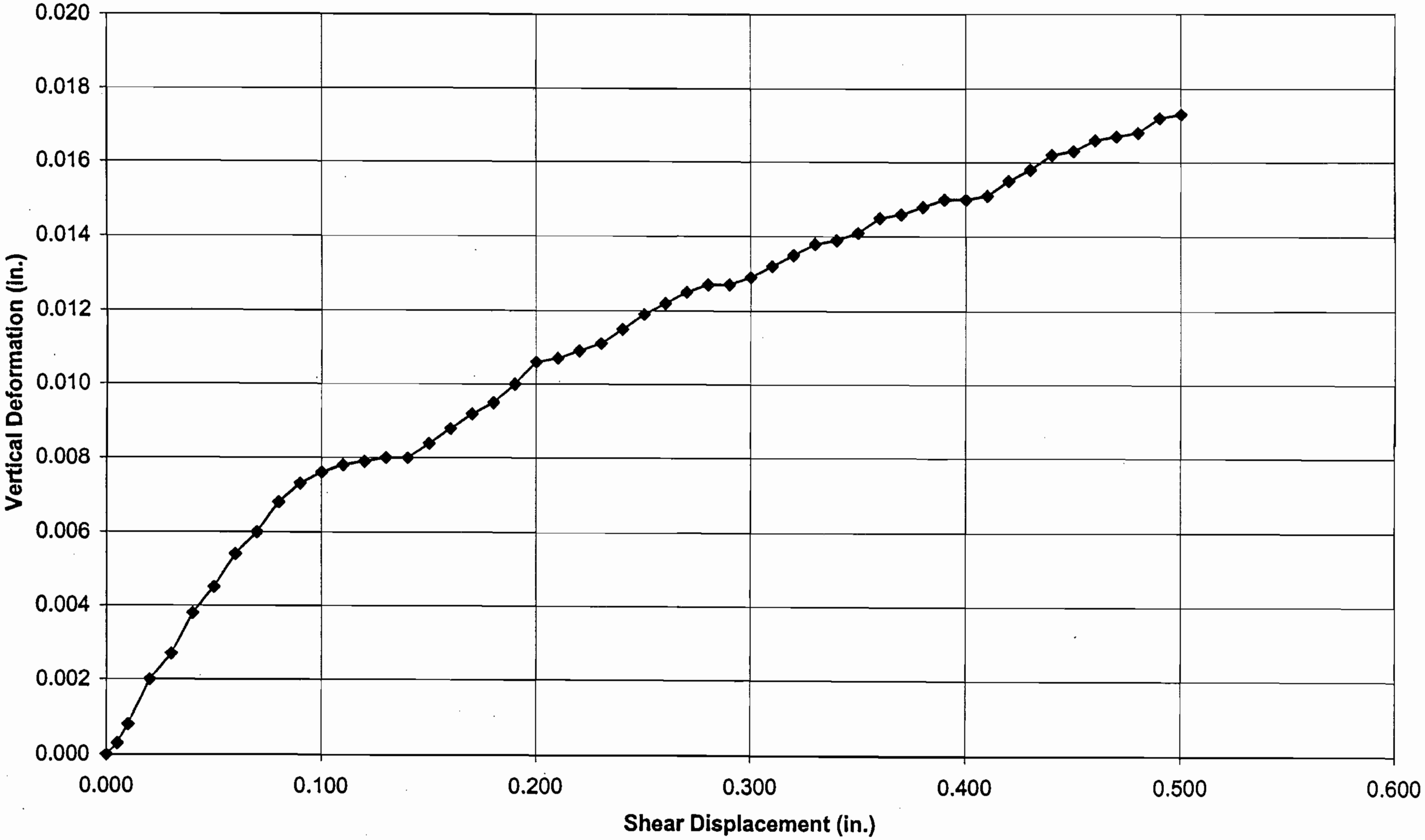
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1842	1691	200	63.12	3.612	0.410	2516	0.410	0.015	21.5
2.42	420	17.4	1842	1687	198	62.49	3.588	0.420	2508	0.420	0.016	22.0
2.42	430	17.8	1842	1684	196	61.86	3.565	0.430	2499	0.430	0.016	22.5
2.42	440	18.2	1842	1680	193	60.91	3.541	0.440	2477	0.440	0.016	23.0
2.42	450	18.6	1842	1679	191	60.28	3.517	0.450	2468	0.450	0.016	23.5
2.42	460	19.0	1842	1676	191	60.28	3.493	0.460	2485	0.460	0.017	24.1
2.42	470	19.4	1842	1675	192	60.60	3.469	0.470	2515	0.470	0.017	24.6
2.42	480	19.8	1842	1674	191	60.28	3.446	0.480	2519	0.480	0.017	25.1
2.42	490	20.2	1842	1670	191	60.28	3.422	0.490	2537	0.490	0.017	25.6
2.42	500	20.7	1842	1669	190	59.96	3.398	0.500	2541	0.500	0.017	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #1, Vertical Load 4190 psf

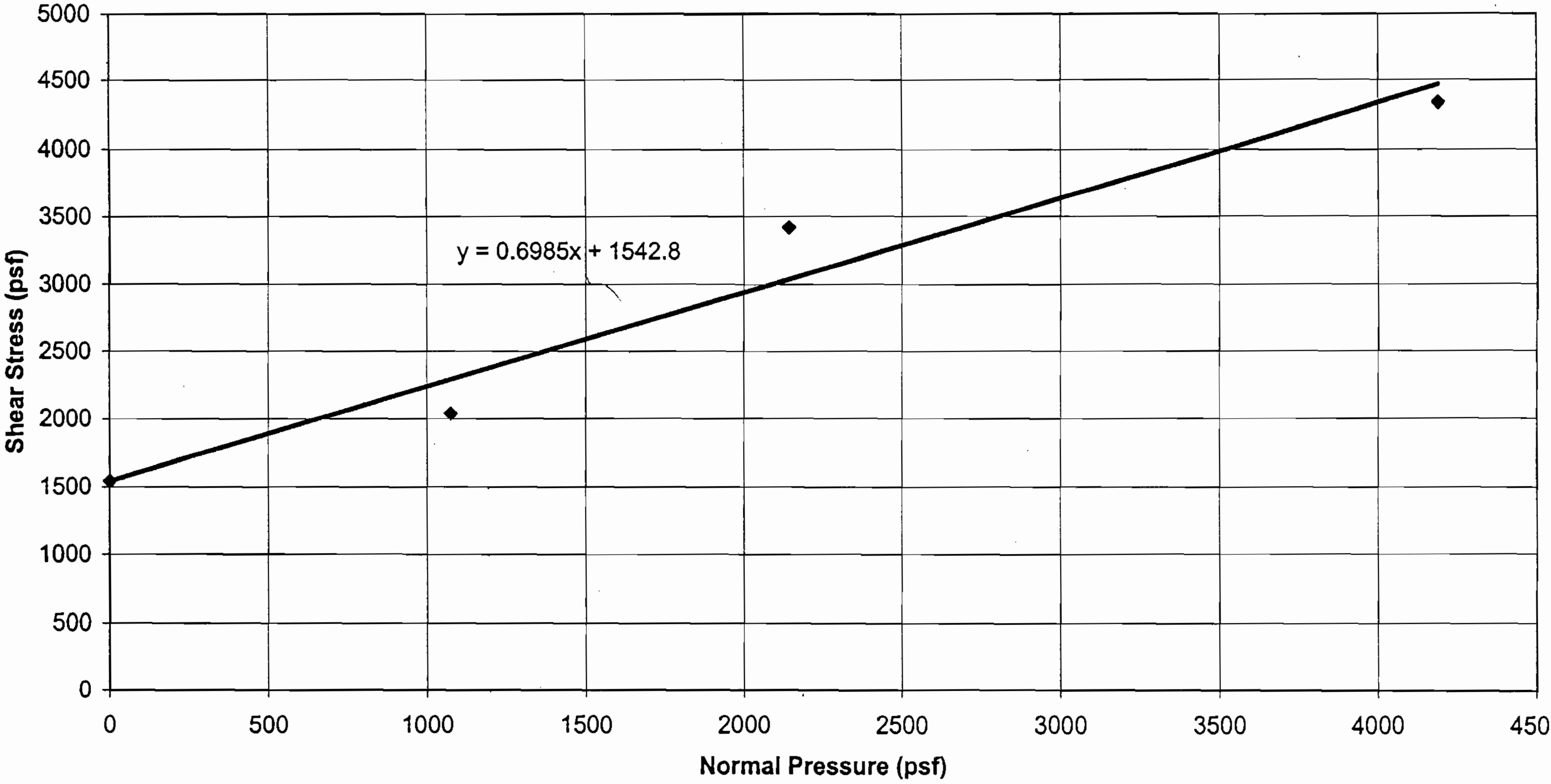


Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 40.0', Sample #1, Vertical Load 4190 psf



DIRECT SHEAR RESULTS (Peak)

Vasco Road, Project No. 001860
Boring B-4, Depth 62.5'
Friction Angle 34.9 deg., Cohesion 1543 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Gray Claystone w/Sand



CLIENT: CAL Engineering and Geology

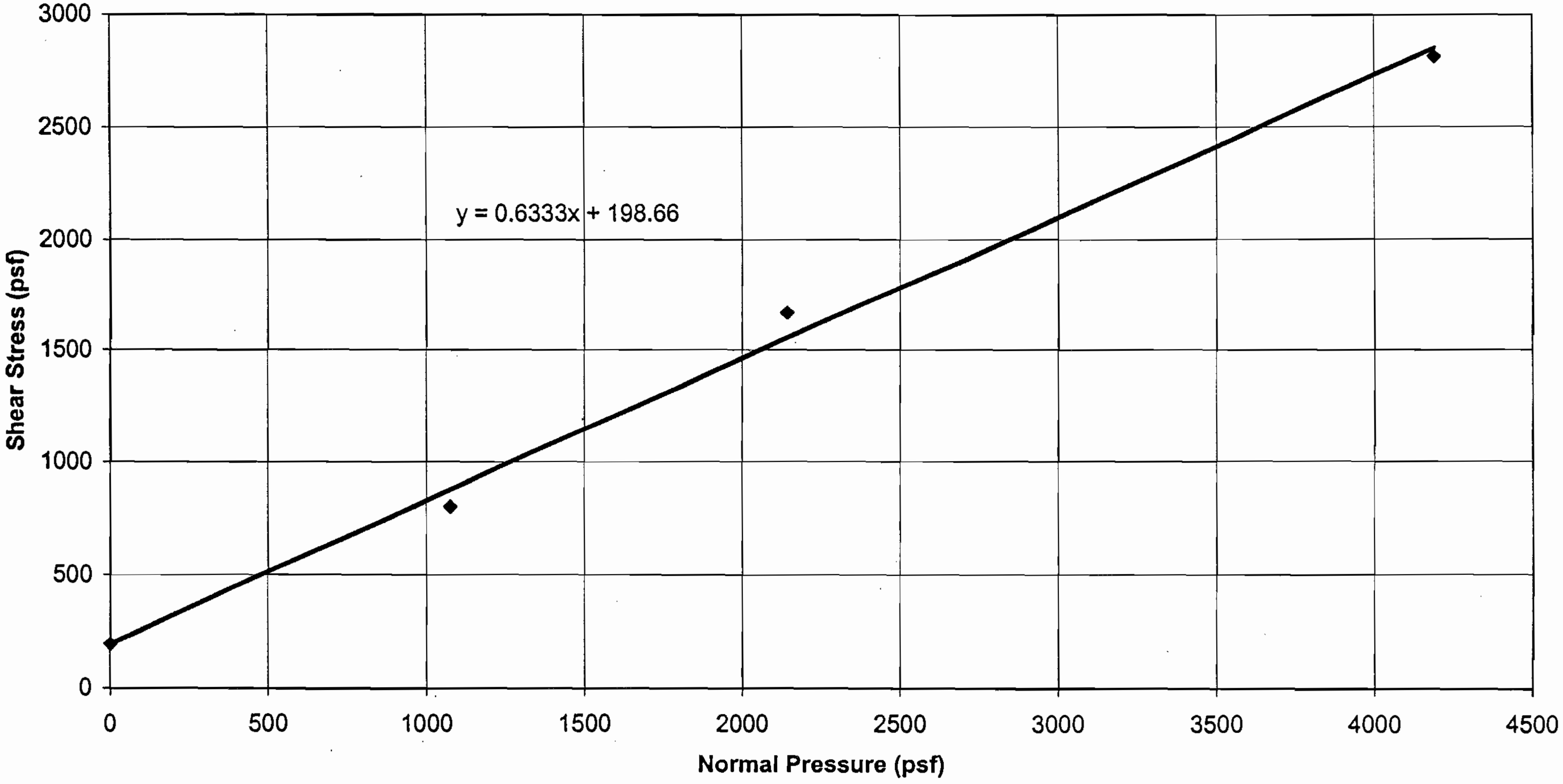
RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

0	1543
1075	2041
2142	3423
4190	4338

Project: Vasco Rd.
Project #: 1860
Boring: B-4
Depth: 62.5

DIRECT SHEAR RESULTS (Ultimate)
Vasco Road, Project No. 001860
Boring B-4, Depth 62.5'
Friction Angle 32.3 deg., Cohesion 199 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Gray Claystone w/Sand



CLIENT: CAL Engineering and Geology

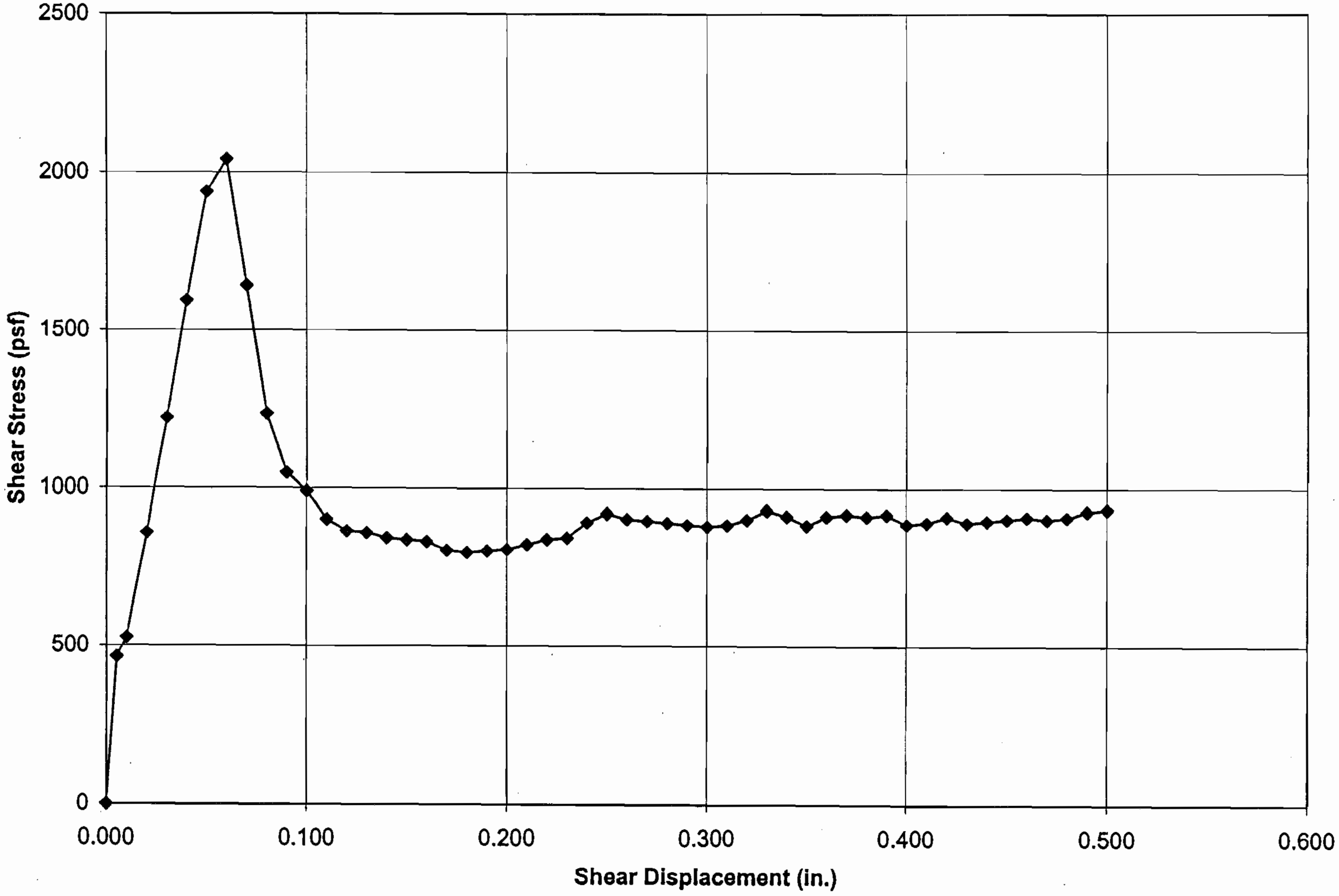
RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Ultimate)

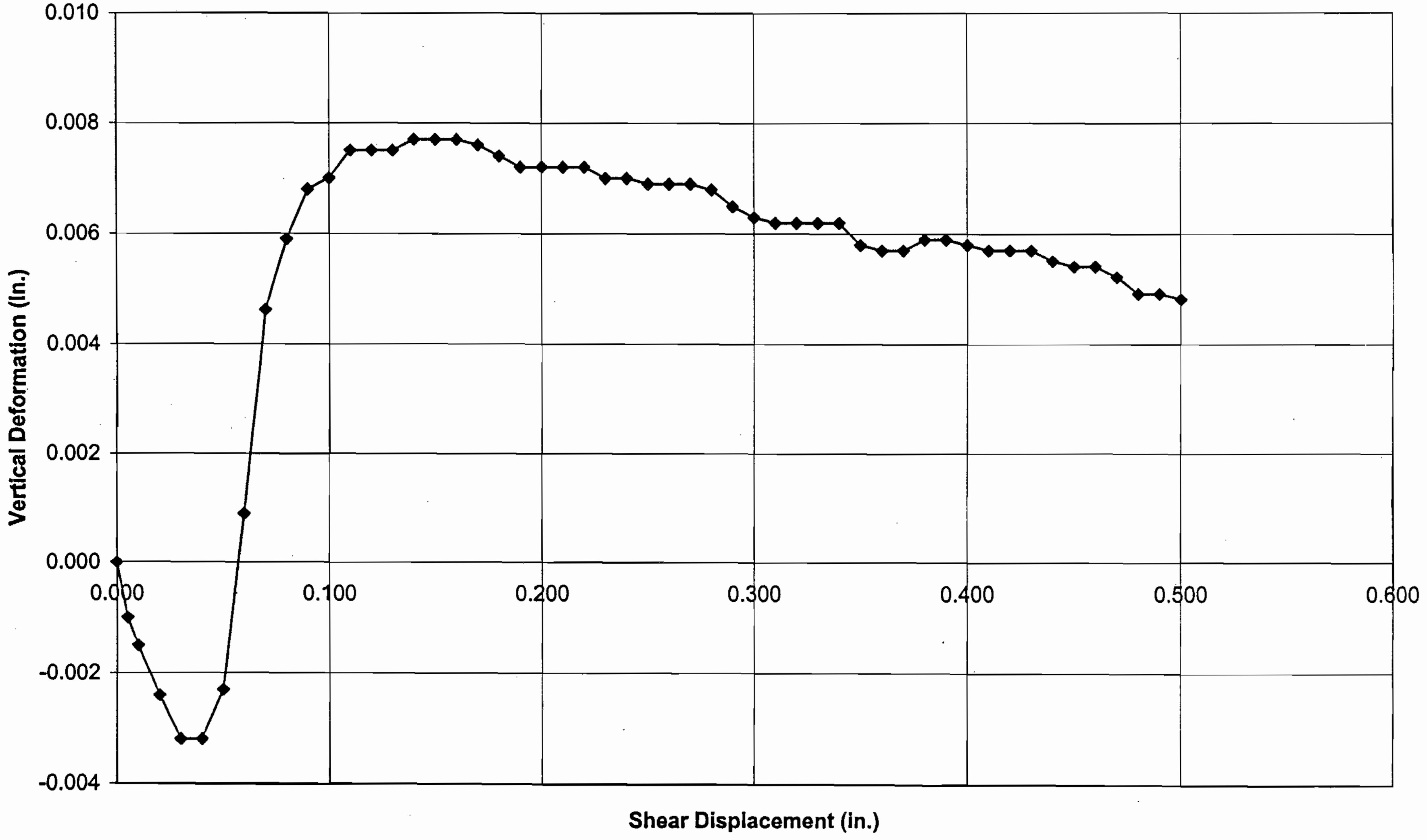
Project: Vasco Rd.
Project #: 1860
Boring: B-4
Depth: 62.5

0	198.66
1075	806
2142	1667
4190	2814

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #1, Vertical Load 1075 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #1, Vertical Load 1075 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	12/22/2001	Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	62.5	Init.Horz. Dial Reading:	0
SAMPLE #:	1			Vertical Pressure (psf):	1075

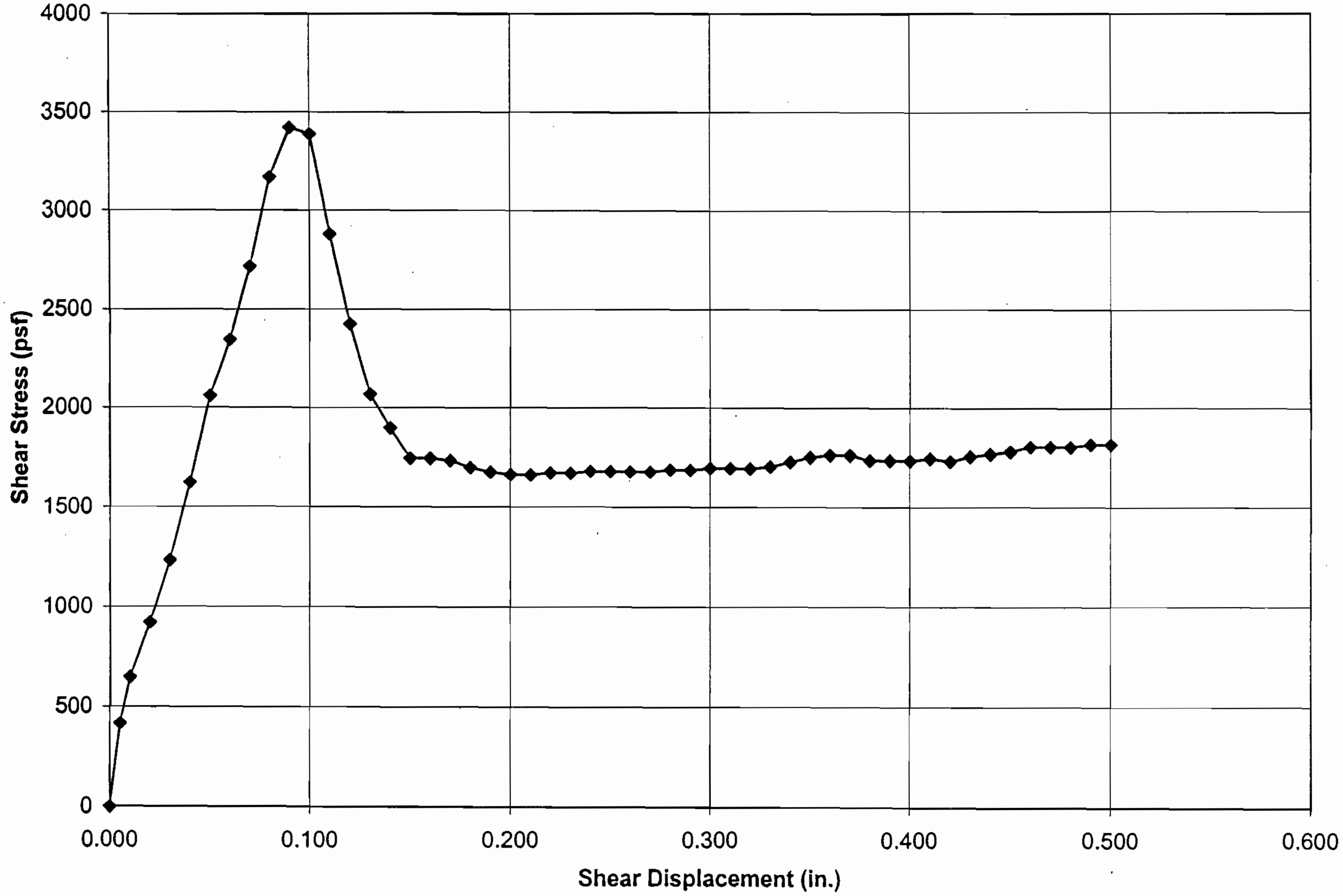
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1500	1500	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1490	1500	47	14.83	4.588	0.005	466	0.005	-0.001	0.3
2.42	10	0.4	1485	1500	53	16.73	4.575	0.010	526	0.010	-0.002	0.5
2.42	20	0.8	1476	1500	86	27.14	4.551	0.020	859	0.020	-0.002	1.1
2.42	30	1.2	1468	1500	122	38.50	4.527	0.030	1225	0.030	-0.003	1.6
2.42	40	1.7	1468	1500	158	49.86	4.503	0.040	1595	0.040	-0.003	2.1
2.42	50	2.1	1477	1500	191	60.28	4.479	0.050	1938	0.050	-0.002	2.6
2.42	60	2.5	1509	1500	200	63.12	4.454	0.060	2041	0.060	0.001	3.2
2.42	70	2.9	1546	1500	160	50.50	4.430	0.070	1641	0.070	0.005	3.7
2.42	80	3.3	1559	1500	120	37.87	4.406	0.080	1238	0.080	0.006	4.2
2.42	90	3.7	1568	1500	101	31.88	4.382	0.090	1048	0.090	0.007	4.7
2.42	100	4.1	1570	1500	95	29.98	4.358	0.100	991	0.100	0.007	5.3
2.42	110	4.5	1575	1500	86	27.14	4.333	0.110	902	0.110	0.008	5.8
2.42	120	5.0	1575	1500	82	25.88	4.309	0.120	865	0.120	0.008	6.3
2.42	130	5.4	1575	1500	81	25.56	4.285	0.130	859	0.130	0.008	6.8
2.42	140	5.8	1577	1500	79	24.93	4.261	0.140	843	0.140	0.008	7.4
2.42	150	6.2	1577	1500	78	24.62	4.237	0.150	837	0.150	0.008	7.9
2.42	160	6.6	1577	1500	77	24.30	4.213	0.160	831	0.160	0.008	8.4
2.42	170	7.0	1576	1500	74	23.35	4.189	0.170	803	0.170	0.008	8.9
2.42	180	7.4	1574	1500	73	23.04	4.164	0.180	797	0.180	0.007	9.5
2.42	190	7.9	1572	1500	73	23.04	4.140	0.190	801	0.190	0.007	10.0
2.42	200	8.3	1572	1500	73	23.04	4.116	0.200	806	0.200	0.007	10.5
2.42	210	8.7	1572	1500	74	23.35	4.092	0.210	822	0.210	0.007	11.0
2.42	220	9.1	1572	1500	75	23.67	4.068	0.220	838	0.220	0.007	11.6
2.42	230	9.5	1570	1500	75	23.67	4.044	0.230	843	0.230	0.007	12.1
2.42	240	9.9	1570	1500	79	24.93	4.020	0.240	893	0.240	0.007	12.6
2.42	250	10.3	1569	1500	81	25.56	3.996	0.250	921	0.250	0.007	13.1
2.42	260	10.7	1569	1500	79	24.93	3.972	0.260	904	0.260	0.007	13.7
2.42	270	11.2	1569	1500	78	24.62	3.948	0.270	898	0.270	0.007	14.2
2.42	280	11.6	1568	1500	77	24.30	3.924	0.280	892	0.280	0.007	14.7
2.42	290	12.0	1565	1500	76	23.99	3.899	0.290	886	0.290	0.007	15.2
2.42	300	12.4	1563	1500	75	23.67	3.875	0.300	880	0.300	0.006	15.7
2.42	310	12.8	1562	1500	75	23.67	3.851	0.310	885	0.310	0.006	16.3
2.42	320	13.2	1562	1500	76	23.99	3.827	0.320	902	0.320	0.006	16.8
2.42	330	13.6	1562	1500	78	24.62	3.803	0.330	932	0.330	0.006	17.3
2.42	340	14.0	1562	1500	76	23.99	3.780	0.340	914	0.340	0.006	17.8
2.42	350	14.5	1558	1500	73	23.04	3.756	0.350	883	0.350	0.006	18.4
2.42	360	14.9	1557	1500	75	23.67	3.732	0.360	913	0.360	0.006	18.9
2.42	370	15.3	1557	1500	75	23.67	3.708	0.370	919	0.370	0.006	19.4
2.42	380	15.7	1559	1500	74	23.35	3.684	0.380	913	0.380	0.006	19.9
2.42	390	16.1	1559	1500	74	23.35	3.660	0.390	919	0.390	0.006	20.4
2.42	400	16.5	1558	1500	71	22.41	3.636	0.400	887	0.400	0.006	20.9

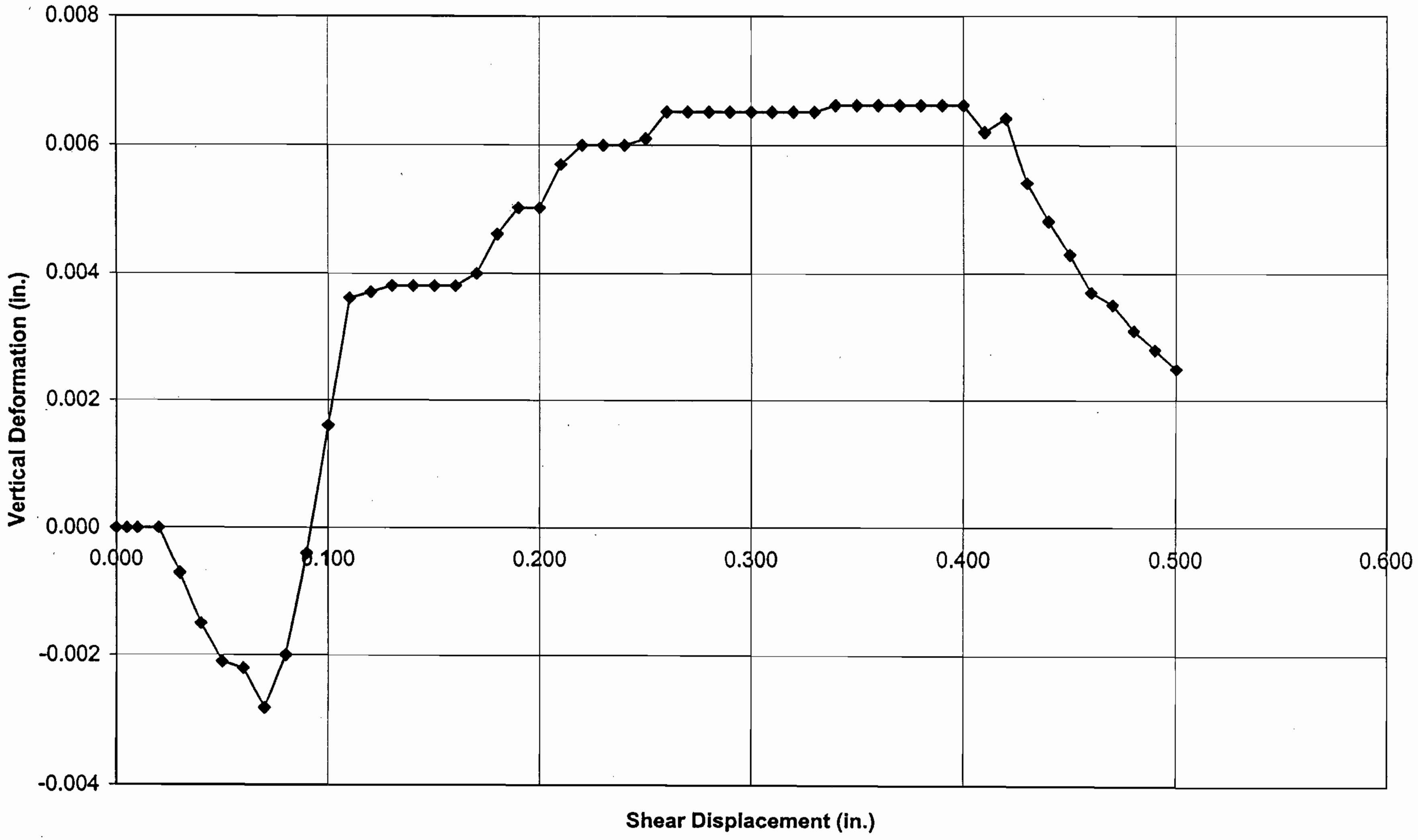
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1557	1500	71	22.41	3.612	0.410	893	0.410	0.006	21.5
2.42	420	17.4	1557	1500	72	22.72	3.588	0.420	912	0.420	0.006	22.0
2.42	430	17.8	1557	1500	70	22.09	3.565	0.430	892	0.430	0.006	22.5
2.42	440	18.2	1555	1500	70	22.09	3.541	0.440	898	0.440	0.006	23.0
2.42	450	18.6	1554	1500	70	22.09	3.517	0.450	905	0.450	0.005	23.5
2.42	460	19.0	1554	1500	70	22.09	3.493	0.460	911	0.460	0.005	24.1
2.42	470	19.4	1552	1500	69	21.78	3.469	0.470	904	0.470	0.005	24.6
2.42	480	19.8	1549	1500	69	21.78	3.446	0.480	910	0.480	0.005	25.1
2.42	490	20.2	1549	1500	70	22.09	3.422	0.490	930	0.490	0.005	25.6
2.42	500	20.7	1548	1500	70	22.09	3.398	0.500	936	0.500	0.005	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #2, Vertical Load 2142 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #2, Vertical Load 2142 psf



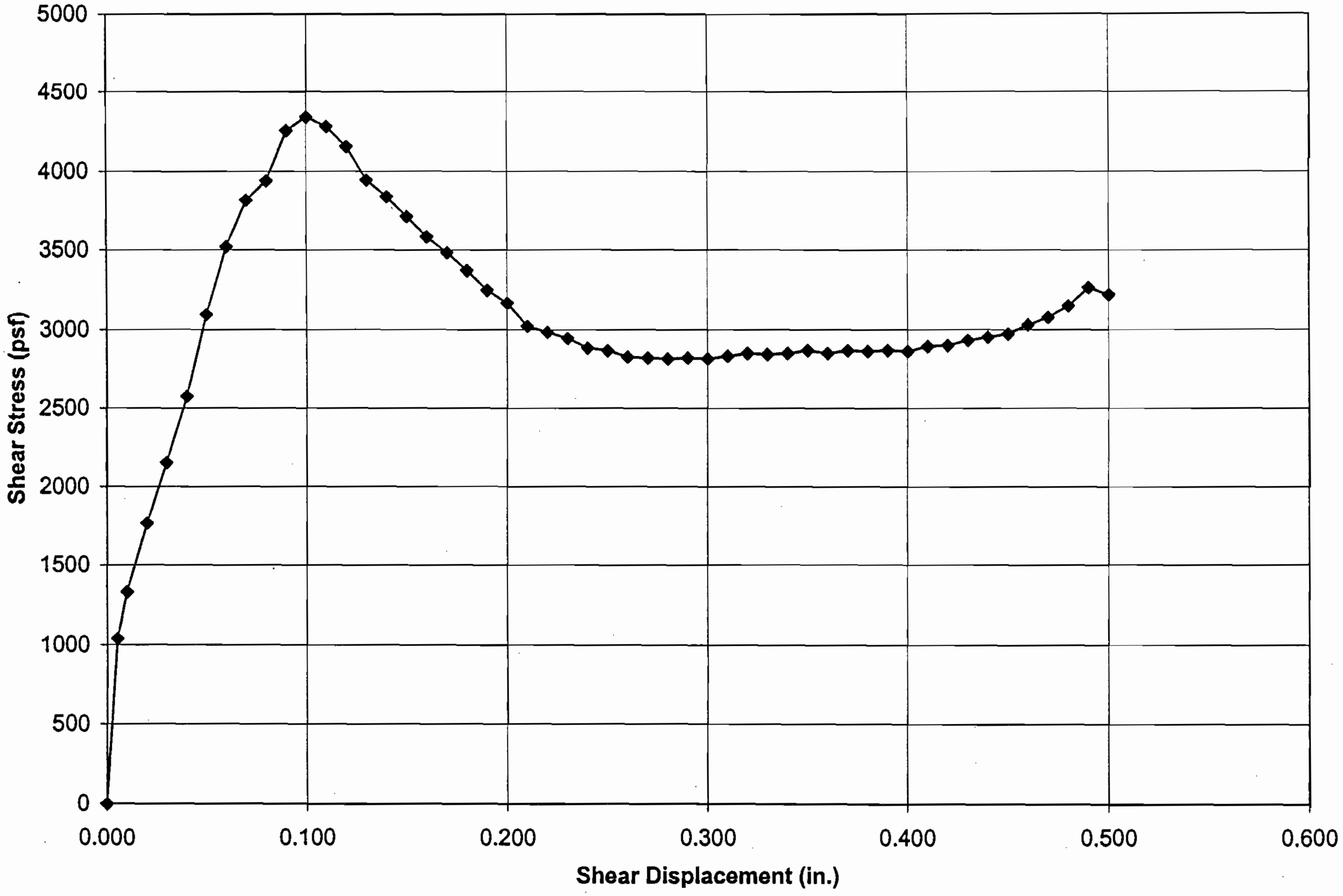
DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology							Ring Constant = 0.3156 lb/div				
PROJECT:	Vasco Road							Sample Diameter (in.):			2.42	
PROJ. # :	001860		TEST DATE:		12/22/2001			Init. Sample Height (in.):			1.20	
BORING:	B-4		DEPTH:		62.5			Init.Horz. Dial Reading:			0	
SAMPLE #:	2							Vertical Pressure (psf):			2142	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.											
Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1209	1209	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1209	1209	42	13.26	4.588	0.005	416	0.005	0.000	0.3
2.42	10	0.4	1209	1209	65	20.51	4.575	0.010	646	0.010	0.000	0.5
2.42	20	0.8	1209	1209	92	29.04	4.551	0.020	919	0.020	0.000	1.1
2.42	30	1.2	1202	1209	123	38.82	4.527	0.030	1235	0.030	-0.001	1.6
2.42	40	1.7	1194	1209	161	50.81	4.503	0.040	1625	0.040	-0.002	2.1
2.42	50	2.1	1188	1209	203	64.07	4.479	0.050	2060	0.050	-0.002	2.6
2.42	60	2.5	1187	1209	230	72.59	4.454	0.060	2347	0.060	-0.002	3.2
2.42	70	2.9	1181	1209	265	83.63	4.430	0.070	2718	0.070	-0.003	3.7
2.42	80	3.3	1189	1209	307	96.89	4.406	0.080	3167	0.080	-0.002	4.2
2.42	90	3.7	1205	1209	330	104.15	4.382	0.090	3423	0.090	0.000	4.7
2.42	100	4.1	1225	1209	325	102.57	4.358	0.100	3389	0.100	0.002	5.3
2.42	110	4.5	1245	1209	275	86.79	4.333	0.110	2884	0.110	0.004	5.8
2.42	120	5.0	1246	1209	230	72.59	4.309	0.120	2426	0.120	0.004	6.3
2.42	130	5.4	1247	1209	195	61.54	4.285	0.130	2068	0.130	0.004	6.8
2.42	140	5.8	1247	1209	178	56.18	4.261	0.140	1898	0.140	0.004	7.4
2.42	150	6.2	1247	1209	163	51.44	4.237	0.150	1748	0.150	0.004	7.9
2.42	160	6.6	1247	1209	162	51.13	4.213	0.160	1748	0.160	0.004	8.4
2.42	170	7.0	1249	1209	160	50.50	4.189	0.170	1736	0.170	0.004	8.9
2.42	180	7.4	1255	1209	156	49.23	4.164	0.180	1702	0.180	0.005	9.5
2.42	190	7.9	1259	1209	153	48.29	4.140	0.190	1679	0.190	0.005	10.0
2.42	200	8.3	1259	1209	151	47.66	4.116	0.200	1667	0.200	0.005	10.5
2.42	210	8.7	1266	1209	150	47.34	4.092	0.210	1666	0.210	0.006	11.0
2.42	220	9.1	1269	1209	150	47.34	4.068	0.220	1676	0.220	0.006	11.6
2.42	230	9.5	1269	1209	149	47.02	4.044	0.230	1675	0.230	0.006	12.1
2.42	240	9.9	1269	1209	149	47.02	4.020	0.240	1685	0.240	0.006	12.6
2.42	250	10.3	1270	1209	148	46.71	3.996	0.250	1683	0.250	0.006	13.1
2.42	260	10.7	1274	1209	147	46.39	3.972	0.260	1682	0.260	0.007	13.7
2.42	270	11.2	1274	1209	146	46.08	3.948	0.270	1681	0.270	0.007	14.2
2.42	280	11.6	1274	1209	146	46.08	3.924	0.280	1691	0.280	0.007	14.7
2.42	290	12.0	1274	1209	145	45.76	3.899	0.290	1690	0.290	0.007	15.2
2.42	300	12.4	1274	1209	145	45.76	3.875	0.300	1700	0.300	0.007	15.7
2.42	310	12.8	1274	1209	144	45.45	3.851	0.310	1699	0.310	0.007	16.3
2.42	320	13.2	1274	1209	143	45.13	3.827	0.320	1698	0.320	0.007	16.8
2.42	330	13.6	1274	1209	143	45.13	3.803	0.330	1709	0.330	0.007	17.3
2.42	340	14.0	1275	1209	144	45.45	3.780	0.340	1732	0.340	0.007	17.8
2.42	350	14.5	1275	1209	145	45.76	3.756	0.350	1755	0.350	0.007	18.4
2.42	360	14.9	1275	1209	145	45.76	3.732	0.360	1766	0.360	0.007	18.9
2.42	370	15.3	1275	1209	144	45.45	3.708	0.370	1765	0.370	0.007	19.4
2.42	380	15.7	1275	1209	141	44.50	3.684	0.380	1739	0.380	0.007	19.9
2.42	390	16.1	1275	1209	140	44.18	3.660	0.390	1738	0.390	0.007	20.4
2.42	400	16.5	1275	1209	139	43.87	3.636	0.400	1737	0.400	0.007	20.9

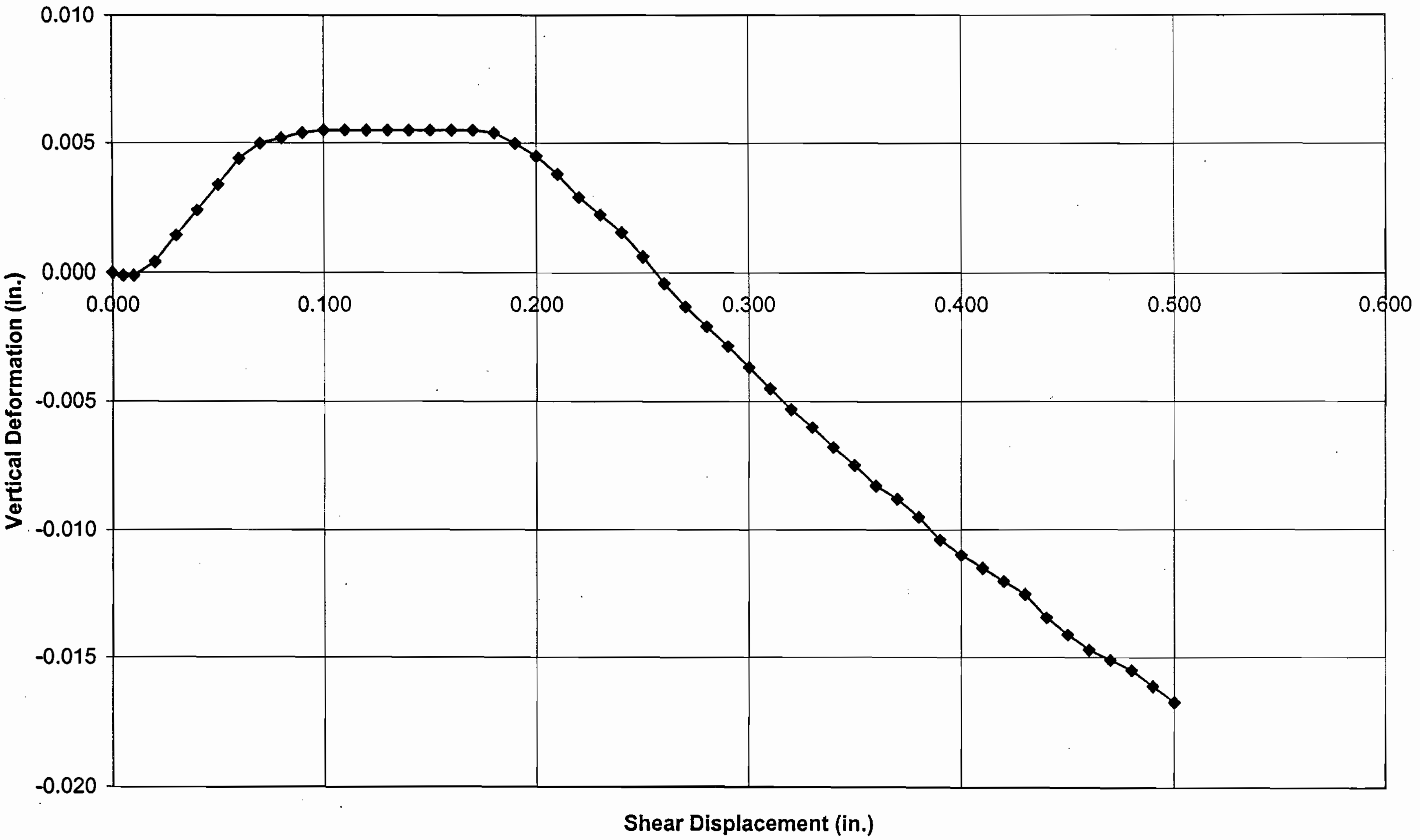
DIRECT SHEAR DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1271	1209	139	43.87	3.612	0.410	1749	0.410	0.006	21.5
2.42	420	17.4	1273	1209	137	43.24	3.588	0.420	1735	0.420	0.006	22.0
2.42	430	17.8	1263	1209	138	43.55	3.565	0.430	1759	0.430	0.005	22.5
2.42	440	18.2	1257	1209	138	43.55	3.541	0.440	1771	0.440	0.005	23.0
2.42	450	18.6	1252	1209	138	43.55	3.517	0.450	1783	0.450	0.004	23.5
2.42	460	19.0	1246	1209	139	43.87	3.493	0.460	1808	0.460	0.004	24.1
2.42	470	19.4	1244	1209	138	43.55	3.469	0.470	1808	0.470	0.004	24.6
2.42	480	19.8	1240	1209	137	43.24	3.446	0.480	1807	0.480	0.003	25.1
2.42	490	20.2	1237	1209	137	43.24	3.422	0.490	1819	0.490	0.003	25.6
2.42	500	20.7	1234	1209	136	42.92	3.398	0.500	1819	0.500	0.003	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #3, Vertical Load 4190 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-4, Depth 62.5', Sample #3, Vertical Load 4190 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	12/22/2001		Init. Sample Height (in.):	1.20
BORING:	B-4	DEPTH:	62.5		Init.Horz. Dial Reading:	0
SAMPLE #:	3				Vertical Pressure (psf):	4190

Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

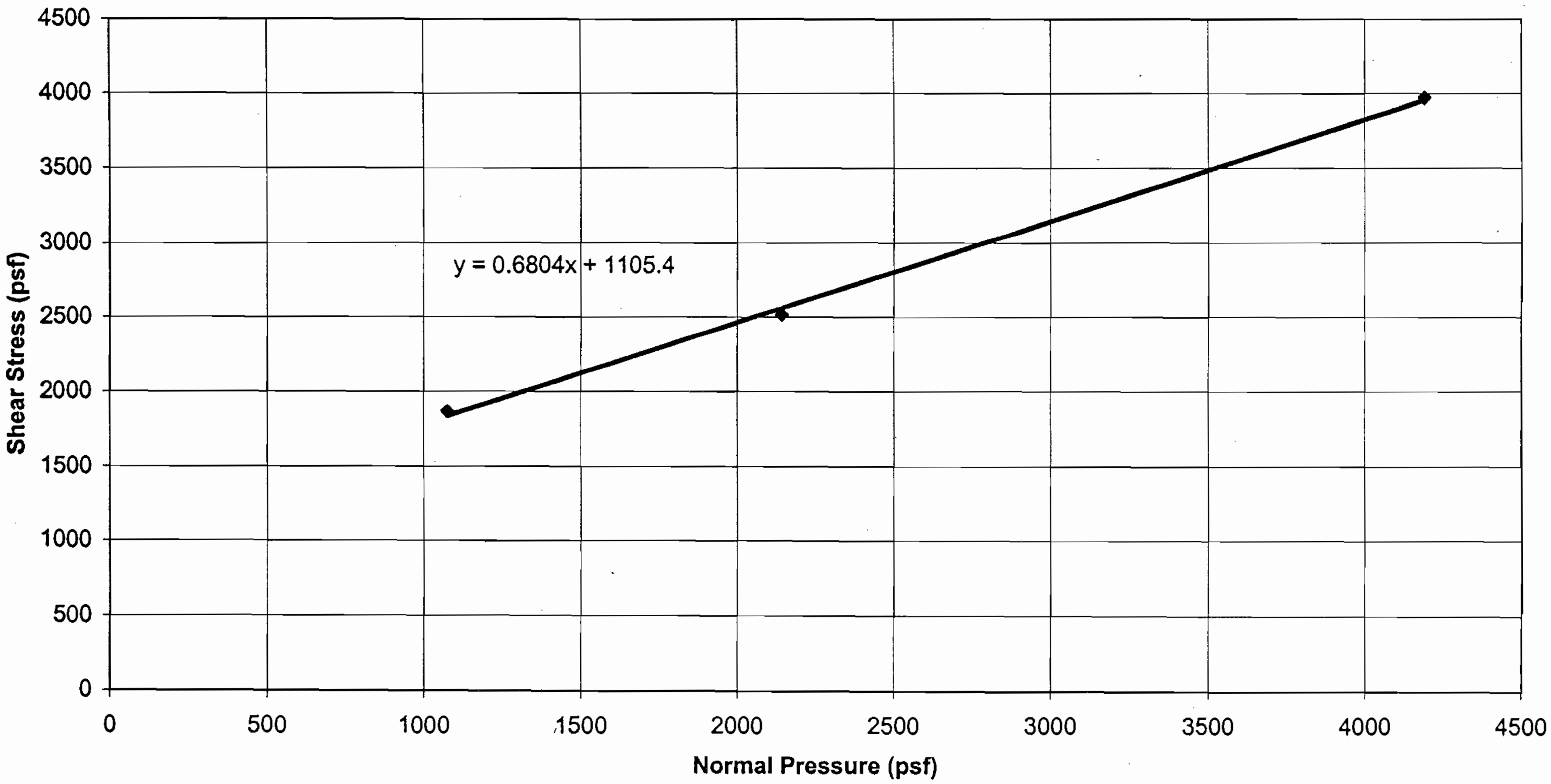
Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1215	1215	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1214	1215	105	33.14	4.588	0.005	1040	0.005	0.000	0.3
2.42	10	0.4	1214	1215	134	42.29	4.575	0.010	1331	0.010	0.000	0.5
2.42	20	0.8	1219	1215	177	55.86	4.551	0.020	1767	0.020	0.000	1.1
2.42	30	1.2	1229	1215	214	67.54	4.527	0.030	2148	0.030	0.001	1.6
2.42	40	1.7	1239	1215	255	80.48	4.503	0.040	2574	0.040	0.002	2.1
2.42	50	2.1	1249	1215	305	96.26	4.479	0.050	3095	0.050	0.003	2.6
2.42	60	2.5	1259	1215	345	108.88	4.454	0.060	3520	0.060	0.004	3.2
2.42	70	2.9	1265	1215	372	117.40	4.430	0.070	3816	0.070	0.005	3.7
2.42	80	3.3	1267	1215	382	120.56	4.406	0.080	3940	0.080	0.005	4.2
2.42	90	3.7	1269	1215	410	129.40	4.382	0.090	4252	0.090	0.005	4.7
2.42	100	4.1	1270	1215	416	131.29	4.358	0.100	4338	0.100	0.006	5.3
2.42	110	4.5	1270	1215	408	128.76	4.333	0.110	4279	0.110	0.006	5.8
2.42	120	5.0	1270	1215	394	124.35	4.309	0.120	4155	0.120	0.006	6.3
2.42	130	5.4	1270	1215	372	117.40	4.285	0.130	3945	0.130	0.006	6.8
2.42	140	5.8	1270	1215	360	113.62	4.261	0.140	3840	0.140	0.006	7.4
2.42	150	6.2	1270	1215	346	109.20	4.237	0.150	3711	0.150	0.006	7.9
2.42	160	6.6	1270	1215	332	104.78	4.213	0.160	3582	0.160	0.006	8.4
2.42	170	7.0	1270	1215	321	101.31	4.189	0.170	3483	0.170	0.006	8.9
2.42	180	7.4	1269	1215	309	97.52	4.164	0.180	3372	0.180	0.005	9.5
2.42	190	7.9	1265	1215	296	93.42	4.140	0.190	3249	0.190	0.005	10.0
2.42	200	8.3	1260	1215	287	90.58	4.116	0.200	3169	0.200	0.005	10.5
2.42	210	8.7	1253	1215	272	85.84	4.092	0.210	3021	0.210	0.004	11.0
2.42	220	9.1	1244	1215	267	84.27	4.068	0.220	2983	0.220	0.003	11.6
2.42	230	9.5	1237	1215	262	82.69	4.044	0.230	2944	0.230	0.002	12.1
2.42	240	9.9	1230	1215	255	80.48	4.020	0.240	2883	0.240	0.002	12.6
2.42	250	10.3	1221	1215	252	79.53	3.996	0.250	2866	0.250	0.001	13.1
2.42	260	10.7	1211	1215	247	77.95	3.972	0.260	2826	0.260	0.000	13.7
2.42	270	11.2	1202	1215	245	77.32	3.948	0.270	2821	0.270	-0.001	14.2
2.42	280	11.6	1194	1215	243	76.69	3.924	0.280	2815	0.280	-0.002	14.7
2.42	290	12.0	1186	1215	242	76.38	3.899	0.290	2820	0.290	-0.003	15.2
2.42	300	12.4	1178	1215	240	75.74	3.875	0.300	2814	0.300	-0.004	15.7
2.42	310	12.8	1170	1215	240	75.74	3.851	0.310	2832	0.310	-0.005	16.3
2.42	320	13.2	1162	1215	240	75.74	3.827	0.320	2850	0.320	-0.005	16.8
2.42	330	13.6	1155	1215	238	75.11	3.803	0.330	2844	0.330	-0.006	17.3
2.42	340	14.0	1147	1215	237	74.80	3.780	0.340	2850	0.340	-0.007	17.8
2.42	350	14.5	1140	1215	237	74.80	3.756	0.350	2868	0.350	-0.008	18.4
2.42	360	14.9	1132	1215	234	73.85	3.732	0.360	2850	0.360	-0.008	18.9
2.42	370	15.3	1127	1215	234	73.85	3.708	0.370	2868	0.370	-0.009	19.4
2.42	380	15.7	1120	1215	232	73.22	3.684	0.380	2862	0.380	-0.010	19.9
2.42	390	16.1	1111	1215	231	72.90	3.660	0.390	2868	0.390	-0.010	20.4
2.42	400	16.5	1105	1215	229	72.27	3.636	0.400	2862	0.400	-0.011	20.9

DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1100	1215	230	72.59	3.612	0.410	2894	0.410	-0.012	21.5
2.42	420	17.4	1095	1215	229	72.27	3.588	0.420	2900	0.420	-0.012	22.0
2.42	430	17.8	1090	1215	230	72.59	3.565	0.430	2932	0.430	-0.013	22.5
2.42	440	18.2	1081	1215	230	72.59	3.541	0.440	2952	0.440	-0.013	23.0
2.42	450	18.6	1074	1215	230	72.59	3.517	0.450	2972	0.450	-0.014	23.5
2.42	460	19.0	1068	1215	233	73.53	3.493	0.460	3031	0.460	-0.015	24.1
2.42	470	19.4	1064	1215	235	74.17	3.469	0.470	3078	0.470	-0.015	24.6
2.42	480	19.8	1060	1215	239	75.43	3.446	0.480	3152	0.480	-0.016	25.1
2.42	490	20.2	1054	1215	246	77.64	3.422	0.490	3267	0.490	-0.016	25.6
2.42	500	20.7	1048	1215	241	76.06	3.398	0.500	3223	0.500	-0.017	26.1

DIRECT SHEAR RESULTS (Peak)

Vasco Road, Project No. 001860
Boring B-5, Depth 62.0'
Friction Angle 34.2 deg., Cohesion 1105 psf
Test Type CU, Inundation Time 24 hrs.
Sample Type Weathered Dk Yel Brn w/Yel Brn and Lt Gry Sandy Claystone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

Project: Vasco Rd.

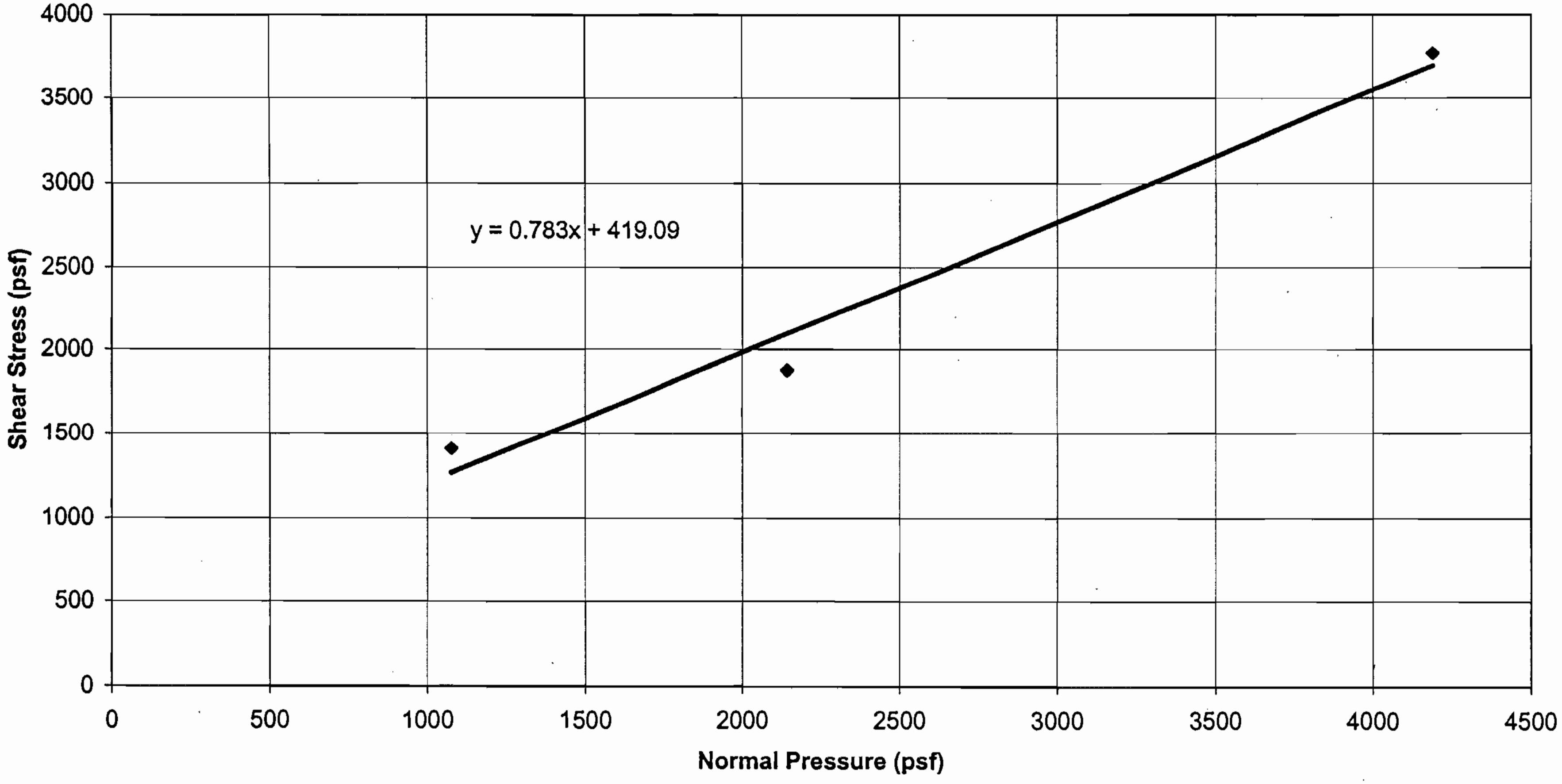
Project #: 1860

Boring: B-5 Depth: 62.0'

1075	1867
2142	2517
4190	3972

DIRECT SHEAR RESULTS (Peak)

Vasco Road, Project No. 001860
Boring B-5, Depth 44.5'
Friction Angle 38.1 deg., Cohesion 419 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Gry and Yel Brn Sandy Siltstone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

Project: Vasco Rd.

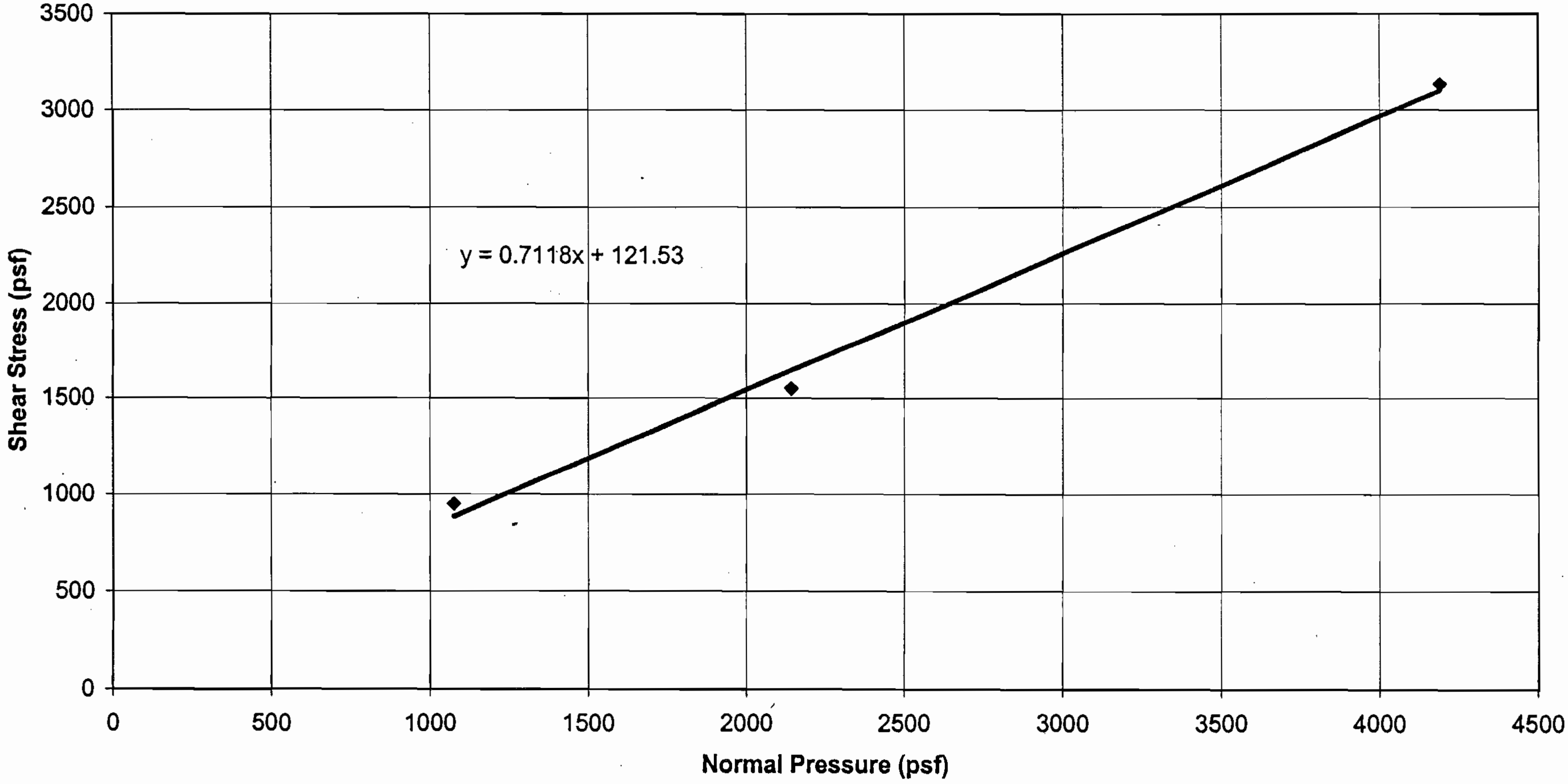
Project #: 1860

Boring: B-5 Depth: 44.5

1075	1405
2142	1877
4190	3775

DIRECT SHEAR RESULTS (Ultimate)

Vasco Road, Project No. 001860
Boring B-5, Depth 44.5'
Friction Angle 35.4 deg., Cohesion 122 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Gry and Yel Brn Sandy Siltstone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

Project: Vasco Rd.

Project #: 1860

Boring: B-5 Depth: 44.5

1075	950
2142	1550
4190	3137

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001		Init. Sample Height (in.):	1.20
BORING:	B-5	DEPTH:	44.5'		Init.Horz. Dial Reading:	0
SAMPLE #:	1				Vertical Pressure (psf):	1075

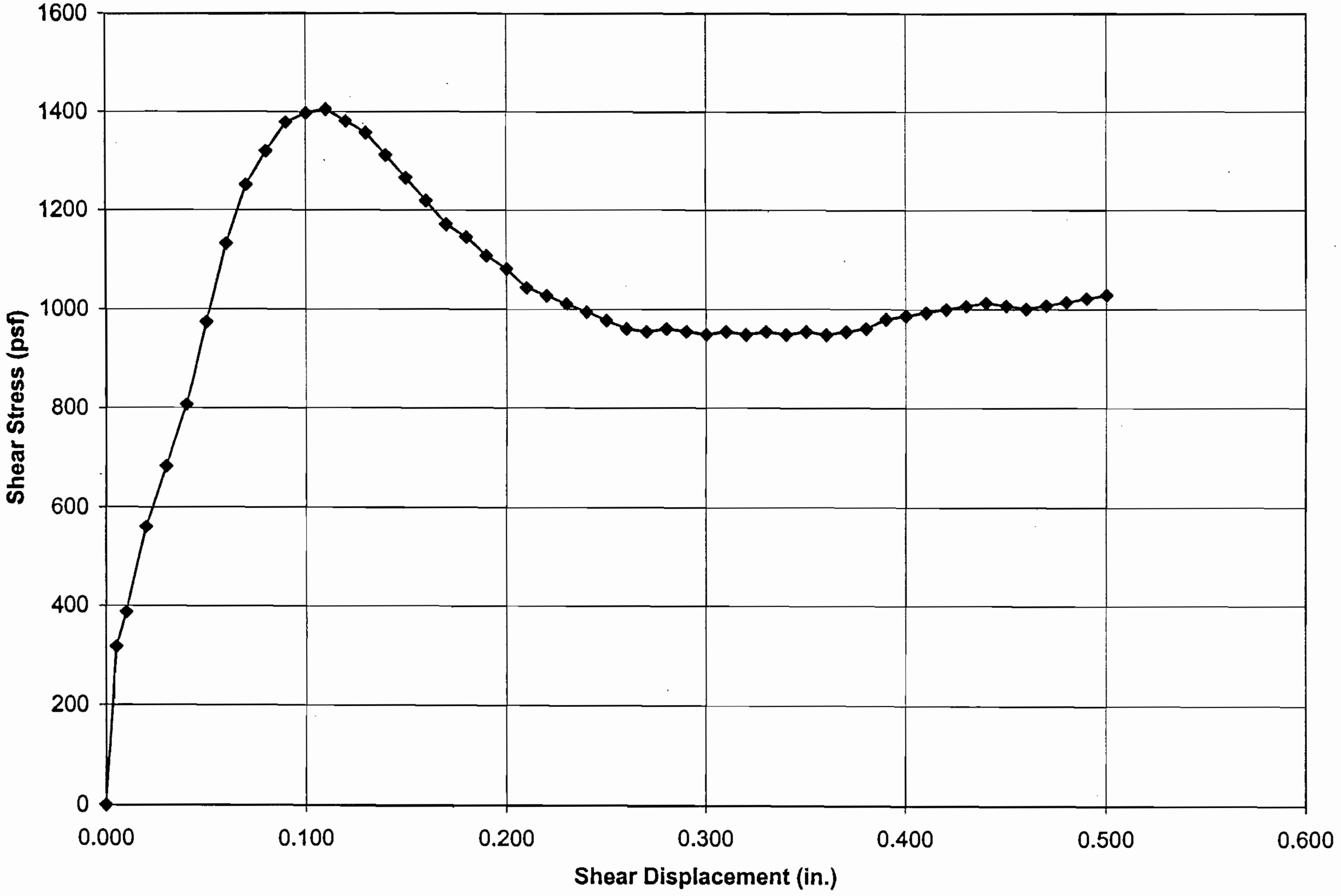
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1434	1434	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1427	1434	32	10.10	4.588	0.005	317	0.005	-0.001	0.3
2.42	10	0.4	1425	1434	39	12.31	4.575	0.010	387	0.010	-0.001	0.5
2.42	20	0.8	1425	1434	56	17.67	4.551	0.020	559	0.020	-0.001	1.1
2.42	30	1.2	1428	1434	68	21.46	4.527	0.030	683	0.030	-0.001	1.6
2.42	40	1.7	1439	1434	80	25.25	4.503	0.040	807	0.040	0.001	2.1
2.42	50	2.1	1449	1434	96	30.30	4.479	0.050	974	0.050	0.002	2.6
2.42	60	2.5	1459	1434	111	35.03	4.454	0.060	1132	0.060	0.003	3.2
2.42	70	2.9	1468	1434	122	38.50	4.430	0.070	1252	0.070	0.003	3.7
2.42	80	3.3	1479	1434	128	40.40	4.406	0.080	1320	0.080	0.005	4.2
2.42	90	3.7	1495	1434	133	41.97	4.382	0.090	1379	0.090	0.006	4.7
2.42	100	4.1	1509	1434	134	42.29	4.358	0.100	1397	0.100	0.008	5.3
2.42	110	4.5	1525	1434	134	42.29	4.333	0.110	1405	0.110	0.009	5.8
2.42	120	5.0	1538	1434	131	41.34	4.309	0.120	1382	0.120	0.010	6.3
2.42	130	5.4	1548	1434	128	40.40	4.285	0.130	1358	0.130	0.011	6.8
2.42	140	5.8	1552	1434	123	38.82	4.261	0.140	1312	0.140	0.012	7.4
2.42	150	6.2	1555	1434	118	37.24	4.237	0.150	1266	0.150	0.012	7.9
2.42	160	6.6	1556	1434	113	35.66	4.213	0.160	1219	0.160	0.012	8.4
2.42	170	7.0	1559	1434	108	34.08	4.189	0.170	1172	0.170	0.013	8.9
2.42	180	7.4	1565	1434	105	33.14	4.164	0.180	1146	0.180	0.013	9.5
2.42	190	7.9	1566	1434	101	31.88	4.140	0.190	1109	0.190	0.013	10.0
2.42	200	8.3	1566	1434	98	30.93	4.116	0.200	1082	0.200	0.013	10.5
2.42	210	8.7	1566	1434	94	29.67	4.092	0.210	1044	0.210	0.013	11.0
2.42	220	9.1	1566	1434	92	29.04	4.068	0.220	1028	0.220	0.013	11.6
2.42	230	9.5	1566	1434	90	28.40	4.044	0.230	1011	0.230	0.013	12.1
2.42	240	9.9	1566	1434	88	27.77	4.020	0.240	995	0.240	0.013	12.6
2.42	250	10.3	1566	1434	86	27.14	3.996	0.250	978	0.250	0.013	13.1
2.42	260	10.7	1566	1434	84	26.51	3.972	0.260	961	0.260	0.013	13.7
2.42	270	11.2	1566	1434	83	26.19	3.948	0.270	956	0.270	0.013	14.2
2.42	280	11.6	1565	1434	83	26.19	3.924	0.280	961	0.280	0.013	14.7
2.42	290	12.0	1564	1434	82	25.88	3.899	0.290	956	0.290	0.013	15.2
2.42	300	12.4	1562	1434	81	25.56	3.875	0.300	950	0.300	0.013	15.7
2.42	310	12.8	1559	1434	81	25.56	3.851	0.310	956	0.310	0.013	16.3
2.42	320	13.2	1556	1434	80	25.25	3.827	0.320	950	0.320	0.012	16.8
2.42	330	13.6	1552	1434	80	25.25	3.803	0.330	956	0.330	0.012	17.3
2.42	340	14.0	1551	1434	79	24.93	3.780	0.340	950	0.340	0.012	17.8
2.42	350	14.5	1549	1434	79	24.93	3.756	0.350	956	0.350	0.012	18.4
2.42	360	14.9	1544	1434	78	24.62	3.732	0.360	950	0.360	0.011	18.9
2.42	370	15.3	1541	1434	78	24.62	3.708	0.370	956	0.370	0.011	19.4
2.42	380	15.7	1538	1434	78	24.62	3.684	0.380	962	0.380	0.010	19.9
2.42	390	16.1	1535	1434	79	24.93	3.660	0.390	981	0.390	0.010	20.4
2.42	400	16.5	1534	1434	79	24.93	3.636	0.400	987	0.400	0.010	20.9

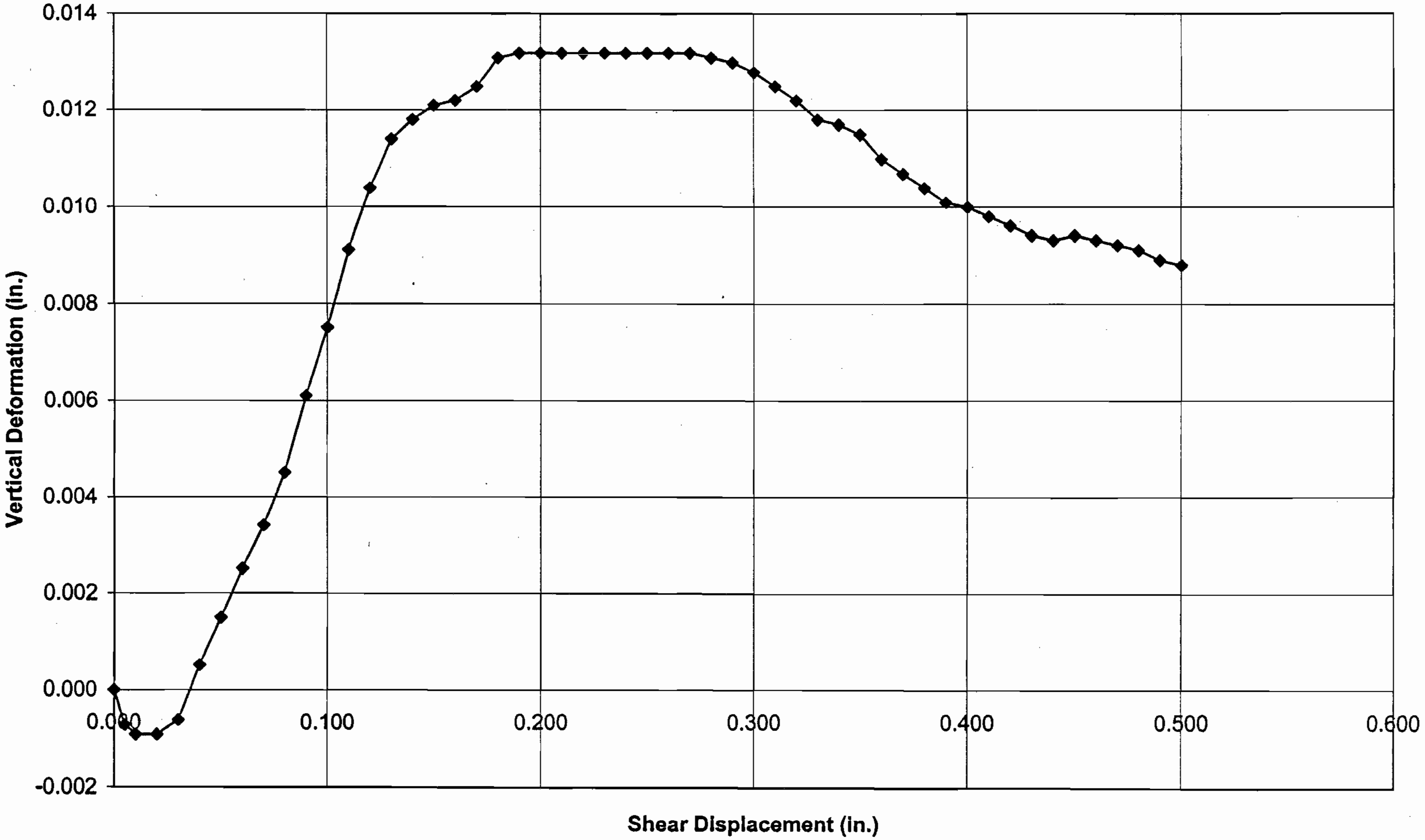
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1532	1434	79	24.93	3.612	0.410	994	0.410	0.010	21.5
2.42	420	17.4	1530	1434	79	24.93	3.588	0.420	1001	0.420	0.010	22.0
2.42	430	17.8	1528	1434	79	24.93	3.565	0.430	1007	0.430	0.009	22.5
2.42	440	18.2	1527	1434	79	24.93	3.541	0.440	1014	0.440	0.009	23.0
2.42	450	18.6	1528	1434	78	24.62	3.517	0.450	1008	0.450	0.009	23.5
2.42	460	19.0	1527	1434	77	24.30	3.493	0.460	1002	0.460	0.009	24.1
2.42	470	19.4	1526	1434	77	24.30	3.469	0.470	1009	0.470	0.009	24.6
2.42	480	19.8	1525	1434	77	24.30	3.446	0.480	1016	0.480	0.009	25.1
2.42	490	20.2	1523	1434	77	24.30	3.422	0.490	1023	0.490	0.009	25.6
2.42	500	20.7	1522	1434	77	24.30	3.398	0.500	1030	0.500	0.009	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #1, Vertical Load 1075 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #1, Vertical Load 1075 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001		Init. Sample Height (in.):	1.20
BORING:	B-5	DEPTH:	44.5'		Init.Horz. Dial Reading:	0
SAMPLE #:	2				Vertical Pressure (psf):	2142

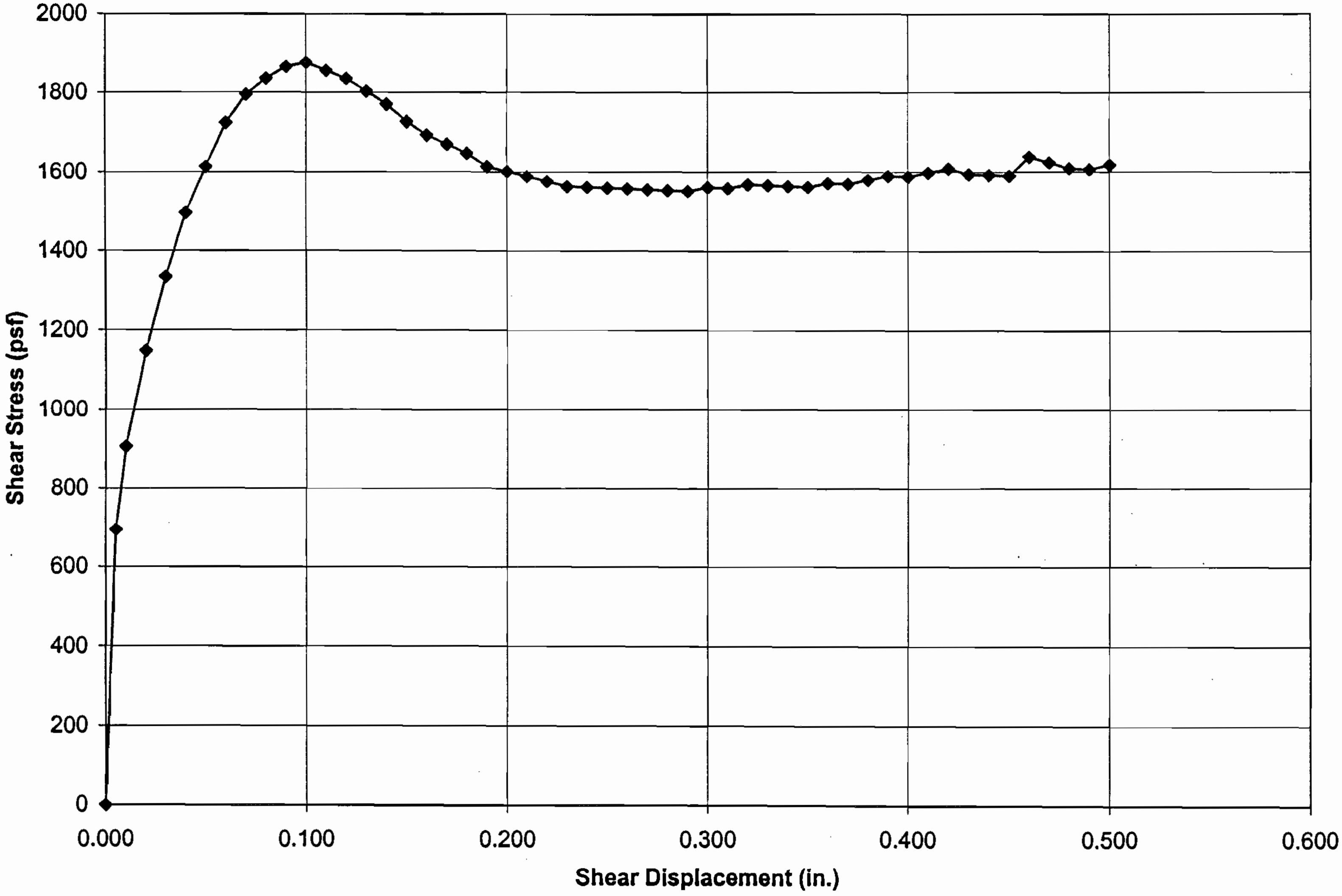
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1426	1426	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1426	1425	70	22.09	4.588	0.005	693	0.005	0.000	0.3
2.42	10	0.4	1426	1425	91	28.72	4.575	0.010	904	0.010	0.000	0.5
2.42	20	0.8	1426	1424	115	36.29	4.551	0.020	1148	0.020	0.000	1.1
2.42	30	1.2	1426	1425	133	41.97	4.527	0.030	1335	0.030	0.000	1.6
2.42	40	1.7	1426	1429	148	46.71	4.503	0.040	1494	0.040	0.000	2.1
2.42	50	2.1	1426	1435	159	50.18	4.479	0.050	1613	0.050	-0.001	2.6
2.42	60	2.5	1426	1439	169	53.34	4.454	0.060	1724	0.060	-0.001	3.2
2.42	70	2.9	1426	1439	175	55.23	4.430	0.070	1795	0.070	-0.001	3.7
2.42	80	3.3	1426	1439	178	56.18	4.406	0.080	1836	0.080	-0.001	4.2
2.42	90	3.7	1426	1439	180	56.81	4.382	0.090	1867	0.090	-0.001	4.7
2.42	100	4.1	1426	1439	180	56.81	4.358	0.100	1877	0.100	-0.001	5.3
2.42	110	4.5	1426	1434	177	55.86	4.333	0.110	1856	0.110	-0.001	5.8
2.42	120	5.0	1426	1427	174	54.91	4.309	0.120	1835	0.120	0.000	6.3
2.42	130	5.4	1426	1421	170	53.65	4.285	0.130	1803	0.130	0.001	6.8
2.42	140	5.8	1426	1415	166	52.39	4.261	0.140	1771	0.140	0.001	7.4
2.42	150	6.2	1426	1408	161	50.81	4.237	0.150	1727	0.150	0.002	7.9
2.42	160	6.6	1426	1402	157	49.55	4.213	0.160	1694	0.160	0.002	8.4
2.42	170	7.0	1426	1398	154	48.60	4.189	0.170	1671	0.170	0.003	8.9
2.42	180	7.4	1426	1392	151	47.66	4.164	0.180	1648	0.180	0.003	9.5
2.42	190	7.9	1426	1388	147	46.39	4.140	0.190	1614	0.190	0.004	10.0
2.42	200	8.3	1426	1381	145	45.76	4.116	0.200	1601	0.200	0.005	10.5
2.42	210	8.7	1426	1375	143	45.13	4.092	0.210	1588	0.210	0.005	11.0
2.42	220	9.1	1426	1370	141	44.50	4.068	0.220	1575	0.220	0.006	11.6
2.42	230	9.5	1426	1366	139	43.87	4.044	0.230	1562	0.230	0.006	12.1
2.42	240	9.9	1426	1360	138	43.55	4.020	0.240	1560	0.240	0.007	12.6
2.42	250	10.3	1426	1354	137	43.24	3.996	0.250	1558	0.250	0.007	13.1
2.42	260	10.7	1426	1351	136	42.92	3.972	0.260	1556	0.260	0.008	13.7
2.42	270	11.2	1426	1346	135	42.61	3.948	0.270	1554	0.270	0.008	14.2
2.42	280	11.6	1426	1340	134	42.29	3.924	0.280	1552	0.280	0.009	14.7
2.42	290	12.0	1426	1335	133	41.97	3.899	0.290	1550	0.290	0.009	15.2
2.42	300	12.4	1426	1327	133	41.97	3.875	0.300	1560	0.300	0.010	15.7
2.42	310	12.8	1426	1323	132	41.66	3.851	0.310	1558	0.310	0.010	16.3
2.42	320	13.2	1426	1318	132	41.66	3.827	0.320	1567	0.320	0.011	16.8
2.42	330	13.6	1426	1313	131	41.34	3.803	0.330	1565	0.330	0.011	17.3
2.42	340	14.0	1426	1308	130	41.03	3.780	0.340	1563	0.340	0.012	17.8
2.42	350	14.5	1426	1303	129	40.71	3.756	0.350	1561	0.350	0.012	18.4
2.42	360	14.9	1426	1300	129	40.71	3.732	0.360	1571	0.360	0.013	18.9
2.42	370	15.3	1426	1295	128	40.40	3.708	0.370	1569	0.370	0.013	19.4
2.42	380	15.7	1426	1292	128	40.40	3.684	0.380	1579	0.380	0.013	19.9
2.42	390	16.1	1426	1285	128	40.40	3.660	0.390	1589	0.390	0.014	20.4
2.42	400	16.5	1426	1280	127	40.08	3.636	0.400	1587	0.400	0.015	20.9

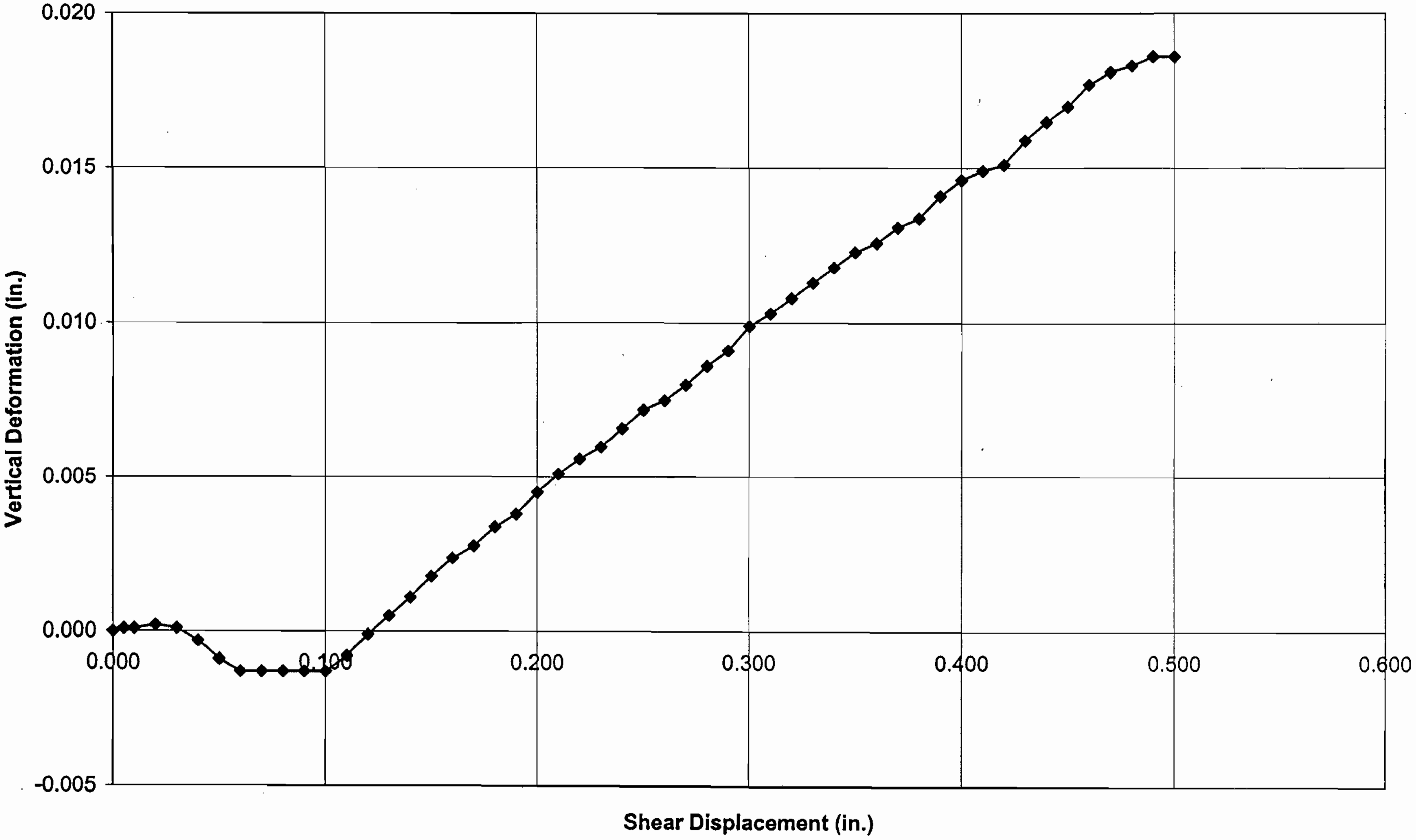
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1426	1277	127	40.08	3.612	0.410	1598	0.410	0.015	21.5
2.42	420	17.4	1426	1275	127	40.08	3.588	0.420	1608	0.420	0.015	22.0
2.42	430	17.8	1426	1267	125	39.45	3.565	0.430	1594	0.430	0.016	22.5
2.42	440	18.2	1426	1261	124	39.13	3.541	0.440	1592	0.440	0.017	23.0
2.42	450	18.6	1426	1256	123	38.82	3.517	0.450	1589	0.450	0.017	23.5
2.42	460	19.0	1426	1249	126	39.77	3.493	0.460	1639	0.460	0.018	24.1
2.42	470	19.4	1426	1245	124	39.13	3.469	0.470	1624	0.470	0.018	24.6
2.42	480	19.8	1426	1243	122	38.50	3.446	0.480	1609	0.480	0.018	25.1
2.42	490	20.2	1426	1240	121	38.19	3.422	0.490	1607	0.490	0.019	25.6
2.42	500	20.7	1426	1240	121	38.19	3.398	0.500	1618	0.500	0.019	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #2, Vertical Load 2142 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #2, Vertical Load 2142 psf



Sheet1

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-5	DEPTH:	44.5'	Init.Horz. Dial Reading:	0
SAMPLE #:	3			Vertical Pressure (psf):	4190

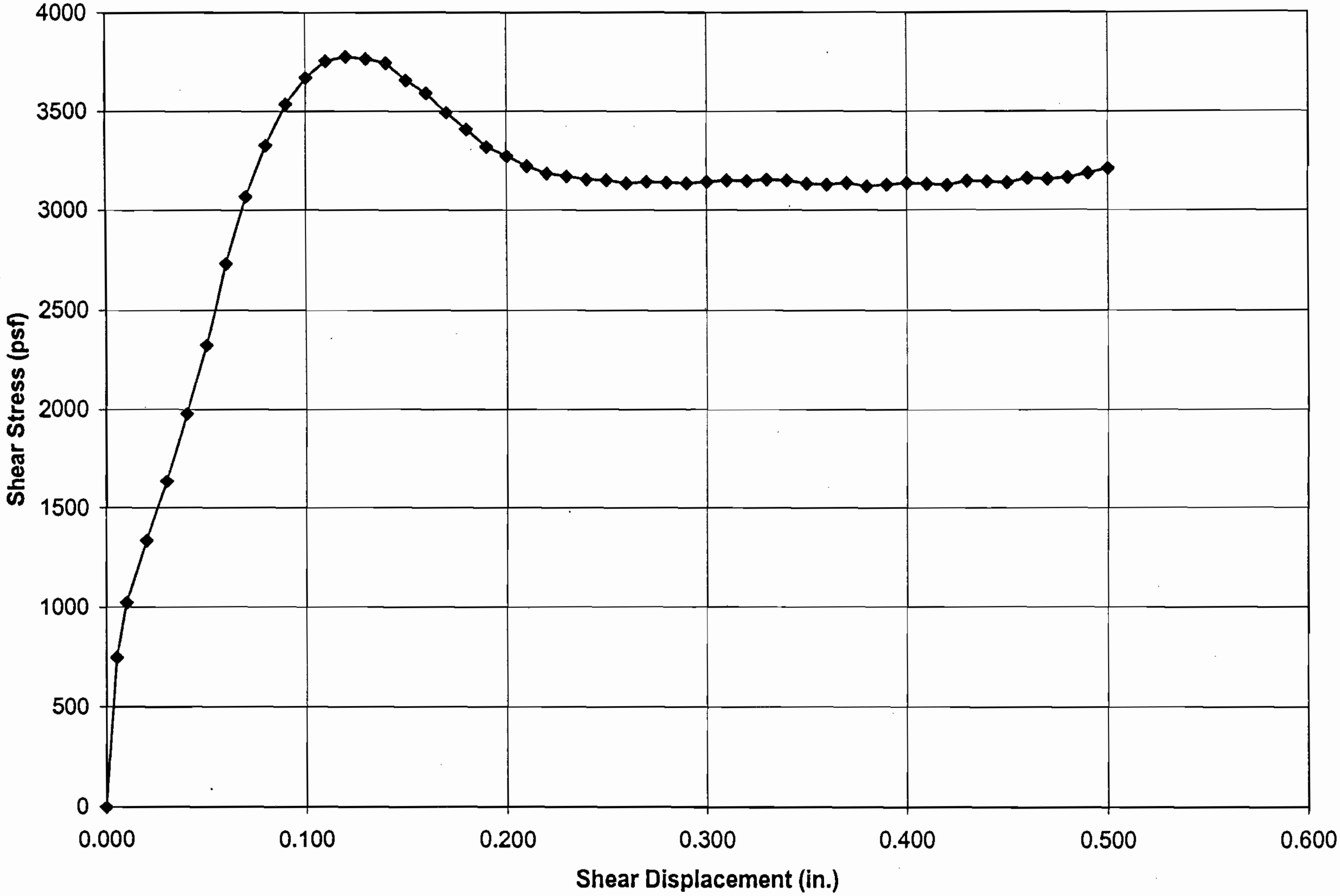
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1482	1482	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1482	1482	76	23.99	4.588	0.005	753	0.005	0.000	0.3
2.42	10	0.4	1482	1481	103	32.51	4.575	0.010	1023	0.010	0.000	0.5
2.42	20	0.8	1482	1477	134	42.29	4.551	0.020	1338	0.020	0.001	1.1
2.42	30	1.2	1482	1471	163	51.44	4.527	0.030	1636	0.030	0.001	1.6
2.42	40	1.7	1482	1468	196	61.86	4.503	0.040	1978	0.040	0.001	2.1
2.42	50	2.1	1482	1465	229	72.27	4.479	0.050	2324	0.050	0.002	2.6
2.42	60	2.5	1482	1463	267	84.27	4.454	0.060	2724	0.060	0.002	3.2
2.42	70	2.9	1482	1462	299	94.36	4.430	0.070	3067	0.070	0.002	3.7
2.42	80	3.3	1482	1462	322	101.62	4.406	0.080	3321	0.080	0.002	4.2
2.42	90	3.7	1482	1462	341	107.62	4.382	0.090	3537	0.090	0.002	4.7
2.42	100	4.1	1482	1464	352	111.09	4.358	0.100	3671	0.100	0.002	5.3
2.42	110	4.5	1482	1468	358	112.98	4.333	0.110	3754	0.110	0.001	5.8
2.42	120	5.0	1482	1469	358	112.98	4.309	0.120	3775	0.120	0.001	6.3
2.42	130	5.4	1482	1475	355	112.04	4.285	0.130	3765	0.130	0.001	6.8
2.42	140	5.8	1482	1478	351	110.78	4.261	0.140	3744	0.140	0.000	7.4
2.42	150	6.2	1482	1479	341	107.62	4.237	0.150	3658	0.150	0.000	7.9
2.42	160	6.6	1482	1479	333	105.09	4.213	0.160	3592	0.160	0.000	8.4
2.42	170	7.0	1482	1479	322	101.62	4.189	0.170	3494	0.170	0.000	8.9
2.42	180	7.4	1482	1479	312	98.47	4.164	0.180	3405	0.180	0.000	9.5
2.42	190	7.9	1482	1479	302	95.31	4.140	0.190	3315	0.190	0.000	10.0
2.42	200	8.3	1482	1475	296	93.42	4.116	0.200	3268	0.200	0.001	10.5
2.42	210	8.7	1482	1469	290	91.52	4.092	0.210	3221	0.210	0.001	11.0
2.42	220	9.1	1482	1460	285	89.95	4.068	0.220	3184	0.220	0.002	11.6
2.42	230	9.5	1482	1453	282	89.00	4.044	0.230	3169	0.230	0.003	12.1
2.42	240	9.9	1482	1447	279	88.05	4.020	0.240	3154	0.240	0.004	12.6
2.42	250	10.3	1482	1442	277	87.42	3.996	0.250	3151	0.250	0.004	13.1
2.42	260	10.7	1482	1436	274	86.47	3.972	0.260	3135	0.260	0.005	13.7
2.42	270	11.2	1482	1431	273	86.16	3.948	0.270	3143	0.270	0.005	14.2
2.42	280	11.6	1482	1425	271	85.53	3.924	0.280	3139	0.280	0.006	14.7
2.42	290	12.0	1482	1421	269	84.90	3.899	0.290	3135	0.290	0.006	15.2
2.42	300	12.4	1482	1416	268	84.58	3.875	0.300	3143	0.300	0.007	15.7
2.42	310	12.8	1482	1409	267	84.27	3.851	0.310	3151	0.310	0.007	16.3
2.42	320	13.2	1482	1406	265	83.63	3.827	0.320	3147	0.320	0.008	16.8
2.42	330	13.6	1482	1401	264	83.32	3.803	0.330	3154	0.330	0.008	17.3
2.42	340	14.0	1482	1396	262	82.69	3.780	0.340	3150	0.340	0.009	17.8
2.42	350	14.5	1482	1391	259	81.74	3.756	0.350	3134	0.350	0.009	18.4
2.42	360	14.9	1482	1388	257	81.11	3.732	0.360	3130	0.360	0.009	18.9
2.42	370	15.3	1482	1385	256	80.79	3.708	0.370	3138	0.370	0.010	19.4
2.42	380	15.7	1482	1380	253	79.85	3.684	0.380	3121	0.380	0.010	19.9
2.42	390	16.1	1482	1375	252	79.53	3.660	0.390	3129	0.390	0.011	20.4
2.42	400	16.5	1482	1371	251	79.22	3.636	0.400	3137	0.400	0.011	20.9

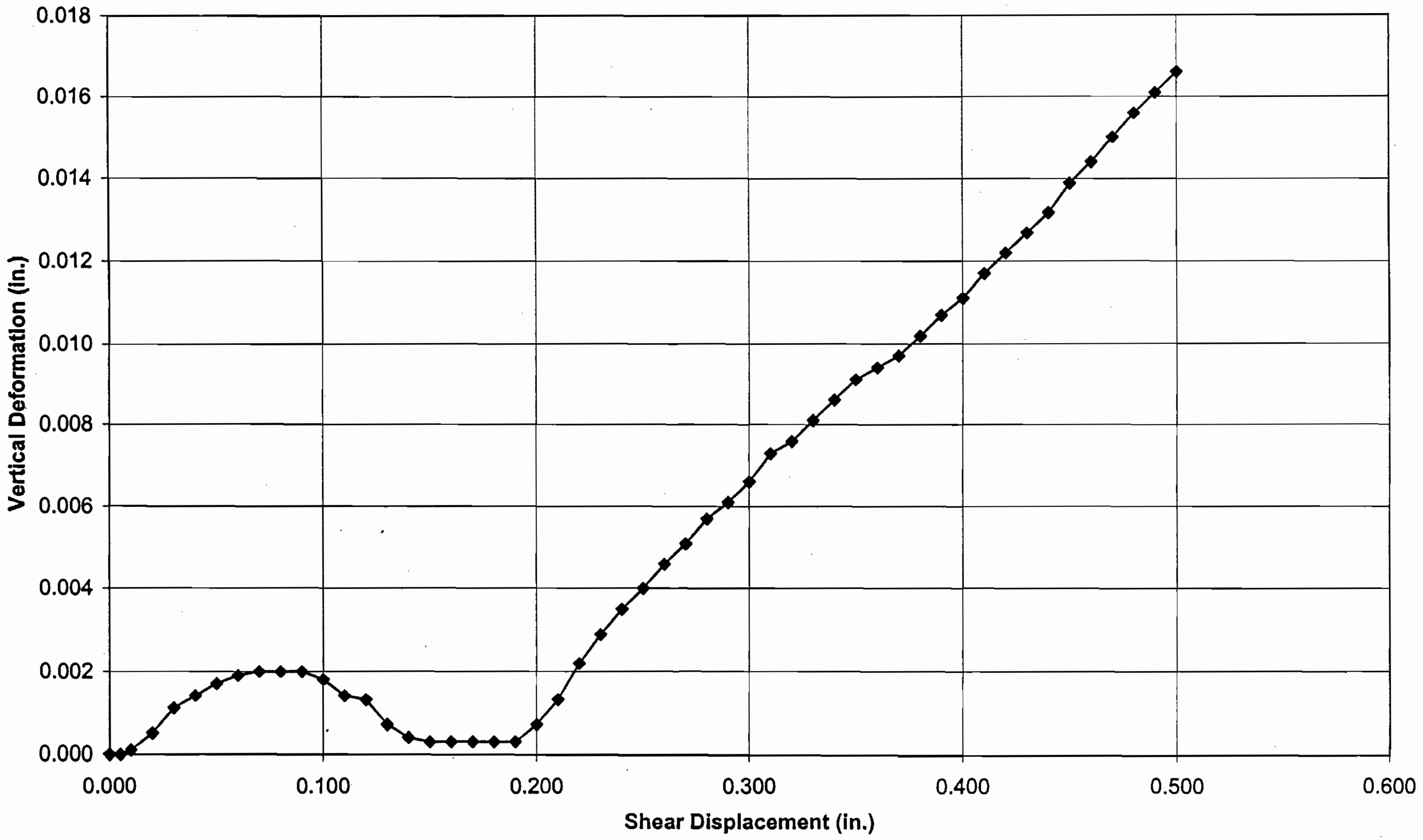
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1482	1365	249	78.58	3.612	0.410	3133	0.410	0.012	21.5
2.42	420	17.4	1482	1360	247	77.95	3.588	0.420	3128	0.420	0.012	22.0
2.42	430	17.8	1482	1355	247	77.95	3.565	0.430	3149	0.430	0.013	22.5
2.42	440	18.2	1482	1350	245	77.32	3.541	0.440	3145	0.440	0.013	23.0
2.42	450	18.6	1482	1343	243	76.69	3.517	0.450	3140	0.450	0.014	23.5
2.42	460	19.0	1482	1338	243	76.69	3.493	0.460	3161	0.460	0.014	24.1
2.42	470	19.4	1482	1332	241	76.06	3.469	0.470	3157	0.470	0.015	24.6
2.42	480	19.8	1482	1326	240	75.74	3.446	0.480	3165	0.480	0.016	25.1
2.42	490	20.2	1482	1321	240	75.74	3.422	0.490	3187	0.490	0.016	25.6
2.42	500	20.7	1482	1316	240	75.74	3.398	0.500	3210	0.500	0.017	26.1

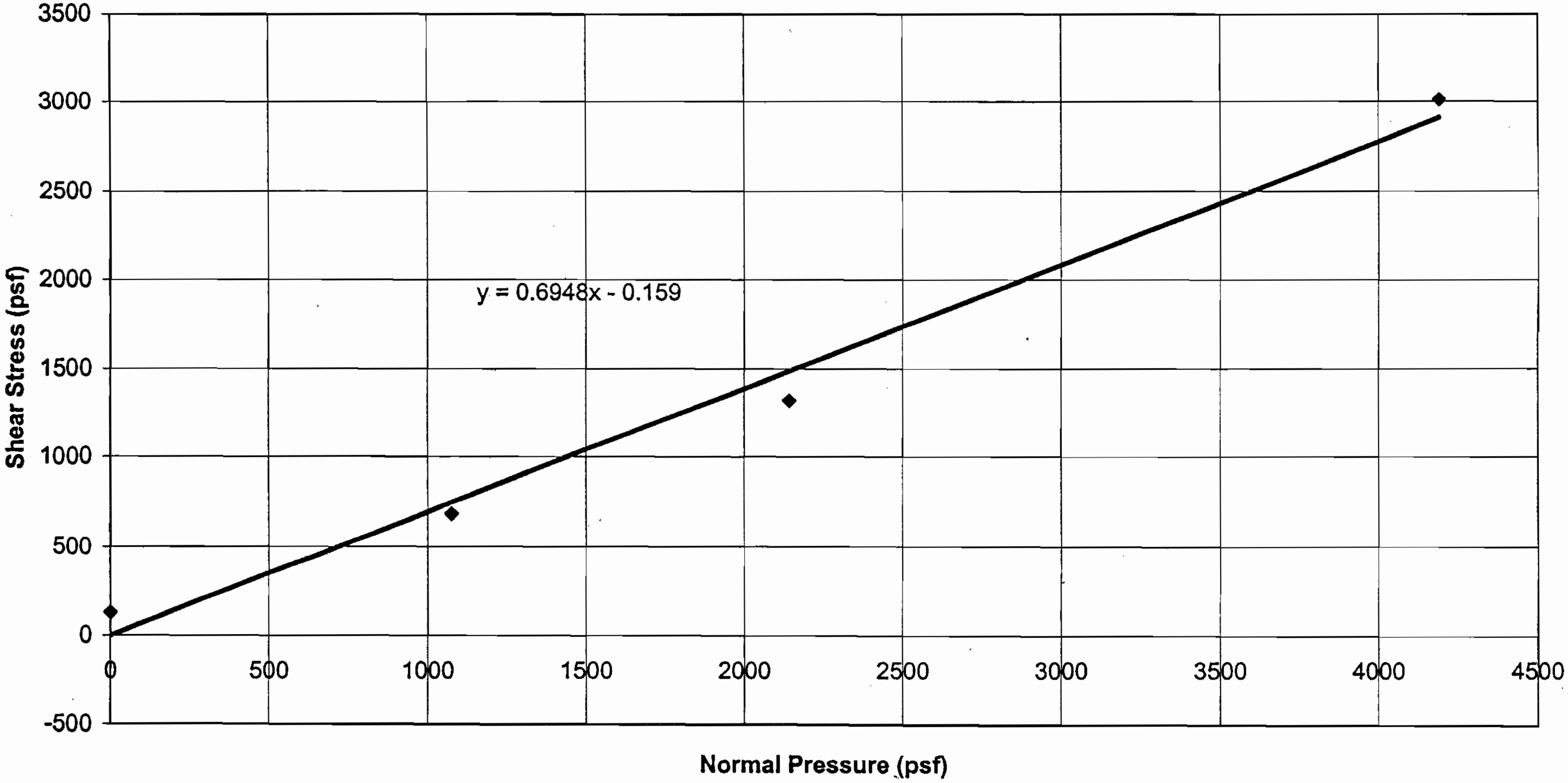
Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #3, Vertical Load 4190 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 44.5', Sample #3, Vertical Load 4190 psf



DIRECT SHEAR RESULTS (Ultimate)
Vasco Road, Project No. 001860
Boring B-5, Depth 62.0'
Friction Angle 34.8 deg., Cohesion 0 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Dk Yel Brn w/Yel Brn and Lt Gry Sandy Claystone



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Ultimate)

Project: Vasco Rd.

Project #: 1860

Boring: B-5 Depth: 62.0'

0	127
1075	685
2142	1322
4190	3012

Sheet1
DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.42
PROJ. # :	001860	TEST DATE:	01/07/2001	Init. Sample Height (in.):	1.20
BORING:	B-5	DEPTH:	62.0'	Init.Horz. Dial Reading:	0
SAMPLE #:	1			Vertical Pressure (psf):	1075

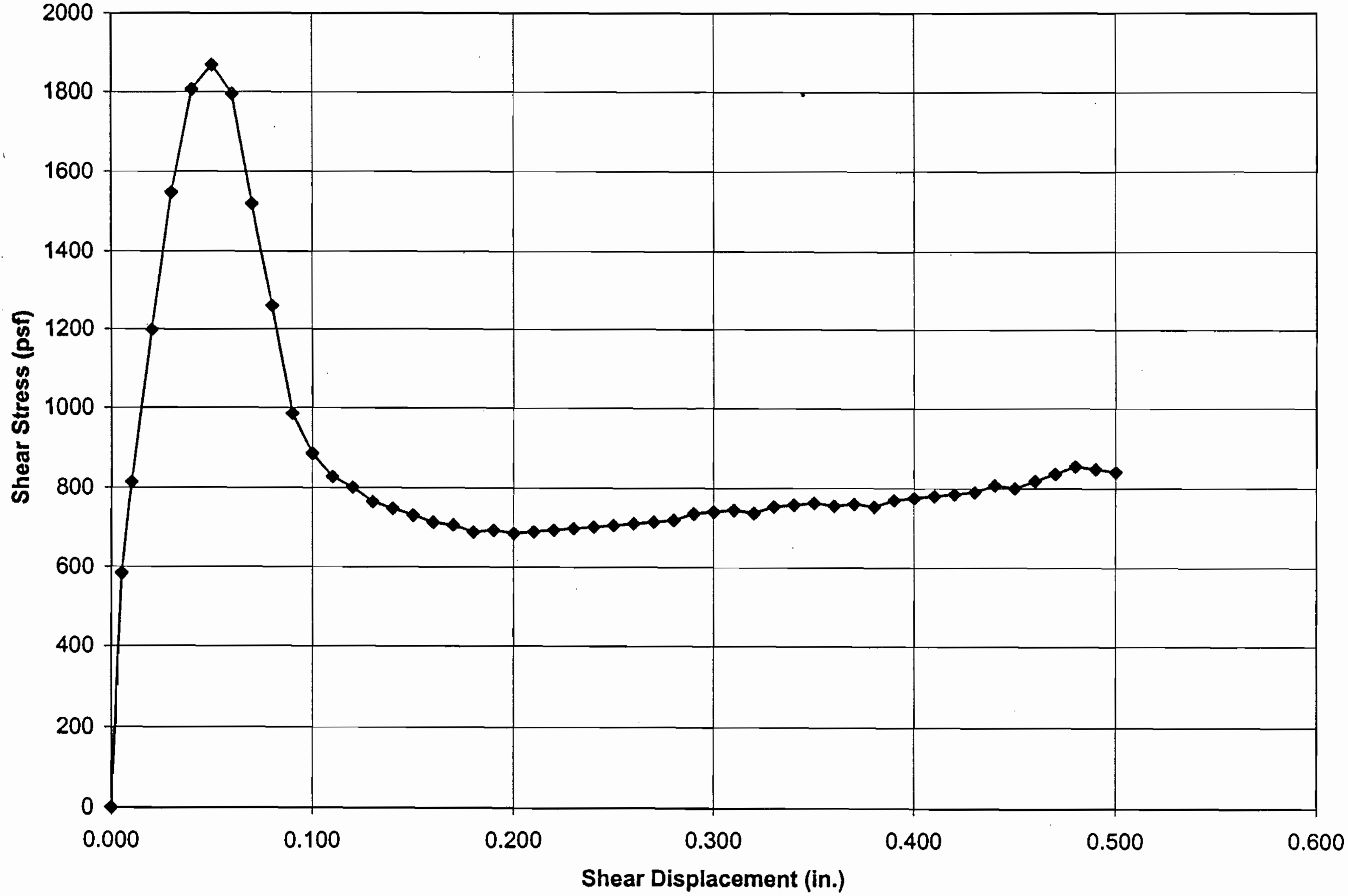
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	2319	2319	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	2319	2319	59	18.62	4.588	0.005	584	0.005	0.000	0.3
2.42	10	0.4	2319	2323	82	25.88	4.575	0.010	814	0.010	0.000	0.5
2.42	20	0.8	2319	2347	120	37.87	4.551	0.020	1198	0.020	-0.003	1.1
2.42	30	1.2	2319	2369	154	48.60	4.527	0.030	1546	0.030	-0.005	1.6
2.42	40	1.7	2319	2399	179	56.49	4.503	0.040	1807	0.040	-0.008	2.1
2.42	50	2.1	2319	2435	184	58.07	4.479	0.050	1867	0.050	-0.012	2.6
2.42	60	2.5	2319	2459	176	55.55	4.454	0.060	1796	0.060	-0.014	3.2
2.42	70	2.9	2319	2487	148	46.71	4.430	0.070	1518	0.070	-0.017	3.7
2.42	80	3.3	2319	2499	122	38.50	4.406	0.080	1258	0.080	-0.018	4.2
2.42	90	3.7	2319	2500	95	29.98	4.382	0.090	985	0.090	-0.018	4.7
2.42	100	4.1	2319	2500	85	26.83	4.358	0.100	886	0.100	-0.018	5.3
2.42	110	4.5	2319	2500	79	24.93	4.333	0.110	828	0.110	-0.018	5.8
2.42	120	5.0	2319	2500	76	23.99	4.309	0.120	802	0.120	-0.018	6.3
2.42	130	5.4	2319	2499	72	22.72	4.285	0.130	764	0.130	-0.018	6.8
2.42	140	5.8	2319	2498	70	22.09	4.261	0.140	747	0.140	-0.018	7.4
2.42	150	6.2	2319	2495	68	21.46	4.237	0.150	729	0.150	-0.018	7.9
2.42	160	6.6	2319	2493	66	20.83	4.213	0.160	712	0.160	-0.017	8.4
2.42	170	7.0	2319	2492	65	20.51	4.189	0.170	705	0.170	-0.017	8.9
2.42	180	7.4	2319	2490	63	19.88	4.164	0.180	688	0.180	-0.017	9.5
2.42	190	7.9	2319	2488	63	19.88	4.140	0.190	692	0.190	-0.017	10.0
2.42	200	8.3	2319	2483	62	19.57	4.116	0.200	685	0.200	-0.016	10.5
2.42	210	8.7	2319	2479	62	19.57	4.092	0.210	689	0.210	-0.016	11.0
2.42	220	9.1	2319	2473	62	19.57	4.068	0.220	693	0.220	-0.015	11.6
2.42	230	9.5	2319	2466	62	19.57	4.044	0.230	697	0.230	-0.015	12.1
2.42	240	9.9	2319	2461	62	19.57	4.020	0.240	701	0.240	-0.014	12.6
2.42	250	10.3	2319	2454	62	19.57	3.996	0.250	705	0.250	-0.014	13.1
2.42	260	10.7	2319	2452	62	19.57	3.972	0.260	709	0.260	-0.013	13.7
2.42	270	11.2	2319	2446	62	19.57	3.948	0.270	714	0.270	-0.013	14.2
2.42	280	11.6	2319	2440	62	19.57	3.924	0.280	718	0.280	-0.012	14.7
2.42	290	12.0	2319	2435	63	19.88	3.899	0.290	734	0.290	-0.012	15.2
2.42	300	12.4	2319	2432	63	19.88	3.875	0.300	739	0.300	-0.011	15.7
2.42	310	12.8	2319	2423	63	19.88	3.851	0.310	743	0.310	-0.010	16.3
2.42	320	13.2	2319	2415	62	19.57	3.827	0.320	736	0.320	-0.010	16.8
2.42	330	13.6	2319	2407	63	19.88	3.803	0.330	753	0.330	-0.009	17.3
2.42	340	14.0	2319	2402	63	19.88	3.780	0.340	758	0.340	-0.008	17.8
2.42	350	14.5	2319	2399	63	19.88	3.756	0.350	762	0.350	-0.008	18.4
2.42	360	14.9	2319	2398	62	19.57	3.732	0.360	755	0.360	-0.008	18.9
2.42	370	15.3	2319	2397	62	19.57	3.708	0.370	760	0.370	-0.008	19.4
2.42	380	15.7	2319	2394	61	19.25	3.684	0.380	753	0.380	-0.008	19.9
2.42	390	16.1	2319	2390	62	19.57	3.660	0.390	770	0.390	-0.007	20.4
2.42	400	16.5	2319	2386	62	19.57	3.636	0.400	775	0.400	-0.007	20.9

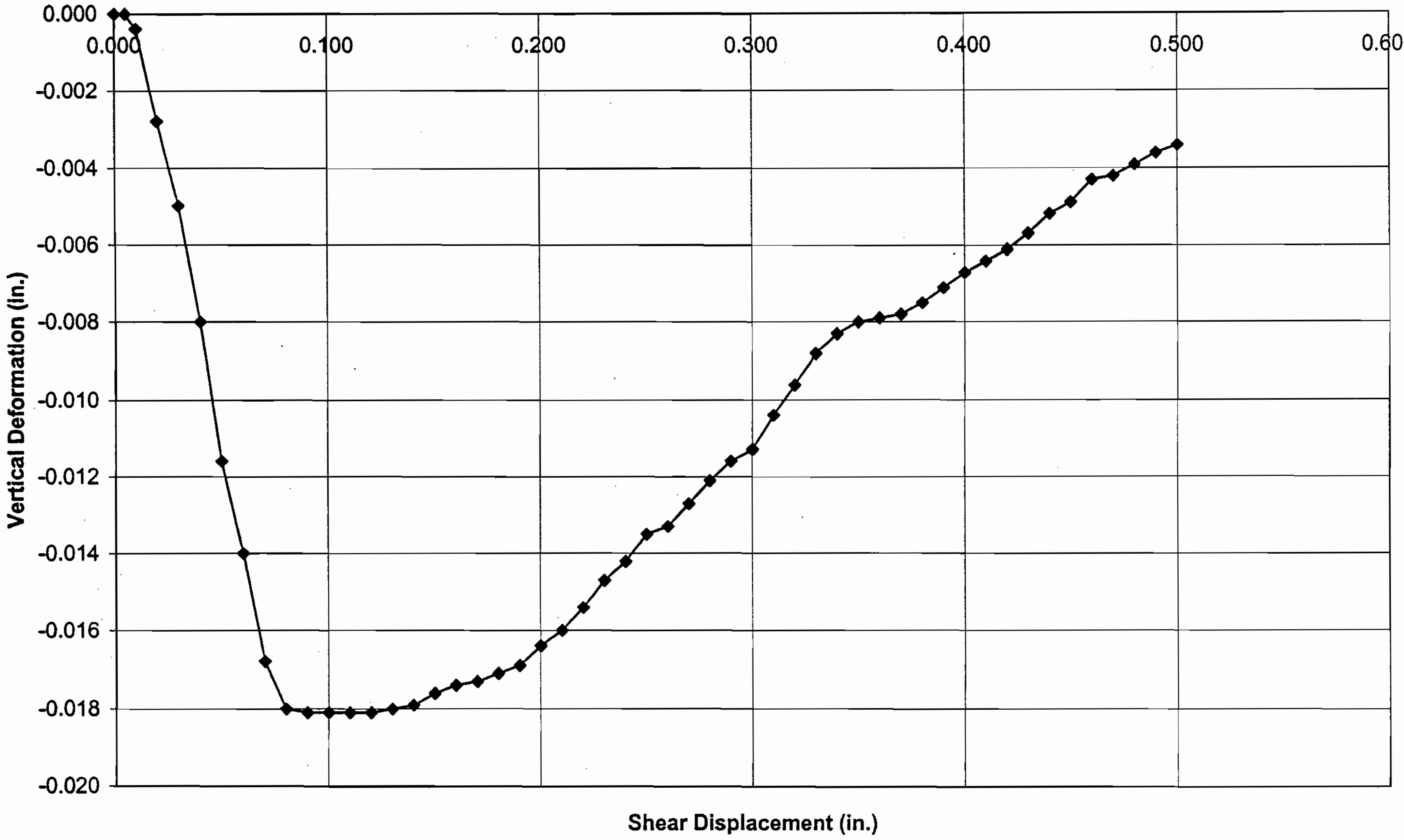
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	2319	2383	62	19.57	3.612	0.410	780	0.410	-0.006	21.5
2.42	420	17.4	2319	2380	62	19.57	3.588	0.420	785	0.420	-0.006	22.0
2.42	430	17.8	2319	2376	62	19.57	3.565	0.430	790	0.430	-0.006	22.5
2.42	440	18.2	2319	2371	63	19.88	3.541	0.440	809	0.440	-0.005	23.0
2.42	450	18.6	2319	2368	62	19.57	3.517	0.450	801	0.450	-0.005	23.5
2.42	460	19.0	2319	2362	63	19.88	3.493	0.460	820	0.460	-0.004	24.1
2.42	470	19.4	2319	2361	64	20.20	3.469	0.470	838	0.470	-0.004	24.6
2.42	480	19.8	2319	2358	65	20.51	3.446	0.480	857	0.480	-0.004	25.1
2.42	490	20.2	2319	2355	64	20.20	3.422	0.490	850	0.490	-0.004	25.6
2.42	500	20.7	2319	2353	63	19.88	3.398	0.500	843	0.500	-0.003	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #1, Vertical Load 1075 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #1, Vertical Load 1075 psf



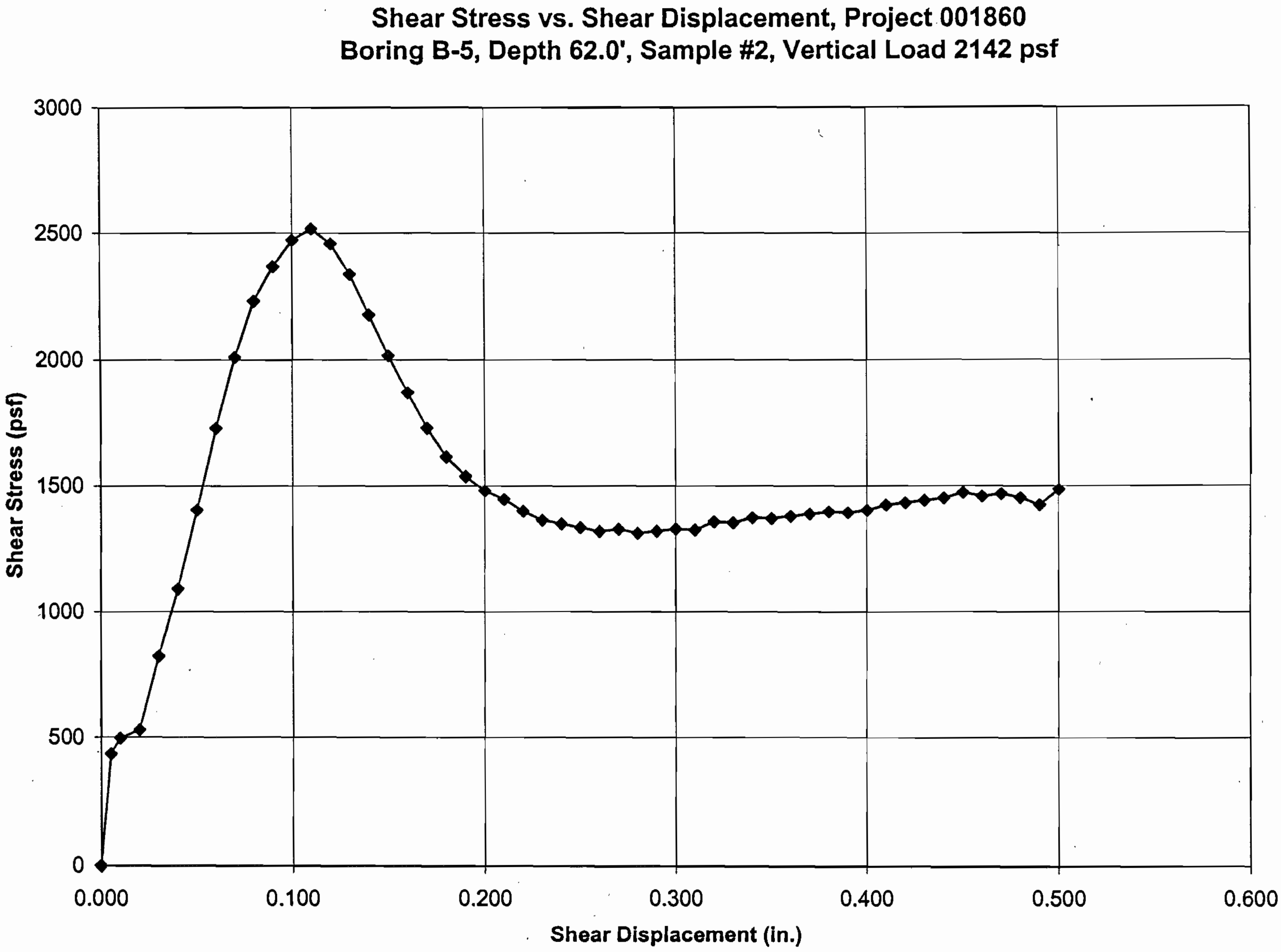
DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology						Ring Constant = 0.3156 lb/div		
PROJECT:	Vasco Road						Sample Diameter (in.):	2.42	
PROJ. # :	001860		TEST DATE:	01/07/2001			Init. Sample Height (in.):	1.20	
BORING:	B-5		DEPTH:	62.0'			Init.Horz. Dial Reading:	0	
SAMPLE #:	2						Vertical Pressure (psf):	2142	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.								

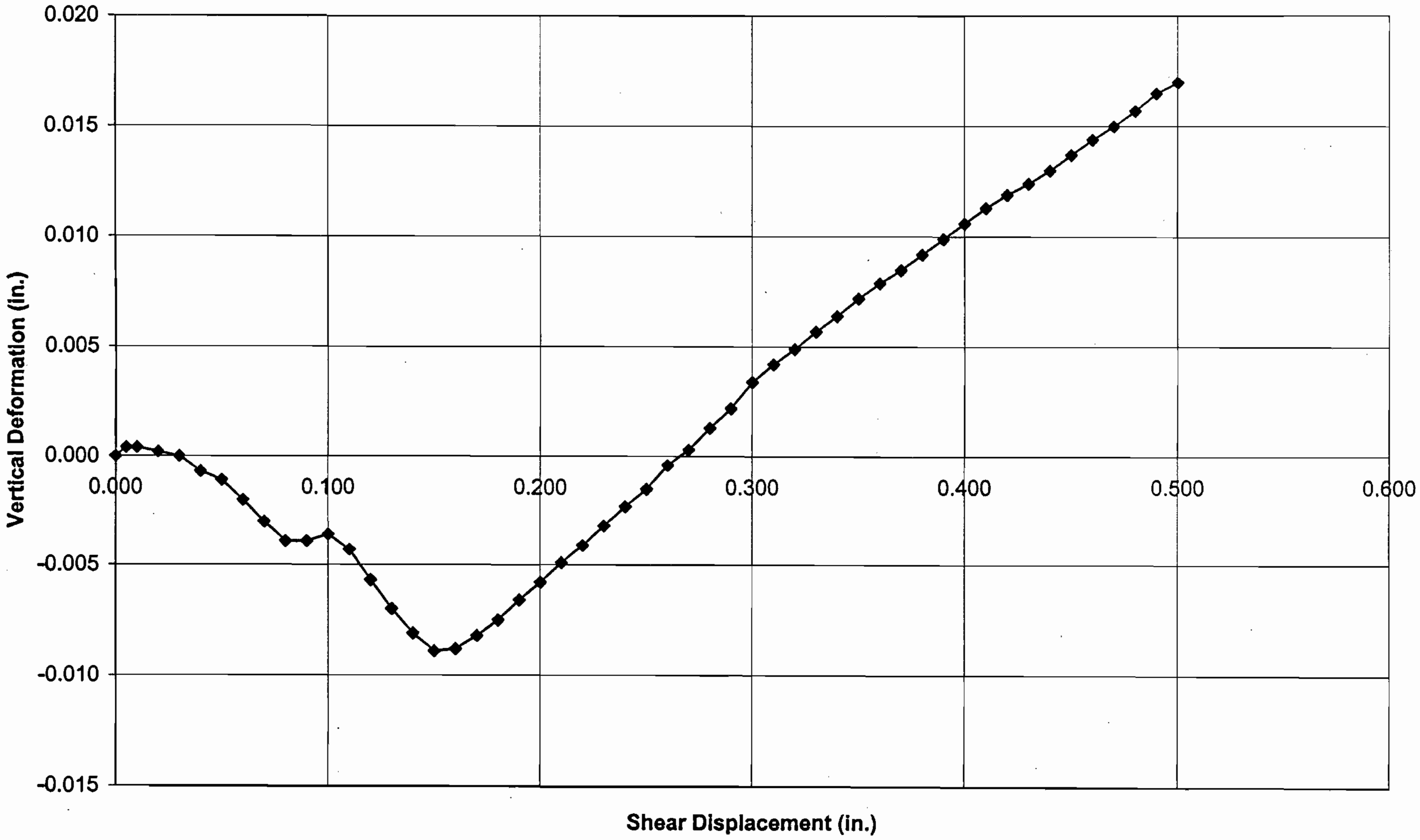
Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.42	0	0.0	1759	1759	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1759	1755	44	13.89	4.588	0.005	436	0.005	0.000	0.3
2.42	10	0.4	1759	1755	50	15.78	4.575	0.010	497	0.010	0.000	0.5
2.42	20	0.8	1759	1757	53	16.73	4.551	0.020	529	0.020	0.000	1.1
2.42	30	1.2	1759	1759	82	25.88	4.527	0.030	823	0.030	0.000	1.6
2.42	40	1.7	1759	1766	108	34.08	4.503	0.040	1090	0.040	-0.001	2.1
2.42	50	2.1	1759	1770	138	43.55	4.479	0.050	1400	0.050	-0.001	2.6
2.42	60	2.5	1759	1779	169	53.34	4.454	0.060	1724	0.060	-0.002	3.2
2.42	70	2.9	1759	1789	196	61.86	4.430	0.070	2011	0.070	-0.003	3.7
2.42	80	3.3	1759	1798	216	68.17	4.406	0.080	2228	0.080	-0.004	4.2
2.42	90	3.7	1759	1798	228	71.96	4.382	0.090	2365	0.090	-0.004	4.7
2.42	100	4.1	1759	1795	237	74.80	4.358	0.100	2472	0.100	-0.004	5.3
2.42	110	4.5	1759	1802	240	75.74	4.333	0.110	2517	0.110	-0.004	5.8
2.42	120	5.0	1759	1816	233	73.53	4.309	0.120	2457	0.120	-0.006	6.3
2.42	130	5.4	1759	1829	220	69.43	4.285	0.130	2333	0.130	-0.007	6.8
2.42	140	5.8	1759	1840	204	64.38	4.261	0.140	2176	0.140	-0.008	7.4
2.42	150	6.2	1759	1848	188	59.33	4.237	0.150	2017	0.150	-0.009	7.9
2.42	160	6.6	1759	1847	173	54.60	4.213	0.160	1866	0.160	-0.009	8.4
2.42	170	7.0	1759	1841	159	50.18	4.189	0.170	1725	0.170	-0.008	8.9
2.42	180	7.4	1759	1834	148	46.71	4.164	0.180	1615	0.180	-0.008	9.5
2.42	190	7.9	1759	1825	140	44.18	4.140	0.190	1537	0.190	-0.007	10.0
2.42	200	8.3	1759	1817	134	42.29	4.116	0.200	1479	0.200	-0.006	10.5
2.42	210	8.7	1759	1808	130	41.03	4.092	0.210	1444	0.210	-0.005	11.0
2.42	220	9.1	1759	1800	125	39.45	4.068	0.220	1396	0.220	-0.004	11.6
2.42	230	9.5	1759	1791	121	38.19	4.044	0.230	1360	0.230	-0.003	12.1
2.42	240	9.9	1759	1782	119	37.56	4.020	0.240	1345	0.240	-0.002	12.6
2.42	250	10.3	1759	1774	117	36.93	3.996	0.250	1331	0.250	-0.002	13.1
2.42	260	10.7	1759	1763	115	36.29	3.972	0.260	1316	0.260	0.000	13.7
2.42	270	11.2	1759	1756	115	36.29	3.948	0.270	1324	0.270	0.000	14.2
2.42	280	11.6	1759	1746	113	35.66	3.924	0.280	1309	0.280	0.001	14.7
2.42	290	12.0	1759	1737	113	35.66	3.899	0.290	1317	0.290	0.002	15.2
2.42	300	12.4	1759	1725	113	35.66	3.875	0.300	1325	0.300	0.003	15.7
2.42	310	12.8	1759	1717	112	35.35	3.851	0.310	1322	0.310	0.004	16.3
2.42	320	13.2	1759	1710	114	35.98	3.827	0.320	1354	0.320	0.005	16.8
2.42	330	13.6	1759	1702	113	35.66	3.803	0.330	1350	0.330	0.006	17.3
2.42	340	14.0	1759	1695	114	35.98	3.780	0.340	1371	0.340	0.006	17.8
2.42	350	14.5	1759	1687	113	35.66	3.756	0.350	1367	0.350	0.007	18.4
2.42	360	14.9	1759	1680	113	35.66	3.732	0.360	1376	0.360	0.008	18.9
2.42	370	15.3	1759	1674	113	35.66	3.708	0.370	1385	0.370	0.009	19.4
2.42	380	15.7	1759	1667	113	35.66	3.684	0.380	1394	0.380	0.009	19.9
2.42	390	16.1	1759	1660	112	35.35	3.660	0.390	1391	0.390	0.010	20.4
2.42	400	16.5	1759	1653	112	35.35	3.636	0.400	1400	0.400	0.011	20.9

DIRECT SHEAR
DATA SHEET

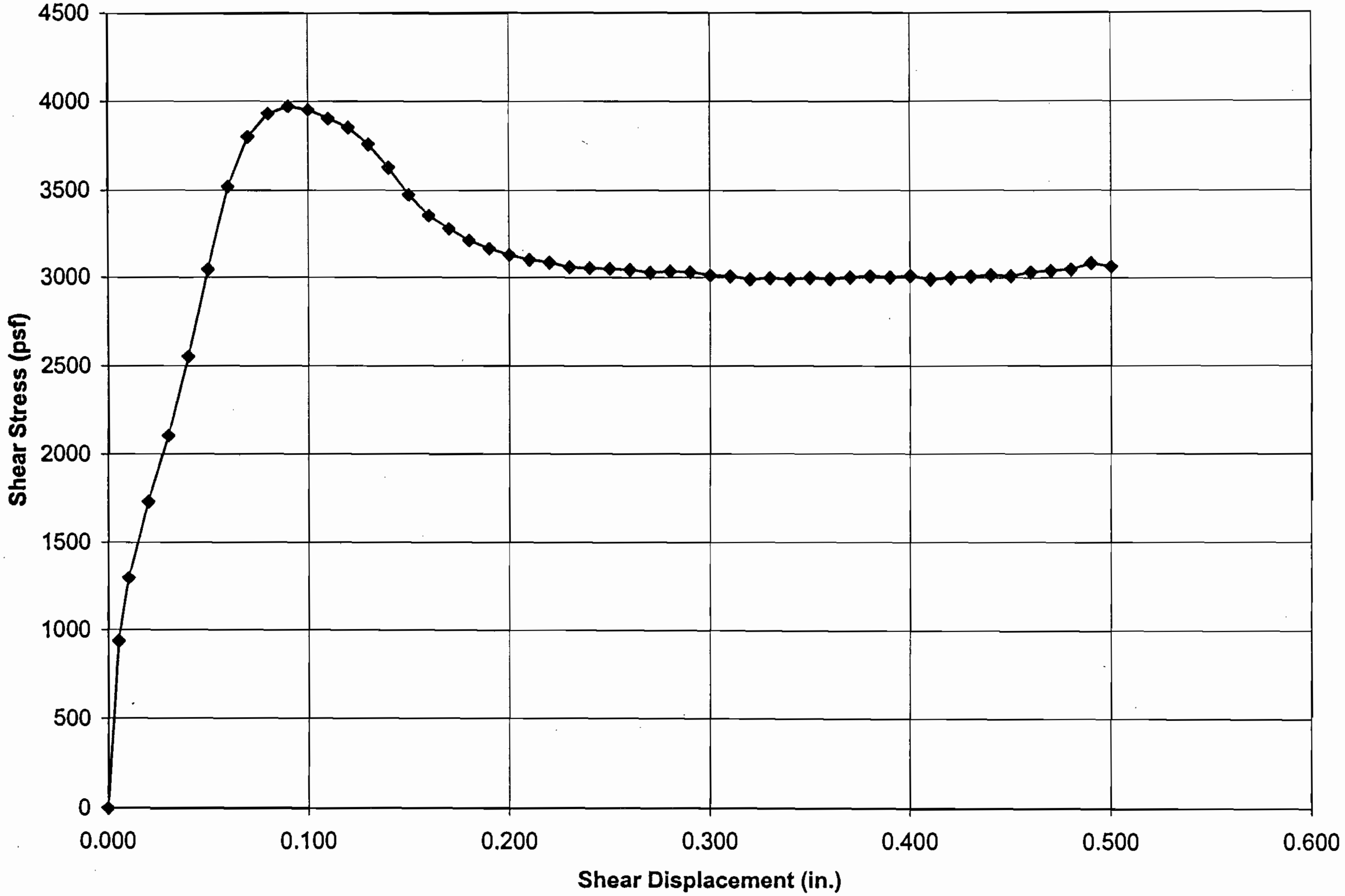
Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1759	1646	113	35.66	3.612	0.410	1422	0.410	0.011	21.5
2.42	420	17.4	1759	1640	113	35.66	3.588	0.420	1431	0.420	0.012	22.0
2.42	430	17.8	1759	1635	113	35.66	3.565	0.430	1441	0.430	0.012	22.5
2.42	440	18.2	1759	1629	113	35.66	3.541	0.440	1450	0.440	0.013	23.0
2.42	450	18.6	1759	1622	114	35.98	3.517	0.450	1473	0.450	0.014	23.5
2.42	460	19.0	1759	1615	112	35.35	3.493	0.460	1457	0.460	0.014	24.1
2.42	470	19.4	1759	1609	112	35.35	3.469	0.470	1467	0.470	0.015	24.6
2.42	480	19.8	1759	1602	110	34.72	3.446	0.480	1451	0.480	0.016	25.1
2.42	490	20.2	1759	1594	107	33.77	3.422	0.490	1421	0.490	0.017	25.6
2.42	500	20.7	1759	1589	111	35.03	3.398	0.500	1484	0.500	0.017	26.1


Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #2, Vertical Load 2142 psf
Shear Stress (psf)
3000
2500
2000
1500
1000
500
0
0.000
0.100
0.200
0.300
0.400
0.500
0.600
Shear Displacement (in.)

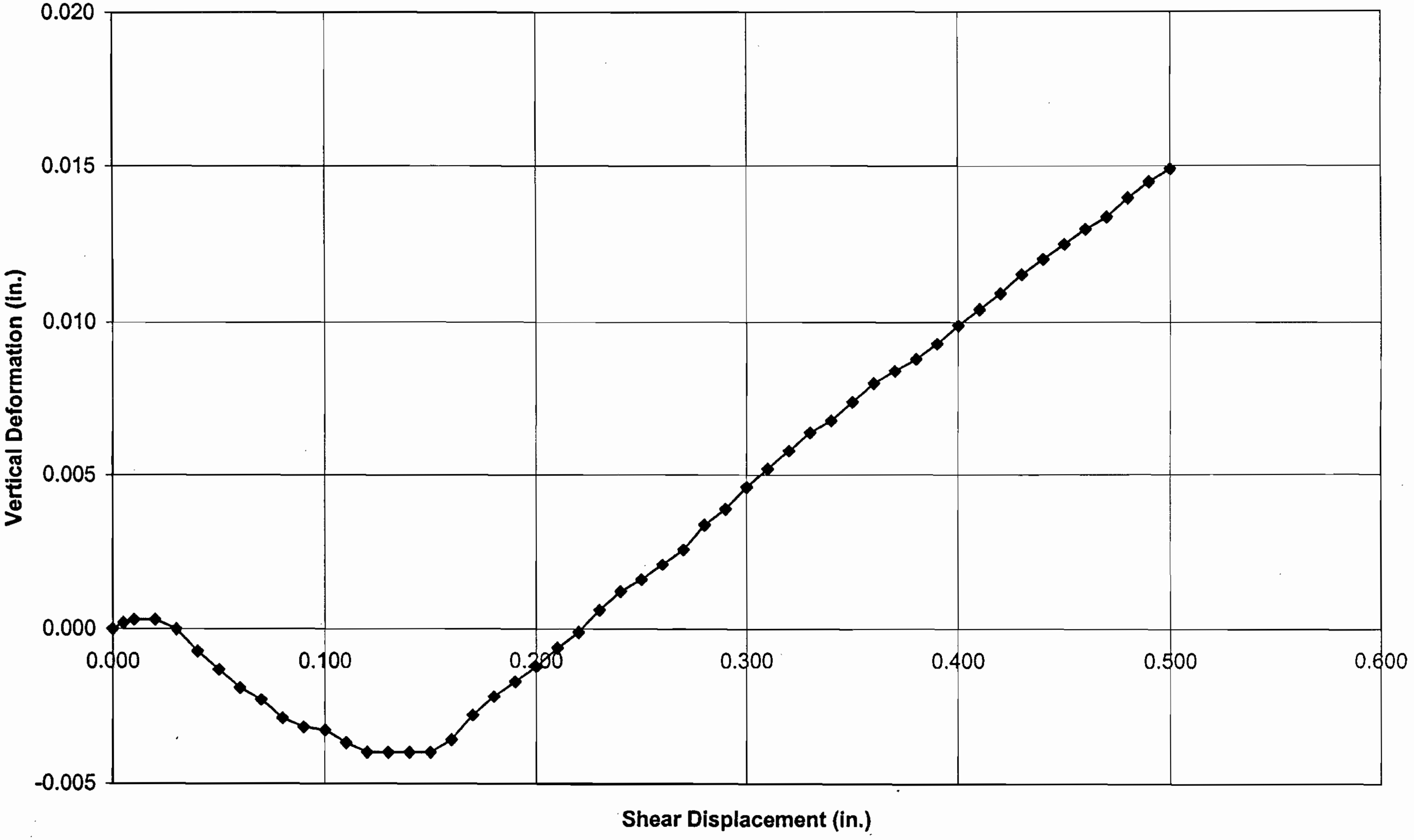
Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #2, Vertical Load 2142 psf



Shear Stress vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #3, Vertical Load 4190 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-5, Depth 62.0', Sample #3, Vertical Load 4190 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.42
PROJ. #:	001860	TEST DATE:	01/07/2001		Init. Sample Height (in.):	1.20
BORING:	B-5	DEPTH:	62.0'		Init.Horz. Dial Reading:	0
SAMPLE #:	3				Vertical Pressure (psf):	4190

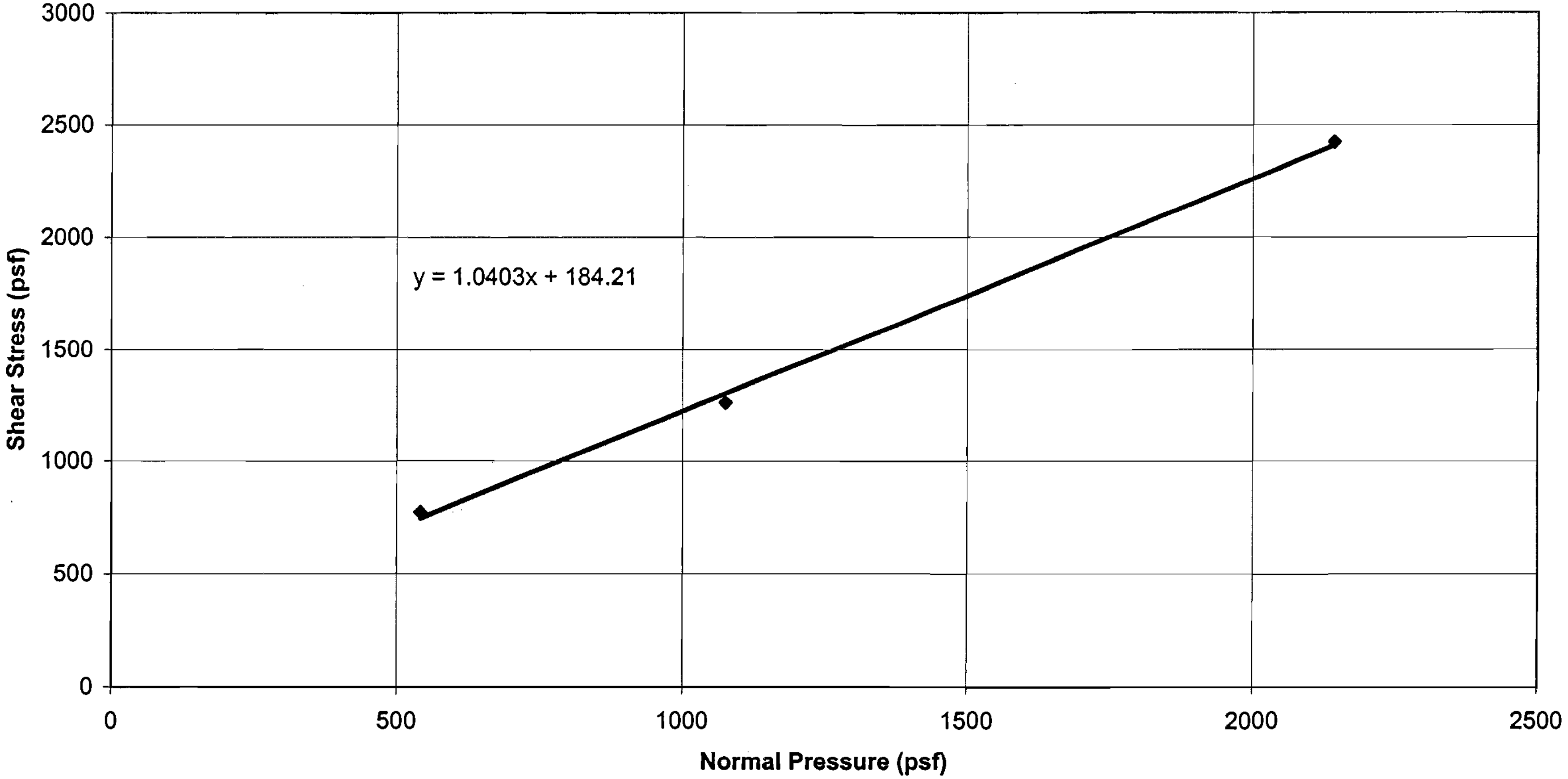
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	0	0.0	1546	1546	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.42	5	0.2	1546	1544	95	29.98	4.588	0.005	941	0.005	0.000	0.3
2.42	10	0.4	1546	1543	130	41.03	4.575	0.010	1291	0.010	0.000	0.5
2.42	20	0.8	1546	1543	173	54.60	4.551	0.020	1728	0.020	0.000	1.1
2.42	30	1.2	1546	1546	210	66.28	4.527	0.030	2108	0.030	0.000	1.6
2.42	40	1.7	1546	1553	253	79.85	4.503	0.040	2554	0.040	-0.001	2.1
2.42	50	2.1	1546	1559	300	94.68	4.479	0.050	3044	0.050	-0.001	2.6
2.42	60	2.5	1546	1565	345	108.88	4.454	0.060	3520	0.060	-0.002	3.2
2.42	70	2.9	1546	1569	370	116.77	4.430	0.070	3796	0.070	-0.002	3.7
2.42	80	3.3	1546	1575	381	120.24	4.406	0.080	3930	0.080	-0.003	4.2
2.42	90	3.7	1546	1578	383	120.87	4.382	0.090	3972	0.090	-0.003	4.7
2.42	100	4.1	1546	1579	379	119.61	4.358	0.100	3953	0.100	-0.003	5.3
2.42	110	4.5	1546	1583	372	117.40	4.333	0.110	3901	0.110	-0.004	5.8
2.42	120	5.0	1546	1586	365	115.19	4.309	0.120	3849	0.120	-0.004	6.3
2.42	130	5.4	1546	1586	354	111.72	4.285	0.130	3754	0.130	-0.004	6.8
2.42	140	5.8	1546	1586	340	107.30	4.261	0.140	3626	0.140	-0.004	7.4
2.42	150	6.2	1546	1586	324	102.25	4.237	0.150	3475	0.150	-0.004	7.9
2.42	160	6.6	1546	1582	311	98.15	4.213	0.160	3355	0.160	-0.004	8.4
2.42	170	7.0	1546	1574	302	95.31	4.189	0.170	3277	0.170	-0.003	8.9
2.42	180	7.4	1546	1568	294	92.79	4.164	0.180	3208	0.180	-0.002	9.5
2.42	190	7.9	1546	1563	288	90.89	4.140	0.190	3161	0.190	-0.002	10.0
2.42	200	8.3	1546	1558	283	89.31	4.116	0.200	3125	0.200	-0.001	10.5
2.42	210	8.7	1546	1552	279	88.05	4.092	0.210	3099	0.210	-0.001	11.0
2.42	220	9.1	1546	1547	276	87.11	4.068	0.220	3083	0.220	0.000	11.6
2.42	230	9.5	1546	1540	272	85.84	4.044	0.230	3057	0.230	0.001	12.1
2.42	240	9.9	1546	1534	270	85.21	4.020	0.240	3053	0.240	0.001	12.6
2.42	250	10.3	1546	1530	268	84.58	3.996	0.250	3048	0.250	0.002	13.1
2.42	260	10.7	1546	1525	266	83.95	3.972	0.260	3044	0.260	0.002	13.7
2.42	270	11.2	1546	1520	263	83.00	3.948	0.270	3028	0.270	0.003	14.2
2.42	280	11.6	1546	1512	262	82.69	3.924	0.280	3035	0.280	0.003	14.7
2.42	290	12.0	1546	1507	260	82.06	3.899	0.290	3030	0.290	0.004	15.2
2.42	300	12.4	1546	1500	257	81.11	3.875	0.300	3014	0.300	0.005	15.7
2.42	310	12.8	1546	1494	255	80.48	3.851	0.310	3009	0.310	0.005	16.3
2.42	320	13.2	1546	1488	252	79.53	3.827	0.320	2992	0.320	0.006	16.8
2.42	330	13.6	1546	1482	251	79.22	3.803	0.330	2999	0.330	0.006	17.3
2.42	340	14.0	1546	1478	249	78.58	3.780	0.340	2994	0.340	0.007	17.8
2.42	350	14.5	1546	1472	248	78.27	3.756	0.350	3001	0.350	0.007	18.4
2.42	360	14.9	1546	1466	246	77.64	3.732	0.360	2996	0.360	0.008	18.9
2.42	370	15.3	1546	1462	245	77.32	3.708	0.370	3003	0.370	0.008	19.4
2.42	380	15.7	1546	1458	244	77.01	3.684	0.380	3010	0.380	0.009	19.9
2.42	390	16.1	1546	1453	242	76.38	3.660	0.390	3005	0.390	0.009	20.4
2.42	400	16.5	1546	1447	241	76.06	3.636	0.400	3012	0.400	0.010	20.9

DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.42	410	16.9	1546	1442	238	75.11	3.612	0.410	2994	0.410	0.010	21.5
2.42	420	17.4	1546	1437	237	74.80	3.588	0.420	3002	0.420	0.011	22.0
2.42	430	17.8	1546	1431	236	74.48	3.565	0.430	3009	0.430	0.012	22.5
2.42	440	18.2	1546	1426	235	74.17	3.541	0.440	3016	0.440	0.012	23.0
2.42	450	18.6	1546	1421	233	73.53	3.517	0.450	3011	0.450	0.013	23.5
2.42	460	19.0	1546	1416	233	73.53	3.493	0.460	3031	0.460	0.013	24.1
2.42	470	19.4	1546	1412	232	73.22	3.469	0.470	3039	0.470	0.013	24.6
2.42	480	19.8	1546	1406	231	72.90	3.446	0.480	3047	0.480	0.014	25.1
2.42	490	20.2	1546	1401	232	73.22	3.422	0.490	3081	0.490	0.015	25.6
2.42	500	20.7	1546	1397	229	72.27	3.398	0.500	3063	0.500	0.015	26.1

DIRECT SHEAR RESULTS (Peak)
Vasco Road, Project No. 001860
Boring B-10, Depth 14.5'
Friction Angle 46.1 deg., Cohesion 184 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Yel Brn Sandstone (VFG-FG)



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Peak)

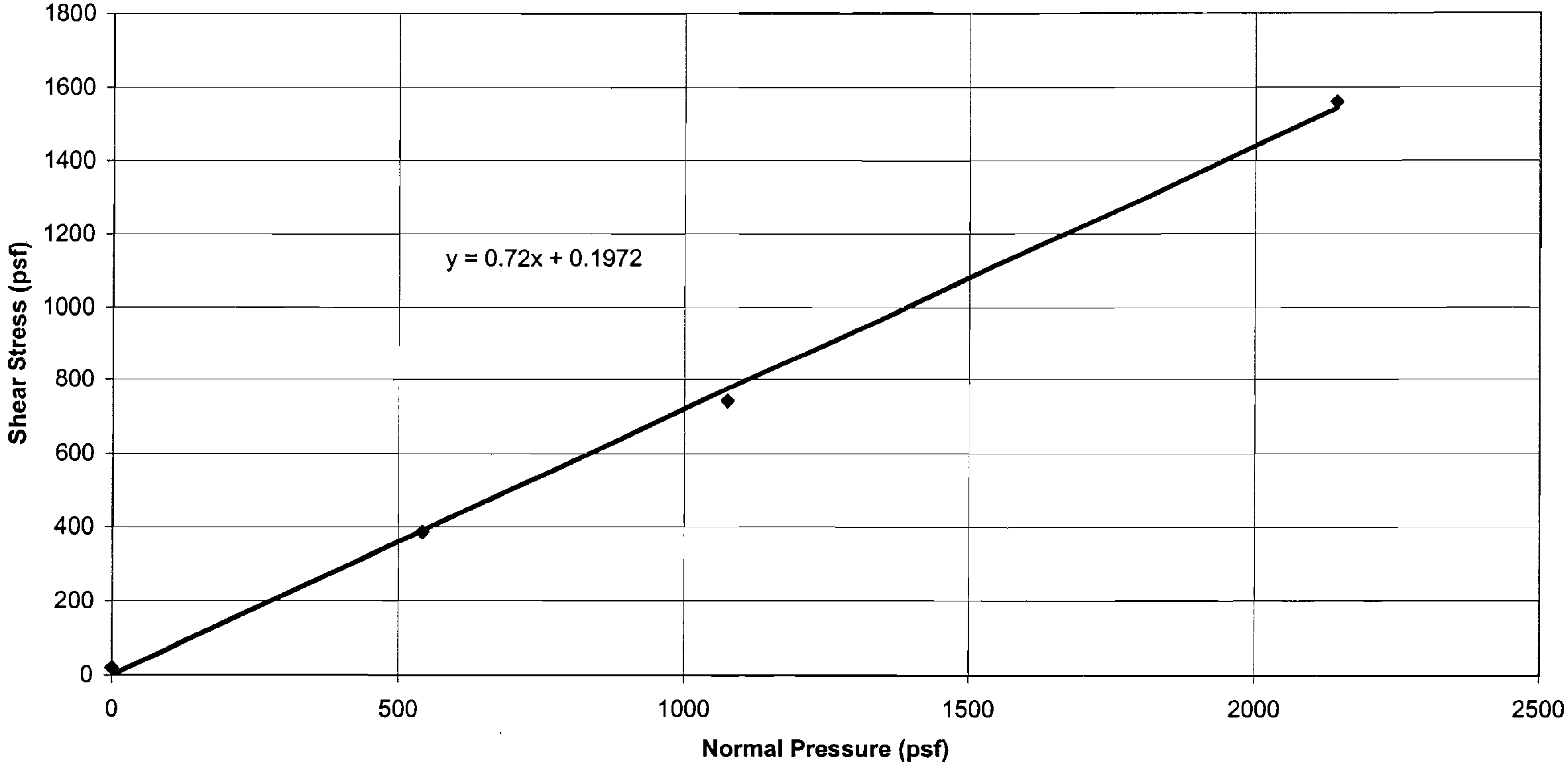
Project: Vasco Rd.

Project #: 1860

Boring: B-10 Depth: 14.5'

541	774
1075	1262
2142	2426

DIRECT SHEAR RESULTS (Ultimate)
Vasco Road, Project No. 001860
Boring B-10, Depth 14.5'
Friction Angle 35.8 deg., Cohesion 0 psf
Test Type CU , Inundation Time 24 hrs.
Sample Type Weathered Yel Brn Sandstone (VFG-FG)



CLIENT: CAL Engineering and Geology

RAYMOND L. FISHER, P.E.
SOIL TESTING LABORATORY

Direct Shear Envelope Plot (Ultimate)

Project: Vasco Rd.

Project #: 1860

Boring: B-10 Depth: 14.5'

0	19.5
541	386
1075	741
2142	1560

DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology				Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road				Sample Diameter (in.):	2.41
PROJ. # :	001860	TEST DATE:	03/02/2001		Init. Sample Height (in.):	1.20
BORING:	B-10	DEPTH:	14.5'		Init.Horz. Dial Reading:	0
SAMPLE #:	1				Vertical Pressure (psf):	541

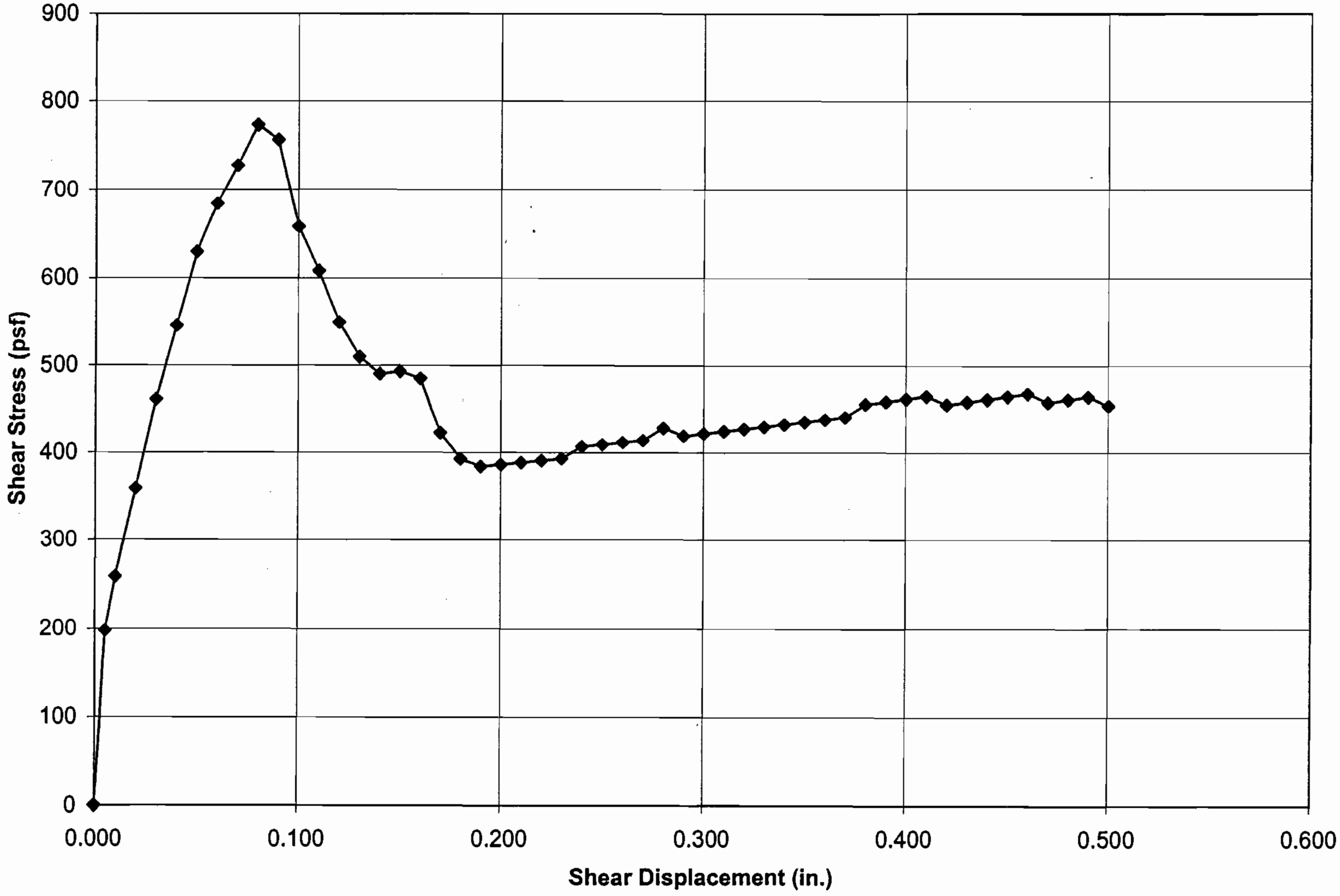
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.41	0	0.0	1692	1692	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.41	5	0.2	1692	1688	20	6.31	4.588	0.005	198	0.005	0.000	0.3
2.41	10	0.4	1692	1686	26	8.21	4.575	0.010	258	0.010	0.001	0.5
2.41	20	0.8	1692	1685	36	11.36	4.551	0.020	359	0.020	0.001	1.1
2.41	30	1.2	1692	1689	46	14.52	4.527	0.030	462	0.030	0.000	1.6
2.41	40	1.7	1692	1700	54	17.04	4.503	0.040	545	0.040	-0.001	2.1
2.41	50	2.1	1692	1718	62	19.57	4.479	0.050	629	0.050	-0.003	2.6
2.41	60	2.5	1692	1737	67	21.15	4.454	0.060	684	0.060	-0.005	3.2
2.41	70	2.9	1692	1759	71	22.41	4.430	0.070	728	0.070	-0.007	3.7
2.41	80	3.3	1692	1789	75	23.67	4.406	0.080	774	0.080	-0.010	4.2
2.41	90	3.7	1692	1819	73	23.04	4.382	0.090	757	0.090	-0.013	4.7
2.41	100	4.1	1692	1834	63	19.88	4.358	0.100	657	0.100	-0.014	5.3
2.41	110	4.6	1692	1836	58	18.30	4.333	0.110	608	0.110	-0.014	5.8
2.41	120	5.0	1692	1835	52	16.41	4.309	0.120	548	0.120	-0.014	6.3
2.41	130	5.4	1692	1825	48	15.15	4.285	0.130	509	0.130	-0.013	6.8
2.41	140	5.8	1692	1814	46	14.52	4.261	0.140	491	0.140	-0.012	7.4
2.41	150	6.2	1692	1808	46	14.52	4.237	0.150	493	0.150	-0.012	7.9
2.41	160	6.6	1692	1803	45	14.20	4.213	0.160	485	0.160	-0.011	8.4
2.41	170	7.1	1692	1788	39	12.31	4.189	0.170	423	0.170	-0.010	8.9
2.41	180	7.5	1692	1791	36	11.36	4.164	0.180	393	0.180	-0.010	9.5
2.41	190	7.9	1692	1785	35	11.05	4.140	0.190	384	0.190	-0.009	10.0
2.41	200	8.3	1692	1783	35	11.05	4.116	0.200	386	0.200	-0.009	10.5
2.41	210	8.7	1692	1781	35	11.05	4.092	0.210	389	0.210	-0.009	11.0
2.41	220	9.1	1692	1776	35	11.05	4.068	0.220	391	0.220	-0.008	11.6
2.41	230	9.5	1692	1771	35	11.05	4.044	0.230	393	0.230	-0.008	12.1
2.41	240	10.0	1692	1766	36	11.36	4.020	0.240	407	0.240	-0.007	12.6
2.41	250	10.4	1692	1761	36	11.36	3.996	0.250	409	0.250	-0.007	13.1
2.41	260	10.8	1692	1755	36	11.36	3.972	0.260	412	0.260	-0.006	13.7
2.41	270	11.2	1692	1751	36	11.36	3.948	0.270	414	0.270	-0.006	14.2
2.41	280	11.6	1692	1749	37	11.68	3.924	0.280	429	0.280	-0.006	14.7
2.41	290	12.0	1692	1745	36	11.36	3.899	0.290	420	0.290	-0.005	15.2
2.41	300	12.4	1692	1739	36	11.36	3.875	0.300	422	0.300	-0.005	15.7
2.41	310	12.9	1692	1732	36	11.36	3.851	0.310	425	0.310	-0.004	16.3
2.41	320	13.3	1692	1729	36	11.36	3.827	0.320	427	0.320	-0.004	16.8
2.41	330	13.7	1692	1724	36	11.36	3.803	0.330	430	0.330	-0.003	17.3
2.41	340	14.1	1692	1719	36	11.36	3.780	0.340	433	0.340	-0.003	17.8
2.41	350	14.5	1692	1713	36	11.36	3.756	0.350	436	0.350	-0.002	18.4
2.41	360	14.9	1692	1710	36	11.36	3.732	0.360	438	0.360	-0.002	18.9
2.41	370	15.4	1692	1705	36	11.36	3.708	0.370	441	0.370	-0.001	19.4
2.41	380	15.8	1692	1702	37	11.68	3.684	0.380	456	0.380	-0.001	19.9
2.41	390	16.2	1692	1700	37	11.68	3.660	0.390	459	0.390	-0.001	20.4
2.41	400	16.6	1692	1698	37	11.68	3.636	0.400	462	0.400	-0.001	20.9

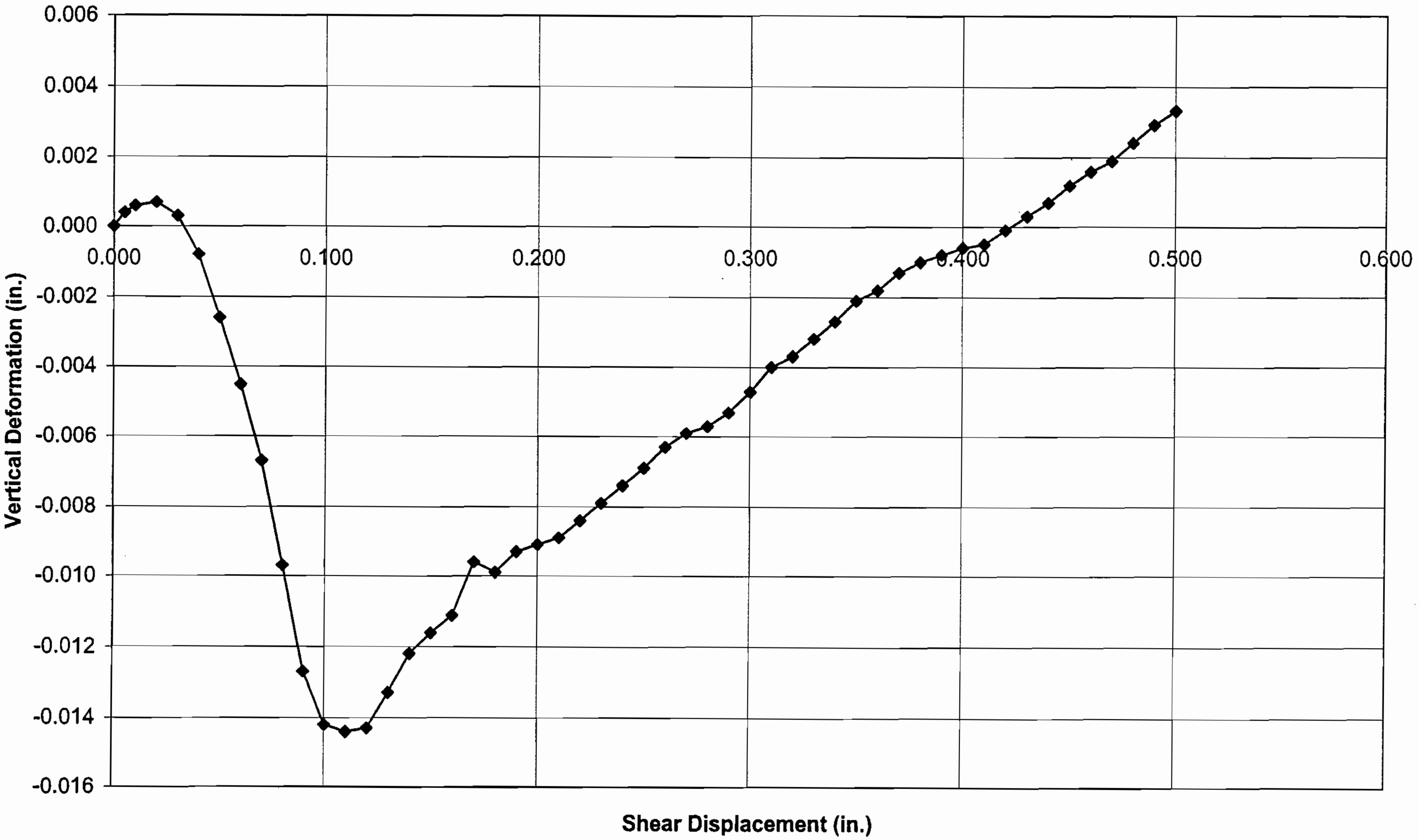
DIRECT SHEAR
DATA SHEET

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.41	410	17.0	1692	1697	37	11.68	3.612	0.410	466	0.410	-0.001	21.5
2.41	420	17.4	1692	1693	36	11.36	3.588	0.420	456	0.420	0.000	22.0
2.41	430	17.8	1692	1689	36	11.36	3.565	0.430	459	0.430	0.000	22.5
2.41	440	18.3	1692	1685	36	11.36	3.541	0.440	462	0.440	0.001	23.0
2.41	450	18.7	1692	1680	36	11.36	3.517	0.450	465	0.450	0.001	23.5
2.41	460	19.1	1692	1676	36	11.36	3.493	0.460	468	0.460	0.002	24.1
2.41	470	19.5	1692	1673	35	11.05	3.469	0.470	458	0.470	0.002	24.6
2.41	480	19.9	1692	1668	35	11.05	3.446	0.480	462	0.480	0.002	25.1
2.41	490	20.3	1692	1663	35	11.05	3.422	0.490	465	0.490	0.003	25.6
2.41	500	20.7	1692	1659	34	10.73	3.398	0.500	455	0.500	0.003	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #1, Vertical Load 541 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #1, Vertical Load 541 psf



DIRECT SHEAR
DATA SHEET

CLIENT:	Cal Engineering and Geology			Ring Constant = 0.3156 lb/div	
PROJECT:	Vasco Road			Sample Diameter (in.):	2.41
PROJ. # :	001860	TEST DATE:	03/02/2001	Init. Sample Height (in.):	1.20
BORING:	B-10	DEPTH:	14.5'	Init.Horz. Dial Reading:	0
SAMPLE #:	2			Vertical Pressure (psf):	1075

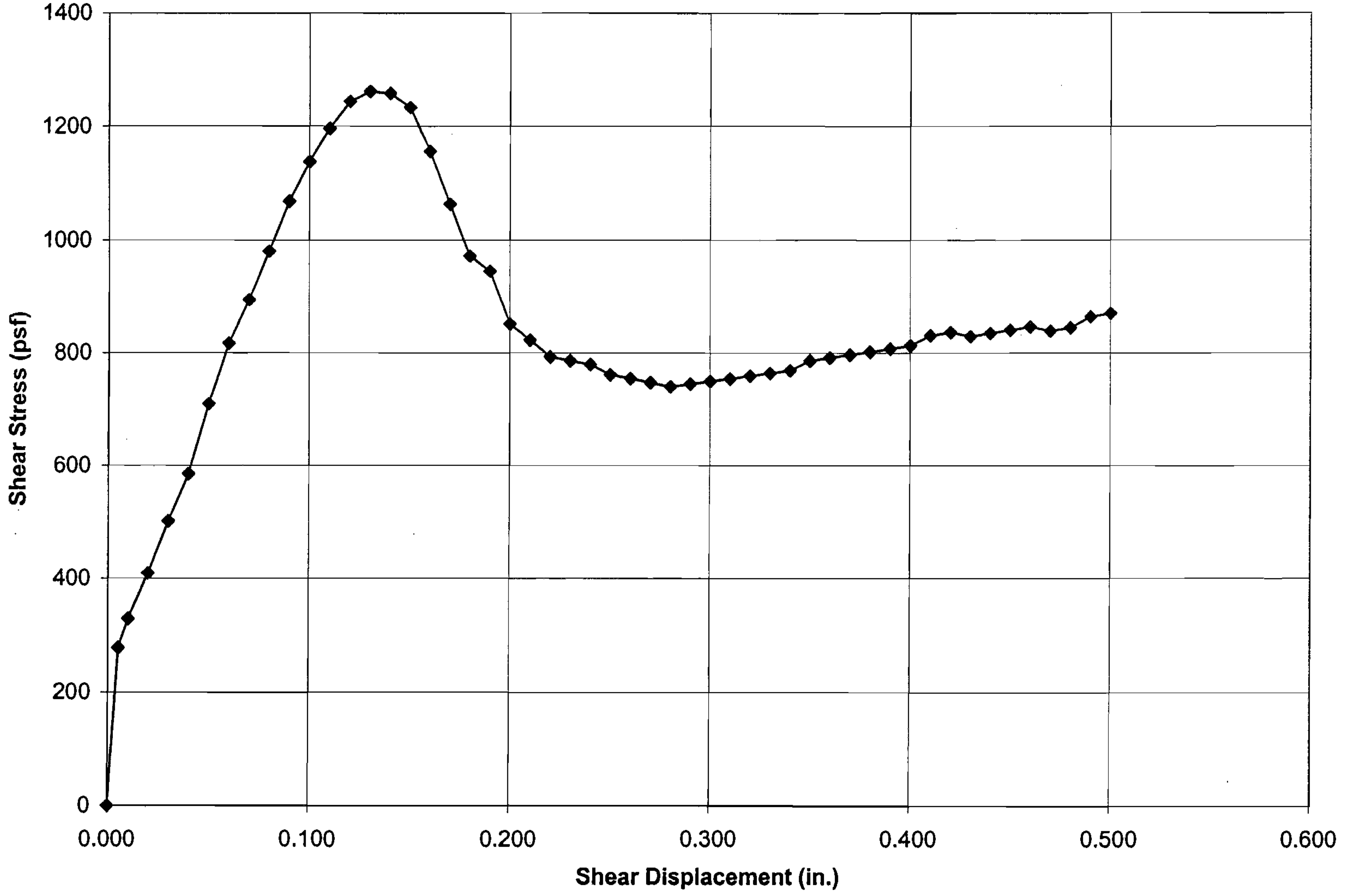
Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.41	0	0.0	1392	1392	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.41	5	0.2	1392	1388	28	8.84	4.588	0.005	277	0.005	0.000	0.3
2.41	10	0.4	1392	1387	33	10.41	4.575	0.010	328	0.010	0.001	0.5
2.41	20	0.8	1392	1385	41	12.94	4.551	0.020	409	0.020	0.001	1.1
2.41	30	1.2	1392	1380	50	15.78	4.527	0.030	502	0.030	0.001	1.6
2.41	40	1.7	1392	1376	58	18.30	4.503	0.040	585	0.040	0.002	2.1
2.41	50	2.1	1392	1373	70	22.09	4.479	0.050	710	0.050	0.002	2.6
2.41	60	2.5	1392	1373	80	25.25	4.454	0.060	816	0.060	0.002	3.2
2.41	70	2.9	1392	1373	87	27.46	4.430	0.070	892	0.070	0.002	3.7
2.41	80	3.3	1392	1373	95	29.98	4.406	0.080	980	0.080	0.002	4.2
2.41	90	3.7	1392	1373	103	32.51	4.382	0.090	1068	0.090	0.002	4.7
2.41	100	4.1	1392	1375	109	34.40	4.358	0.100	1137	0.100	0.002	5.3
2.41	110	4.6	1392	1379	114	35.98	4.333	0.110	1196	0.110	0.001	5.8
2.41	120	5.0	1392	1387	118	37.24	4.309	0.120	1244	0.120	0.001	6.3
2.41	130	5.4	1392	1396	119	37.56	4.285	0.130	1262	0.130	0.000	6.8
2.41	140	5.8	1392	1406	118	37.24	4.261	0.140	1259	0.140	-0.001	7.4
2.41	150	6.2	1392	1416	115	36.29	4.237	0.150	1234	0.150	-0.002	7.9
2.41	160	6.6	1392	1423	107	33.77	4.213	0.160	1154	0.160	-0.003	8.4
2.41	170	7.1	1392	1429	98	30.93	4.189	0.170	1063	0.170	-0.004	8.9
2.41	180	7.5	1392	1432	89	28.09	4.164	0.180	971	0.180	-0.004	9.5
2.41	190	7.9	1392	1433	86	27.14	4.140	0.190	944	0.190	-0.004	10.0
2.41	200	8.3	1392	1428	77	24.30	4.116	0.200	850	0.200	-0.004	10.5
2.41	210	8.7	1392	1424	74	23.35	4.092	0.210	822	0.210	-0.003	11.0
2.41	220	9.1	1392	1423	71	22.41	4.068	0.220	793	0.220	-0.003	11.6
2.41	230	9.5	1392	1421	70	22.09	4.044	0.230	787	0.230	-0.003	12.1
2.41	240	10.0	1392	1414	69	21.78	4.020	0.240	780	0.240	-0.002	12.6
2.41	250	10.4	1392	1409	67	21.15	3.996	0.250	762	0.250	-0.002	13.1
2.41	260	10.8	1392	1405	66	20.83	3.972	0.260	755	0.260	-0.001	13.7
2.41	270	11.2	1392	1402	65	20.51	3.948	0.270	748	0.270	-0.001	14.2
2.41	280	11.6	1392	1399	64	20.20	3.924	0.280	741	0.280	-0.001	14.7
2.41	290	12.0	1392	1395	64	20.20	3.899	0.290	746	0.290	0.000	15.2
2.41	300	12.4	1392	1392	64	20.20	3.875	0.300	751	0.300	0.000	15.7
2.41	310	12.9	1392	1386	64	20.20	3.851	0.310	755	0.310	0.001	16.3
2.41	320	13.3	1392	1382	64	20.20	3.827	0.320	760	0.320	0.001	16.8
2.41	330	13.7	1392	1377	64	20.20	3.803	0.330	765	0.330	0.002	17.3
2.41	340	14.1	1392	1372	64	20.20	3.780	0.340	770	0.340	0.002	17.8
2.41	350	14.5	1392	1371	65	20.51	3.756	0.350	787	0.350	0.002	18.4
2.41	360	14.9	1392	1369	65	20.51	3.732	0.360	792	0.360	0.002	18.9
2.41	370	15.4	1392	1367	65	20.51	3.708	0.370	797	0.370	0.003	19.4
2.41	380	15.8	1392	1362	65	20.51	3.684	0.380	802	0.380	0.003	19.9
2.41	390	16.2	1392	1361	65	20.51	3.660	0.390	807	0.390	0.003	20.4
2.41	400	16.6	1392	1361	65	20.51	3.636	0.400	812	0.400	0.003	20.9

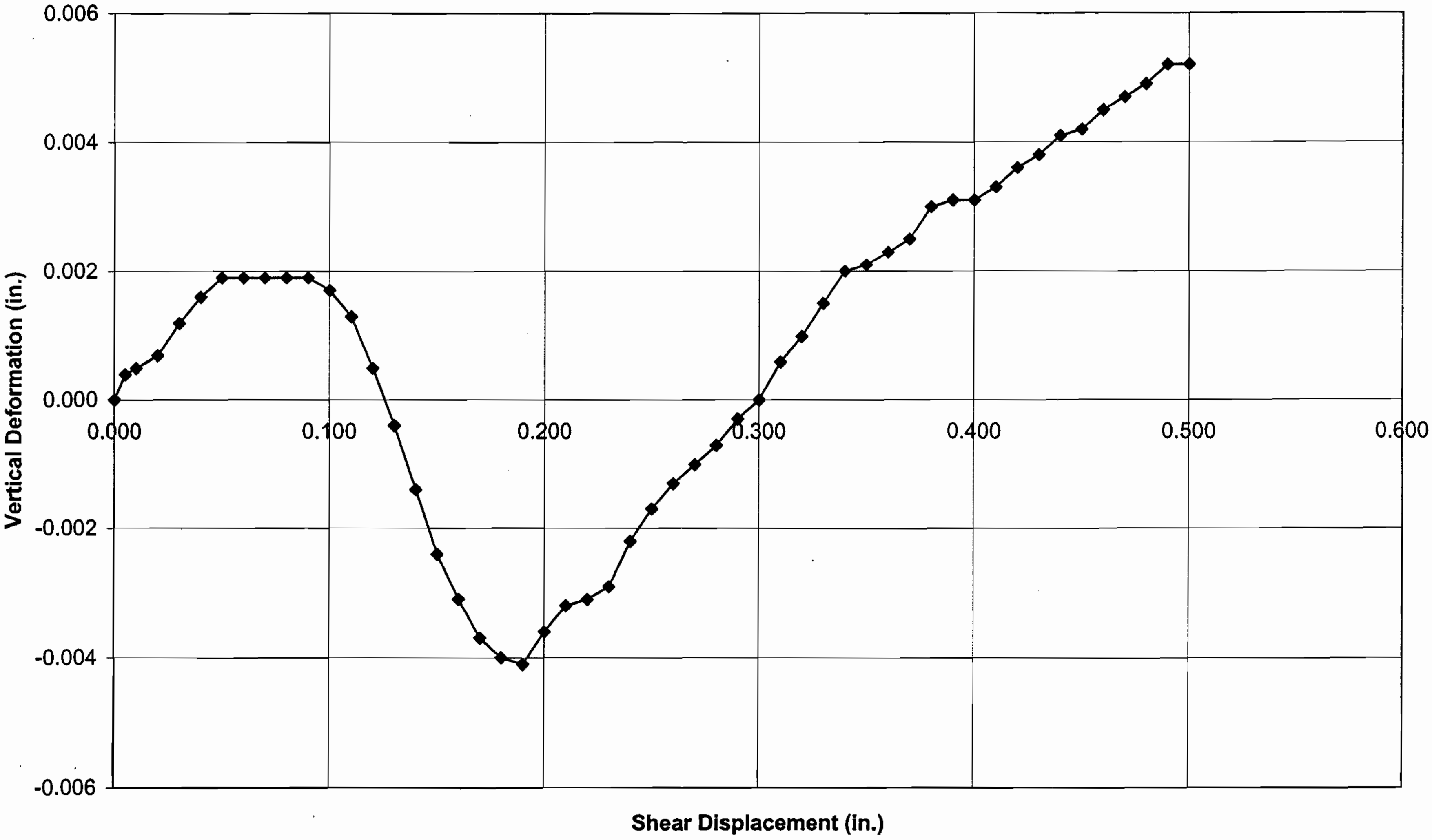
DIRECT SHEAR
DATA SHEET

Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.41	410	17.0	1392	1359	66	20.83	3.612	0.410	830	0.410	0.003	21.5
2.41	420	17.4	1392	1356	66	20.83	3.588	0.420	836	0.420	0.004	22.0
2.41	430	17.8	1392	1354	65	20.51	3.565	0.430	829	0.430	0.004	22.5
2.41	440	18.3	1392	1351	65	20.51	3.541	0.440	834	0.440	0.004	23.0
2.41	450	18.7	1392	1350	65	20.51	3.517	0.450	840	0.450	0.004	23.5
2.41	460	19.1	1392	1347	65	20.51	3.493	0.460	846	0.460	0.005	24.1
2.41	470	19.5	1392	1345	64	20.20	3.469	0.470	838	0.470	0.005	24.6
2.41	480	19.9	1392	1343	64	20.20	3.446	0.480	844	0.480	0.005	25.1
2.41	490	20.3	1392	1340	65	20.51	3.422	0.490	863	0.490	0.005	25.6
2.41	500	20.7	1392	1340	65	20.51	3.398	0.500	869	0.500	0.005	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #2, Vertical Load 1075 psf



Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #2, Vertical Load 1075 psf



DIRECT SHEAR
DATA SHEET

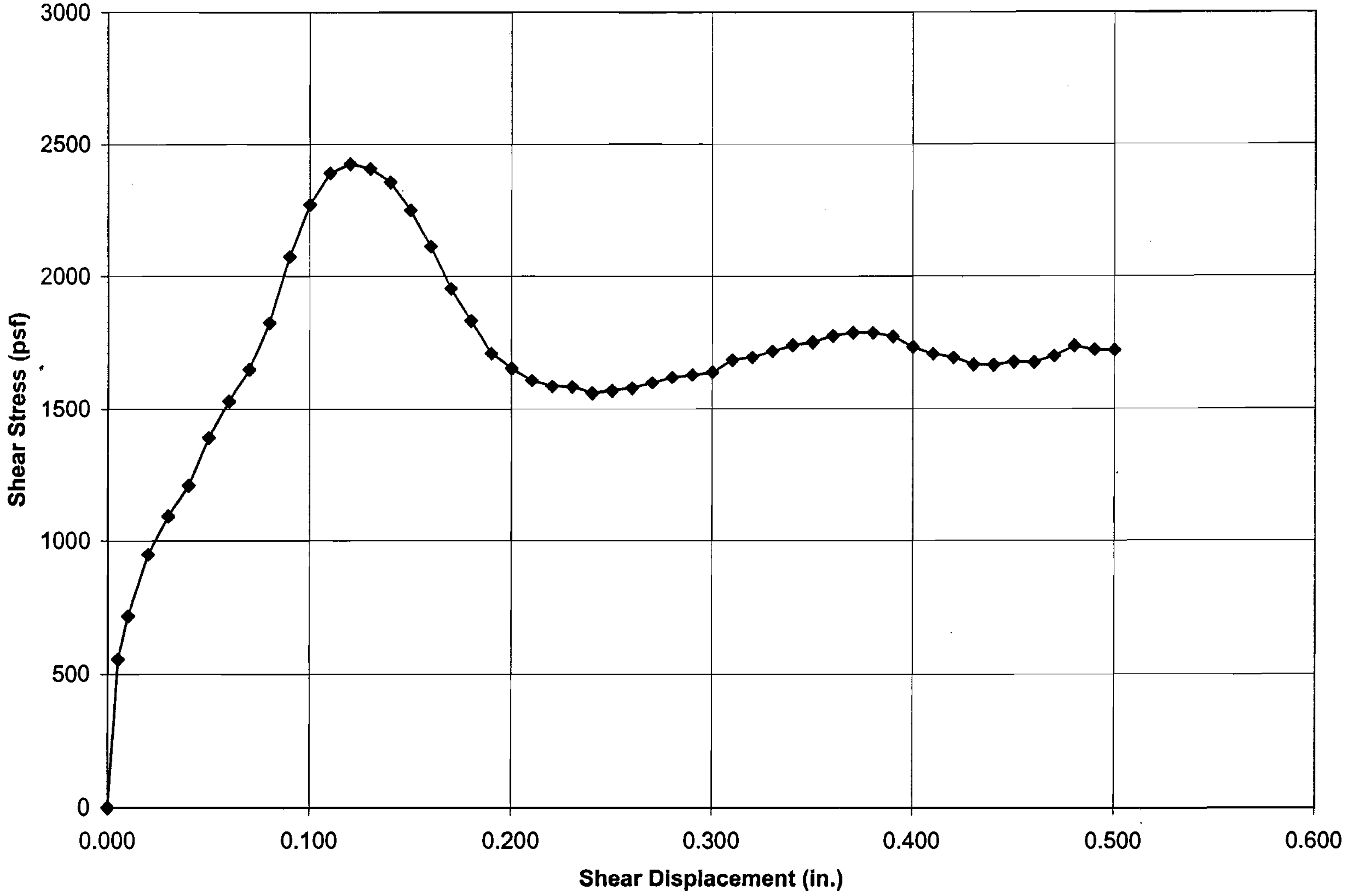
CLIENT:	Cal Engineering and Geology							Ring Constant = 0.3156 lb/div		
PROJECT:	Vasco Road							Sample Diameter (in.):	2.41	
PROJ. # :	001860		TEST DATE:		03/02/2001			Init. Sample Height (in.):	1.20	
BORING:	B-10		DEPTH:		14.5'			Init.Horz. Dial Reading:	0	
SAMPLE #:	3							Vertical Pressure (psf):	2142	
	Corrected Area for 2.42" Diameter Sample Only. Refer to Derivation for Other Diameters.									

Sample Diameter (in.)	Horiz. Dial Reading X 0.001"	Strain fn(dia.) (%)	Vert. Dial Reading X 0.0001"	Orig. Vert. Dial. Read. X 0.0001"	Proving Ring Read. (Div.)	Proving Ring Load (lbs.)	Corr. Area 2.42" only (sq. in.)	Horiz. Deform. (in.)	Shear Stress (psf)	Horiz. Deform. (in.)	Deform. Vert. (in.)	Area Reduct. (%)
2.41	0	0.0	1965	1965	0	0.00	4.600	0.000	0	0.000	0.000	0.0
2.41	5	0.2	1955	1965	56	17.67	4.588	0.005	555	0.005	-0.001	0.3
2.41	10	0.4	1952	1965	72	22.72	4.575	0.010	715	0.010	-0.001	0.5
2.41	20	0.8	1942	1965	95	29.98	4.551	0.020	949	0.020	-0.002	1.1
2.41	30	1.2	1929	1965	109	34.40	4.527	0.030	1094	0.030	-0.004	1.6
2.41	40	1.7	1925	1965	120	37.87	4.503	0.040	1211	0.040	-0.004	2.1
2.41	50	2.1	1921	1965	137	43.24	4.479	0.050	1390	0.050	-0.004	2.6
2.41	60	2.5	1916	1965	150	47.34	4.454	0.060	1530	0.060	-0.005	3.2
2.41	70	2.9	1915	1965	161	50.81	4.430	0.070	1652	0.070	-0.005	3.7
2.41	80	3.3	1912	1965	177	55.86	4.406	0.080	1826	0.080	-0.005	4.2
2.41	90	3.7	1913	1965	200	63.12	4.382	0.090	2074	0.090	-0.005	4.7
2.41	100	4.1	1920	1965	218	68.80	4.358	0.100	2274	0.100	-0.005	5.3
2.41	110	4.6	1935	1965	228	71.96	4.333	0.110	2391	0.110	-0.003	5.8
2.41	120	5.0	1949	1965	230	72.59	4.309	0.120	2426	0.120	-0.002	6.3
2.41	130	5.4	1965	1965	227	71.64	4.285	0.130	2407	0.130	0.000	6.8
2.41	140	5.8	1977	1965	221	69.75	4.261	0.140	2357	0.140	0.001	7.4
2.41	150	6.2	1989	1965	210	66.28	4.237	0.150	2253	0.150	0.002	7.9
2.41	160	6.6	1999	1965	196	61.86	4.213	0.160	2114	0.160	0.003	8.4
2.41	170	7.1	2008	1965	180	56.81	4.189	0.170	1953	0.170	0.004	8.9
2.41	180	7.5	2008	1965	168	53.02	4.164	0.180	1833	0.180	0.004	9.5
2.41	190	7.9	2007	1965	156	49.23	4.140	0.190	1712	0.190	0.004	10.0
2.41	200	8.3	2005	1965	150	47.34	4.116	0.200	1656	0.200	0.004	10.5
2.41	210	8.7	2001	1965	145	45.76	4.092	0.210	1610	0.210	0.004	11.0
2.41	220	9.1	1996	1965	142	44.82	4.068	0.220	1586	0.220	0.003	11.6
2.41	230	9.5	1991	1965	141	44.50	4.044	0.230	1585	0.230	0.003	12.1
2.41	240	10.0	1986	1965	138	43.55	4.020	0.240	1560	0.240	0.002	12.6
2.41	250	10.4	1981	1965	138	43.55	3.996	0.250	1570	0.250	0.002	13.1
2.41	260	10.8	1973	1965	138	43.55	3.972	0.260	1579	0.260	0.001	13.7
2.41	270	11.2	1968	1965	139	43.87	3.948	0.270	1600	0.270	0.000	14.2
2.41	280	11.6	1965	1965	140	44.18	3.924	0.280	1622	0.280	0.000	14.7
2.41	290	12.0	1960	1965	140	44.18	3.899	0.290	1632	0.290	-0.001	15.2
2.41	300	12.4	1955	1965	140	44.18	3.875	0.300	1642	0.300	-0.001	15.7
2.41	310	12.9	1947	1965	143	45.13	3.851	0.310	1687	0.310	-0.002	16.3
2.41	320	13.3	1944	1965	143	45.13	3.827	0.320	1698	0.320	-0.002	16.8
2.41	330	13.7	1941	1965	144	45.45	3.803	0.330	1721	0.330	-0.002	17.3
2.41	340	14.1	1937	1965	145	45.76	3.780	0.340	1744	0.340	-0.003	17.8
2.41	350	14.5	1936	1965	145	45.76	3.756	0.350	1755	0.350	-0.003	18.4
2.41	360	14.9	1936	1965	146	46.08	3.732	0.360	1778	0.360	-0.003	18.9
2.41	370	15.4	1937	1965	146	46.08	3.708	0.370	1790	0.370	-0.003	19.4
2.41	380	15.8	1937	1965	145	45.76	3.684	0.380	1789	0.380	-0.003	19.9
2.41	390	16.2	1937	1965	143	45.13	3.660	0.390	1776	0.390	-0.003	20.4
2.41	400	16.6	1937	1965	139	43.87	3.636	0.400	1737	0.400	-0.003	20.9

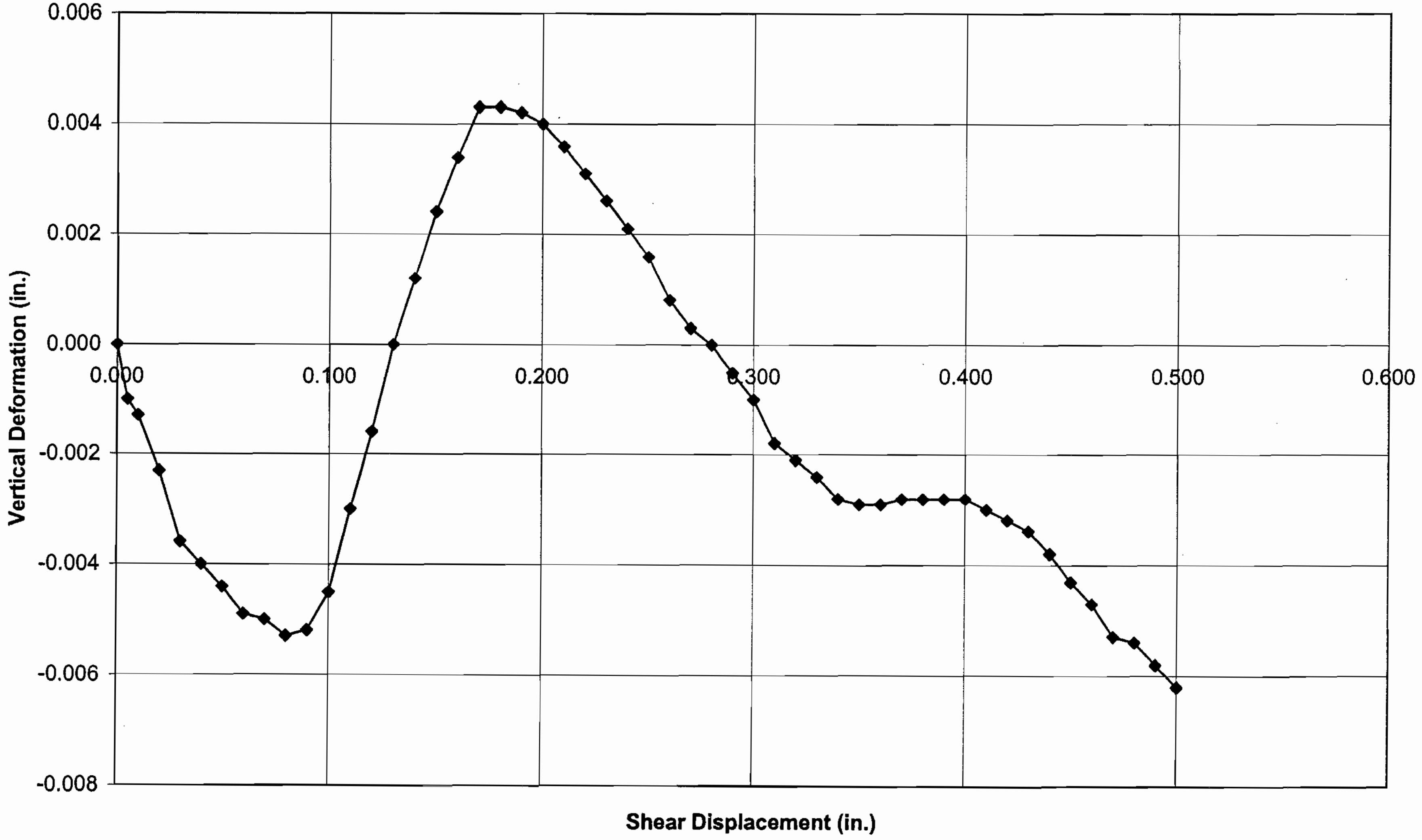
DIRECT SHEAR
DATA SHEET

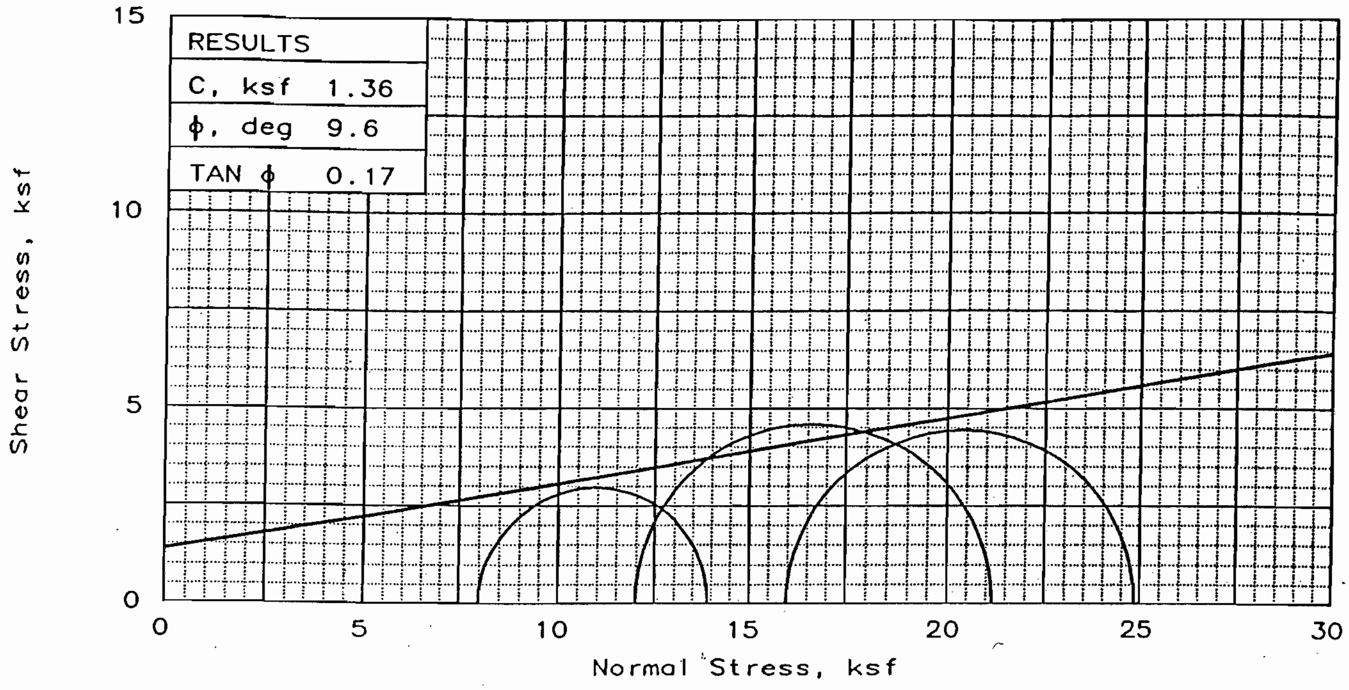
Sample	Horiz. Dial	Strain	Vert. Dial	Orig. Vert.	Proving	Proving	Corr. Area	Horiz.	Shear	Horiz.	Deform.	Area
Diameter	Reading	fn(dia.)	Reading	Dial. Read.	Ring Read.	Ring Load	2.42" only	Deform.	Stress	Deform.	Vert.	Reduct.
(in.)	X 0.001"	(%)	X 0.0001"	X 0.0001"	(Div.)	(lbs.)	(sq. in.)	(in.)	(psf)	(in.)	(in.)	(%)
2.41	410	17.0	1935	1965	136	42.92	3.612	0.410	1711	0.410	-0.003	21.5
2.41	420	17.4	1933	1965	134	42.29	3.588	0.420	1697	0.420	-0.003	22.0
2.41	430	17.8	1931	1965	131	41.34	3.565	0.430	1670	0.430	-0.003	22.5
2.41	440	18.3	1927	1965	130	41.03	3.541	0.440	1669	0.440	-0.004	23.0
2.41	450	18.7	1922	1965	130	41.03	3.517	0.450	1680	0.450	-0.004	23.5
2.41	460	19.1	1918	1965	129	40.71	3.493	0.460	1678	0.460	-0.005	24.1
2.41	470	19.5	1912	1965	130	41.03	3.469	0.470	1703	0.470	-0.005	24.6
2.41	480	19.9	1911	1965	132	41.66	3.446	0.480	1741	0.480	-0.005	25.1
2.41	490	20.3	1907	1965	130	41.03	3.422	0.490	1727	0.490	-0.006	25.6
2.41	500	20.7	1903	1965	129	40.71	3.398	0.500	1725	0.500	-0.006	26.1

Shear Stress vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #3, Vertical Load 2142 psf

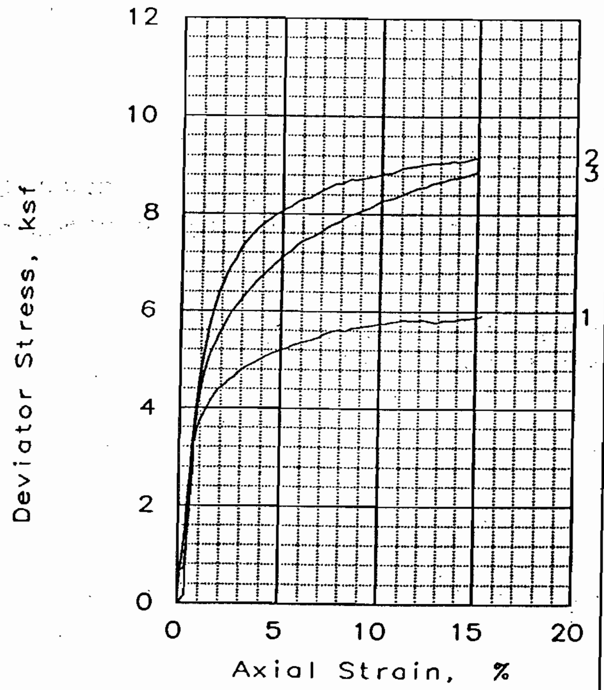


Vertical Deformation vs. Shear Displacement, Project 001860
Boring B-10, Depth 14.5', Sample #3, Vertical Load 2142 psf





RESULTS	
C, ksf	1.36
ϕ, deg	9.6
TAN ϕ	0.17



	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	20.6	22.8	19.2
	DRY DENSITY, pcf	106.8	103.2	110.7
	SATURATION, %	96.0	97.1	99.4
	VOID RATIO	0.578	0.634	0.522
	DIAMETER, in	2.40	2.40	2.40
	HEIGHT, in	5.00	5.00	4.94
AT TEST	WATER CONTENT, %	20.6	22.8	19.2
	DRY DENSITY, pcf	106.8	103.2	110.7
	SATURATION, %	96.0	97.1	99.4
	VOID RATIO	0.578	0.634	0.522
	DIAMETER, in	2.40	2.40	2.40
	HEIGHT, in	5.00	5.00	4.94
	Strain rate, %/min	1.00	1.00	1.00
	BACK PRESSURE, ksf	0.0	0.0	0.0
	CELL PRESSURE, ksf	8.0	12.0	16.0
	DEVIATOR STRESS, ksf	5.9	9.2	8.9
	STRAIN, %	15.3	15.1	15.0
	ULT. STRESS, ksf			
	STRAIN, %			
	σ_1 FAILURE, ksf	13.9	21.2	24.9
	σ_3 FAILURE, ksf	8.0	12.0	16.0

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: undisturbed

DESCRIPTION: gray CLAY w/sand

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS:

Fig. No.: ______

CLIENT: Fisher

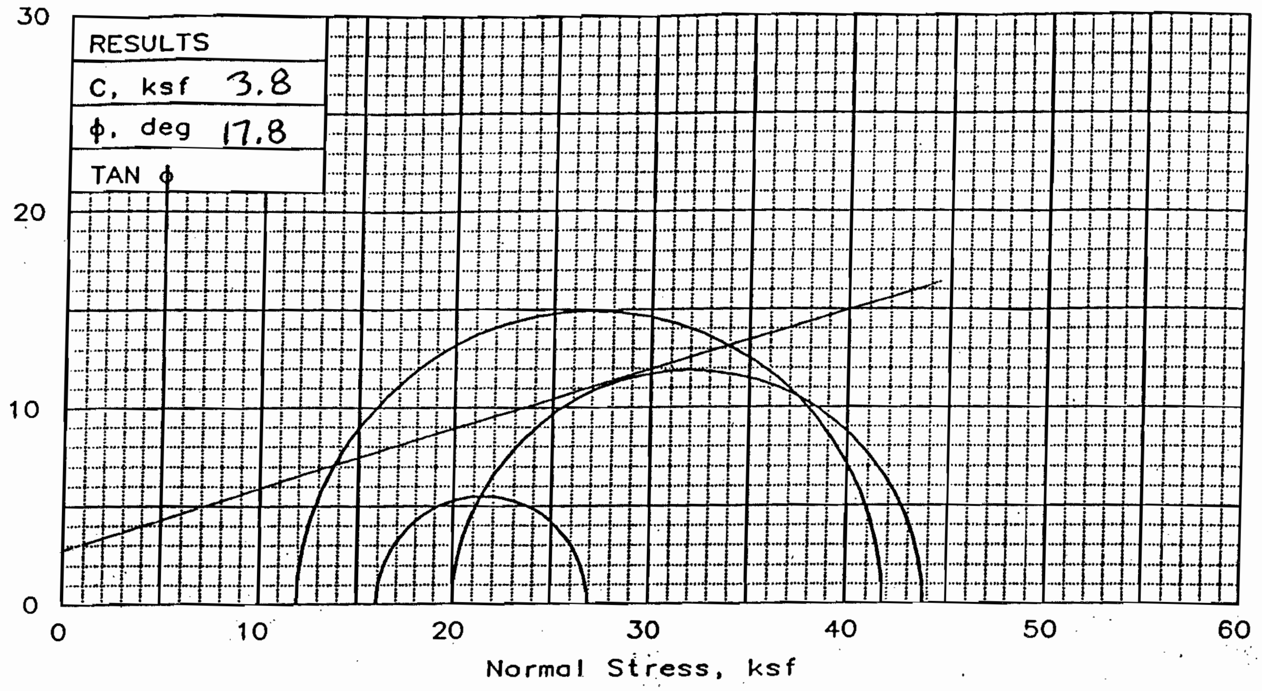
PROJECT: 001860

SAMPLE LOCATION: 1)B4 @ 37' 2)B4 @ 37.5'
3)B4 @ 38'

PROJ. NO.: 331-014b DATE: 3/22/01

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

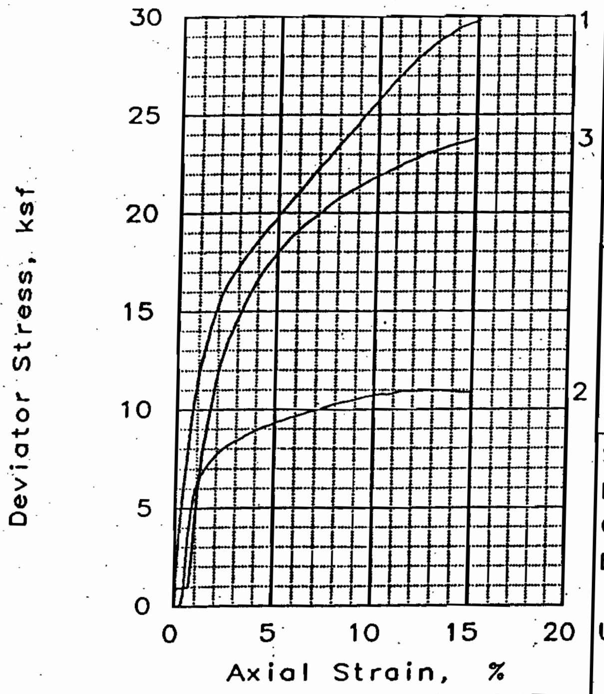


RESULTS

C, ksf 3.8

ϕ, deg 17.8

TAN ϕ



	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	9.4	14.1	13.6
	DRY DENSITY, pcf	127.6	122.2	122.9
	SATURATION, %	78.8	95.9	98.8
	VOID RATIO	0.321	0.405	0.371
	DIAMETER, in	2.40	2.40	2.39
	HEIGHT, in	5.00	4.99	4.98
AT TEST	WATER CONTENT, %	9.4	14.1	13.6
	DRY DENSITY, pcf	127.6	122.2	122.9
	SATURATION, %	78.8	95.9	98.8
	VOID RATIO	0.321	0.405	0.371
	DIAMETER, in	2.40	2.40	2.39
	HEIGHT, in	5.00	4.99	4.98
Strain rate, %/min		1.00	1.00	1.00
BACK PRESSURE, ksf		0.0	0.0	0.0
CELL PRESSURE, ksf		12.0	16.0	20.0
DEVIATOR STRESS, ksf		29.8	11.0	23.8
STRAIN, %		15.1	13.0	14.9
ULT. STRESS, ksf				
STRAIN, %				
σ_1 FAILURE, ksf		41.8	26.9	43.8
σ_3 FAILURE, ksf		12.0	16.0	20.0

TYPE OF TEST:
Unconsolidated Undrained

SAMPLE TYPE: undisturbed

DESCRIPTION: gray Claystone

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS:

Fig. No.: ______

CLIENT: Fisher

PROJECT: 001860

SAMPLE LOCATION: 1)B2 @ 47' 2)B2 @ 47.5'
3)B2 @ 48'

PROJ. NO.: 331-014c DATE: 3/22/01

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

L

MOISTURE CON NT AND DRY DENSITY

SLAKE TEST SAMPLES

Client Name: CAL ENGINEERING & GEOLOGY
Project Name: VASCO RD
Client Project No: 001860

Date Sampled: ______ Date Received ______
Date Tested: 3/13/01 IN 12:52 PM
Tested by: RLF

Boring No.	Depth (ft)	Sample Length (in)	Sample Diameter (in)	Cup No.	Cup Weight (g)	Wet Weight + Cup (g)	Dry Weight + Cup (g)	Sample Dry Density (pcf)	Moisture Content (%)	Material Description (Soil type is based on visual/manual examination; classification test results may modify soil type.)
B-3	29.5			F-308	16.0	260.3	222.0	—	18.6	GRN GRY + GRY SANDY CLAYSTONE
	45.5			F-26	14.4	303.4	261.4	—	17.0	DK GRY CLAYSTONE
B-4	17.0			F-304	13.7	233.8	190.0	—	24.8	YEL BRN & GRY CLAYSTONE
	27.0			F-300	13.5	281.3	232.1	—	22.5	YEL BRN + GRY BRN CLAYSTONE
	44.5			F314	16.1	280.7	241.9	—	17.2	DK GRY CLAYSTONE
	64.5			F-104	13.6	257.0	228.6	—	13.2	GRN GRY SANDY CLAYSTONE/ CLAYEY SANDSTONE
AFTER SLAKE TESTS										
B-3	29.5			F-308	16.0		28.0			
	45.5			F-26	14.4		30.0			
B-4	17.0			F-304	13.7		28.3			
	27.0			F-300	13.5		50.2			
	44.5			F314	16.1		47.6			
	64.5			F104	13.6		33.4			

F-308

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT: Cal Engineering and Geology
Project: Vasco Rd.
Project No 001860
Date: 3/21/01
2^{25}pm

Boring or Sample No.: B-3
Depth: 29.5'
Wet Wt. + Pan= 260.3 g (should be about 150g)
Initial Dry Wt. +Pan= 222.0 (photograph with mm scale)
Pan No.: F-308
Pan Wt.: 16.0

TAP ~~WATER~~ WATER pH=8.3
FINAL PH=5.2

Cycle No.: 1 Observations:	Cycle No.: Observations:
0-1 min. DISINGRATING + CLOUDY	0-1 min.
1-3 min. RAPID DISINT.	1-3 min.
3-6 min. " "	3-6 min.
6-10 min. NR. COMPLETE "	6-10 min.
10-30 min. COMPLETE @ 17MIN ±	10-30 min.
2 hrs.	2 hrs.
4 ~~or~~ 8 hrs. FLAKES AND FINE PARTICLES/MUD	4 or 8 hrs.
24 hrs. " " " " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 28.0	Final Dry Wt. of +#10 Material + Pan=
Cycle No.: Observations:	Cycle No.: Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

2^{25}pm

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 87.4

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

F-26

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT: Cal Engineering and Geology
Project: Vasco Rd.
Project No 001860
Date: 3/21/01
2^{25} pm

Boring or Sample No.: B-3
Depth: 45.5
Wet Wt. + Pan= 303.4 g (should be about 150g)
Initial Dry Wt. +Pan= 261.4 (photograph with mm scale)
Pan No.: F-26
Pan Wt.: 14.4

TAP WATER pH=8.3
FINAL pH = 7.6

Cycle No.: 1 Observations:	Cycle No.: Observations:
0-1 min. FLAKING	0-1 min.
1-3 min. DISINTEGRATING	1-3 min.
3-6 min. RAPID DISINTEGRATION	3-6 min.
6-10 min. COMPLETE "	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 ~~or 8~~ hrs. FLAKES & FINE PARTICLES/MUD	4 or 8 hrs.
3/22 2^{25} pm 24 hrs. " " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 30.0g	Final Dry Wt. of +#10 Material + Pan=
Cycle No.: Observations:	Cycle No.: Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 88.5

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

F-304

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT: Cal Engineering and Geology
Project: Vasco Rd.
Project No 001860
Date: 3/21/01
2^{25}pm

Boring or Sample No.: B-4
Depth: 17.0
Wet Wt. + Pan= 233.8 g (should be about 150g)
Initial Dry Wt. +Pan= 195.0 (photograph with mm scale)
Pan No.: F-304
Pan Wt.: 13.1

TAP WATER pH = 8.3
FINAL pH = 8.1

Cycle No.: 1 Observations:	Cycle No.: Observations:
0-1 min. DISINTIGRATING + CLOUDY	0-1 min.
1-3 min. VERY RAPID DISINT.	1-3 min.
3-6 min. COMPLETE DISINTEGRATION	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 ~~or 8~~ hrs. FINE PARTICLES/MUD	4 or 8 hrs.
24 hrs. " " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 28.3	Final Dry Wt. of +#10 Material + Pan=
Cycle No.: Observations:	Cycle No.: Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

3/22 2^{25}pm

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 85.1

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

F-300

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT: Cal Engineering and Geology
Project: Vasco Rd.
Project No 001860
Date: 3/21/01
2^{25} pm

Boring or Sample No.: B-4
Depth: 27.0'
Wet Wt. + Pan= 281.3g (should be about 150g)
Initial Dry Wt. +Pan= 232.1 (photograph with mm scale)
Pan No.: F-300 TAPWATER pH=8.3
Pan Wt.: 13.5 FINAL PH = 8.2

Cycle No.: 1 Observations:	Cycle No.: Observations:
0-1 min. DISINTEGRATING + CLOUDY	0-1 min.
1-3 min. RAPID DISINT.	1-3 min.
3-6 min. " "	3-6 min.
6-10 min. COMPLETE DISINT	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 ~~or 8~~ hrs. FINE PARTICLES/MUD W/FLAKES	4 or 8 hrs.
24 hrs. " " / " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 50.2g	Final Dry Wt. of +#10 Material + Pan=
Cycle No.: Observations:	Cycle No.: Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

3/22 2^{35} pm

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 78.4

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

F-314

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT:	Cal Engineering and Geology	Boring or Sample No.: B-4	
Project:	Vasco Rd.	Depth: 44.5'	
Project No 001860		Wet Wt. + Pan= 280.7g	(should be about 150g)
Date:	3/21/01	Initial Dry Wt. +Pan= 241.7	(photograph with mm scale)
		Pan No.: F-314	TAP WATER pH=8.3
2^{25} pm		Pan Wt.: 16.1	FINAL pH=7.4

Cycle No.: 1	Cycle No.:
Observations:	Observations:
0-1 min. DISINTIGRATING	0-1 min.
1-3 min. RAPID DISINTEGRATION	1-3 min.
3-6 min. " "	3-6 min.
6-10 min. COMPLETE "	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 ~~or 8~~ hrs. FLAKES AND FINE PARTICLES/MUD	4 or 8 hrs.
3/22 2^{25} pm 24 hrs. " " " " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 47.6g	Final Dry Wt. of +#10 Material + Pan=

Cycle No.:	Cycle No.:
Observations:	Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 80.3

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

F-104

COMBINED SLAKE TEST AND JAR SLAKE TEST

Reference: Landslides Investigationand Mitigation, 1996
Transportation Research Board Special Publication 247, p 559-561

CLIENT: Cal Engineering and Geology
Project: Vasco Rd.
Project No 001860
Date: 3/21/01
2^{25} pm

Boring or Sample No.: B-4
Depth: 64.5'
Wet Wt. + Pan= 257.0 g (should be about 150g)
Initial Dry Wt. +Pan= 228.6 (photograph with mm scale)
Pan No.: F-104
Pan Wt.: 13.6

TAP WATER PH= 8.3
FINAL PH = 8.5

Cycle No.: 1	Cycle No.:
Observations:	Observations:
0-1 min. FLAKING	0-1 min.
1-3 min. DISINTEGRATING + FLAKING	1-3 min.
3-6 min. " "	3-6 min.
6-10 min. " "	6-10 min.
10-30 min. COMPLETE AT 17 MIN ±	10-30 min.
2 hrs.	2 hrs.
4 ~~or 8~~ hrs. FLAKES AND FINE PARTICLES/MUD	4 or 8 hrs.
24 hrs. " " " " "	24 hrs.
Final Dry Wt. of +#10 Material + Pan= 33.4	Final Dry Wt. of +#10 Material + Pan=

3/22 2^{25} pm

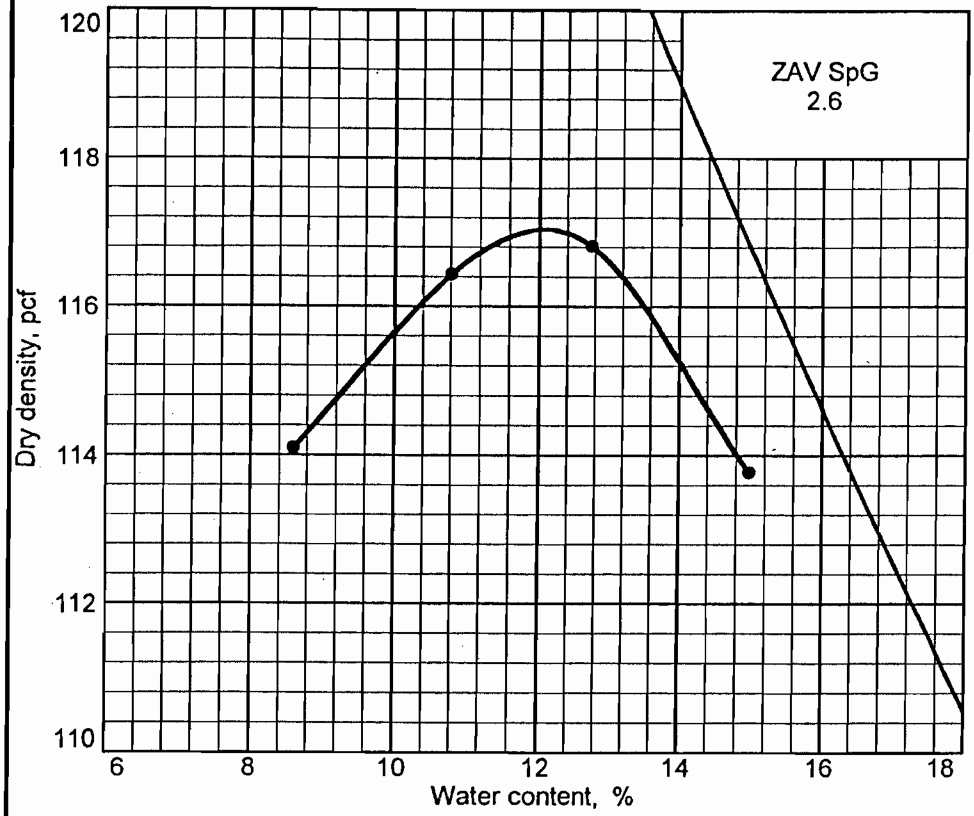
Cycle No.:	Cycle No.:
Observations:	Observations:
0-1 min.	0-1 min.
1-3 min.	1-3 min.
3-6 min.	3-6 min.
6-10 min.	6-10 min.
10-30 min.	10-30 min.
2 hrs.	2 hrs.
4 or 8 hrs.	4 or 8 hrs.
24 hrs.	24 hrs.
Final Dry Wt. of +#10 Material + Pan=	Final Dry Wt. of +#10 Material + Pan=

Slake Index S_I=(Orig. Wt.-Final Wt.) X 100/Orig. Wt.= 85.4

Jar Slake Index I_J= 1

1 - Degrades to a pile of flakes or mud
2 - Breaks rapidly, forms many chips, or both
3 - Breaks slowly, forms few chips, or both
4 - Breaks rapidly, develops several fractures, or both
5 - Breaks slowly, develops few fractures, or both
6 - No change

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>3/8 in. ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.83	8.80	8.74	8.57		
WM	4.44	4.44	4.44	4.44		
WW + T #1	769.80	743.10	666.90	723.10		
WD + T #1	694.00	658.80	609.10	673.50		
TARE #1	99.60	96.00	74.20	97.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	12.8	15.0	10.8	8.6		
DRY DENSITY	116.8	113.8	116.4	114.1		

ROCK CORRECTED TEST RESULTS	**UNCORRECTED**	**Material Description**
Maximum dry density = 117 pcf	117 pcf	light brown clayey SAND
Optimum moisture = 12 %	12 %	

Project No. 331-014 **Client:** Fisher
Project: 001860 / Vasco Road

● **Source:** TP-2 **Elev./Depth:** 0-2'

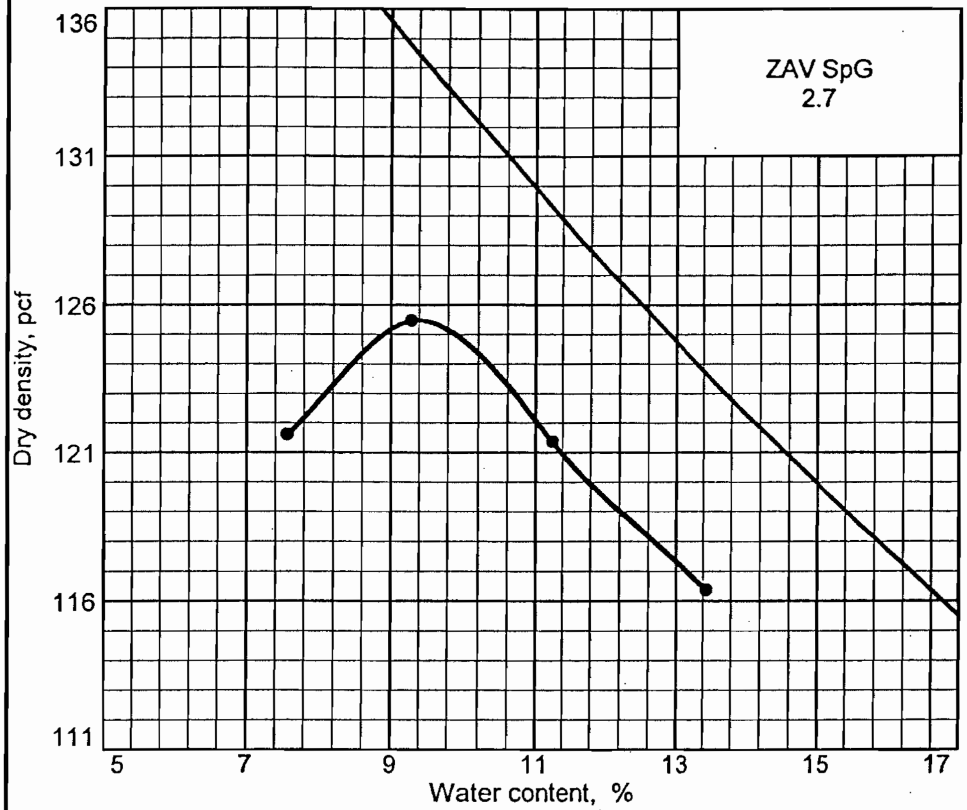
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Plate

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM		**Sp.G.**	
LL		**PI**	
%>3/8 in.		**%<#200**	
USCS		**AASHTO**	

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.94	8.84	9.01	8.80		
WM	4.44	4.44	4.44	4.44		
WW + T #1	807.50	824.10	821.00	576.60		
WD + T #1	741.60	745.00	764.70	544.10		
TARE #1	156.00	156.90	158.70	114.60		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	11.3	13.5	9.3	7.6		
DRY DENSITY	121.4	116.4	125.5	121.6		

ROCK CORRECTED TEST RESULTS	**UNCORRECTED**	**Material Description**
Maximum dry density = 125 pcf	125 pcf	light brown silty SAND
Optimum moisture = 9 %	9 %	

Project No. 331-014 **Client:** Fisher
Project: 001860 / Vasco Road

● **Source:** TP-5 **Elev./Depth:** 0-2'

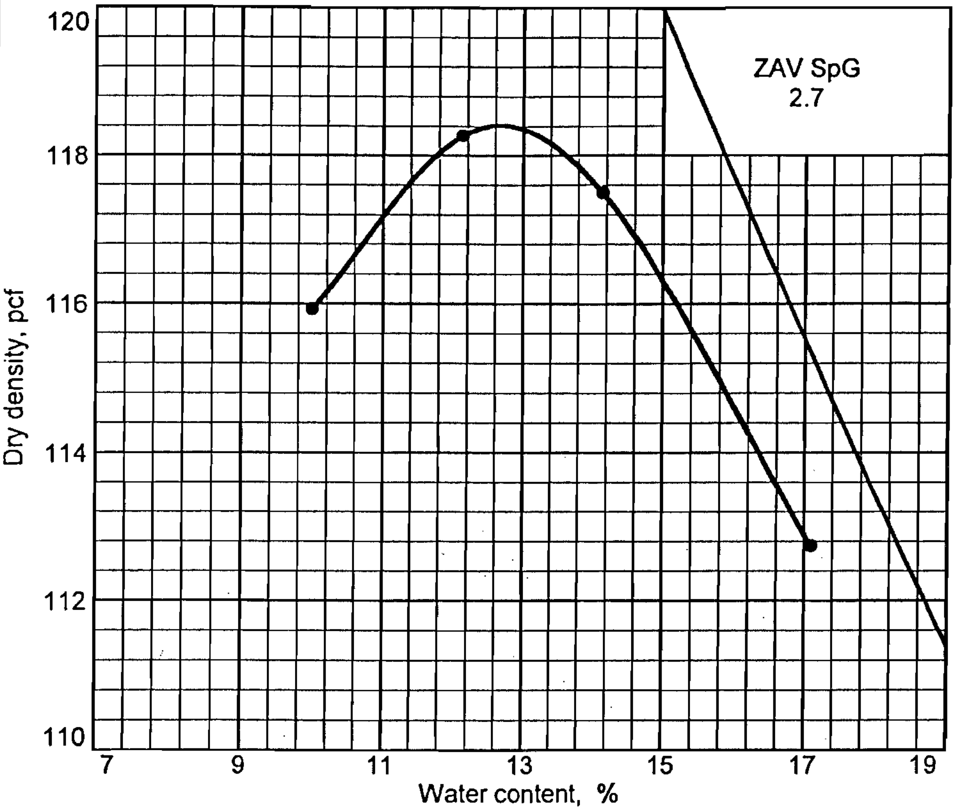
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Plate

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data
NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>3/8 in. ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.86	8.91	8.84	8.69		
WM	4.44	4.44	4.44	4.44		
WW + T #1	722.40	780.40	626.40	634.00		
WD + T #1	652.30	695.60	549.50	585.40		
TARE #1	74.30	96.30	99.70	99.00		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	12.1	14.1	17.1	10.0		
DRY DENSITY	118.3	117.5	112.7	115.9		

ROCK CORRECTED TEST RESULTS	**UNCORRECTED**	**Material Description**
Maximum dry density = 118 pcf	118 pcf	brown sandy CLAY
Optimum moisture = 13 %	13 %	

Project No. 331-014 **Client:** Fisher
Project: 001860 / Vasco Road

● **Source:** B-5 **Elev./Depth:** 30-66

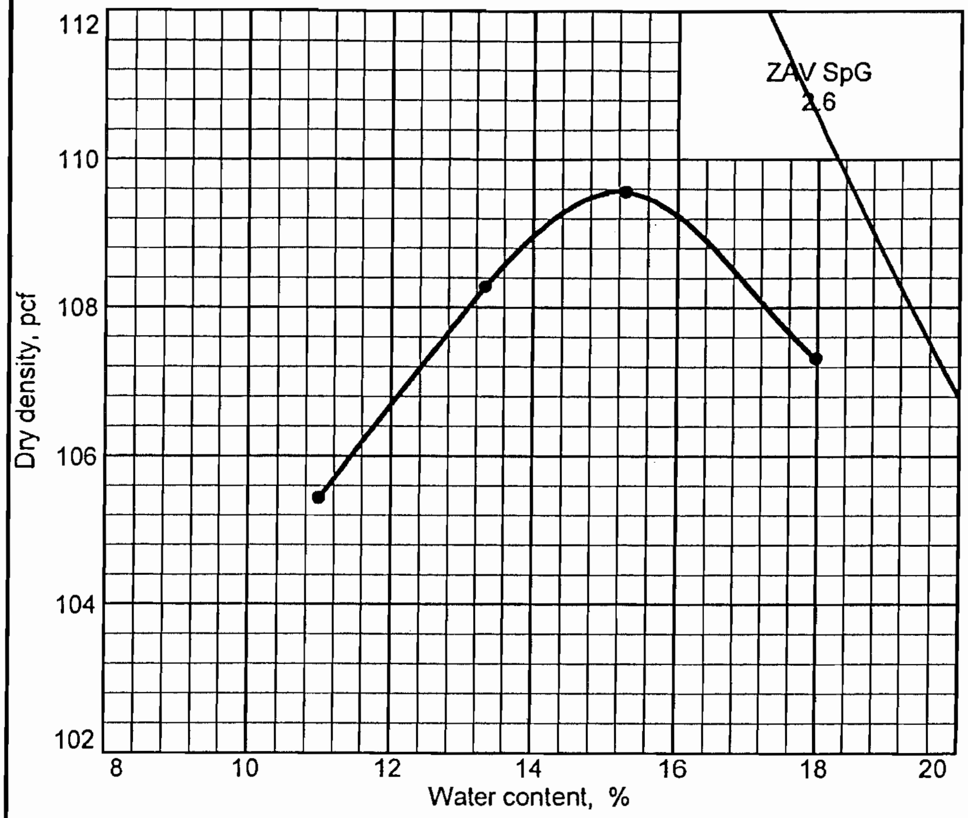
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Plate

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data
NM ____ **Sp.G.** ____
LL ____ **PI** ____
%>3/8 in. ____ **%<#200** ____
USCS ____ **AASHTO** ____

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.34	8.53	8.65	8.66		
WM	4.44	4.44	4.44	4.44		
WW + T #1	673.60	732.60	678.00	696.90		
WD + T #1	622.50	664.70	597.90	602.00		
TARE #1	157.20	155.30	74.20	74.30		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	11.0	13.3	15.3	18.0		
DRY DENSITY	105.4	108.3	109.6	107.3		

ROCK CORRECTED TEST RESULTS	UNCORRECTED	Material Description
Maximum dry density = 110 pcf	110 pcf	white gray clayey SAND
Optimum moisture = 15 %	15 %	

Project No. 331-014 **Client:** Fisher
Project: 001860 / Vasco Road

● **Source:** TP-4 **Elev./Depth:** 0-2

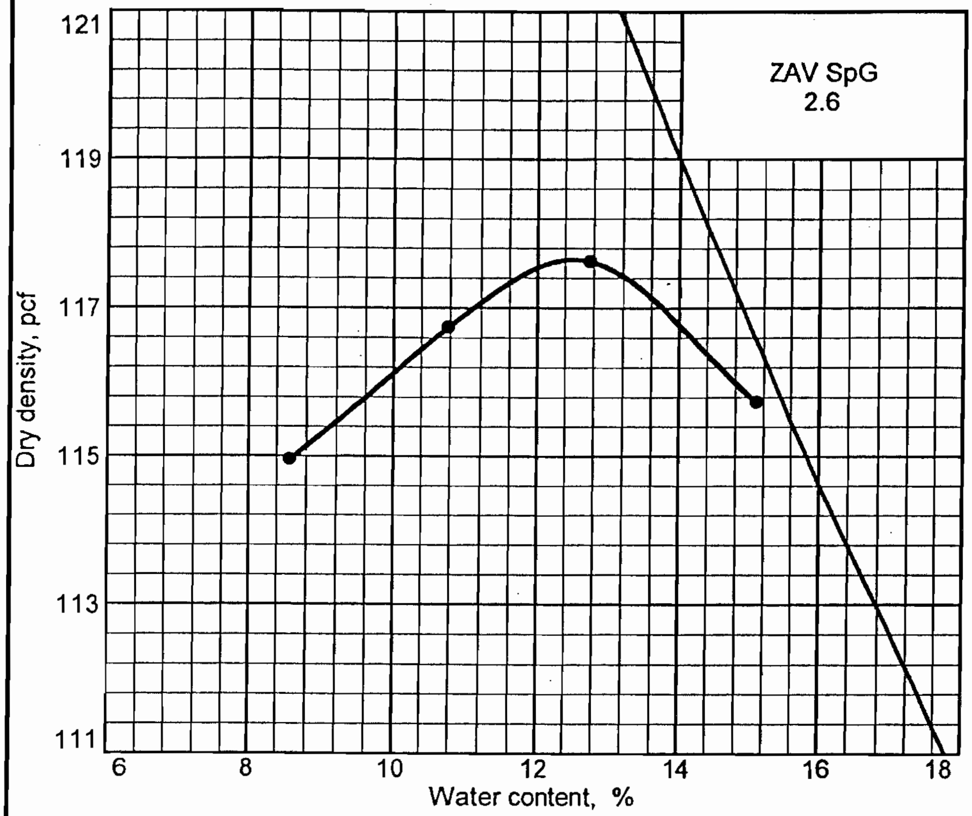
Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Plate

COMPACTION TEST REPORT



Curve No.

Test Specification:
ASTM D 1557-91 Procedure B Modified
Oversize correction applied to each point

Hammer Wt.: 10 lb.
Hammer Drop: 18 in.
Number of Layers: five
Blows per Layer: 25
Mold Size: .03333 cu.ft.
Test Performed on Material Passing 3/8 in. **Sieve**

Soil Data

NM ______ **Sp.G.** ______
LL ______ **PI** ______
%>3/8 in. ______ **%<#200** ______
USCS ______ **AASHTO** ______

TESTING DATA

	1	2	3	4	5	6
WM + WS	8.75	8.86	8.88	8.60		
WM	4.44	4.44	4.44	4.44		
WW + T #1	590.60	696.80	718.80	664.80		
WD + T #1	542.60	635.40	645.00	624.90		
TARE #1	96.90	153.70	156.20	159.50		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	10.8	12.7	15.1	8.6		
DRY DENSITY	116.7	117.6	115.7	115.0		

ROCK CORRECTED TEST RESULTS	UNCORRECTED	Material Description
Maximum dry density = 118 pcf	118 pcf	gray clayey SAND
Optimum moisture = 13 %	13 %	

Project No. 331-014 **Client:** Fisher
Project: 001860 / Vasco Road

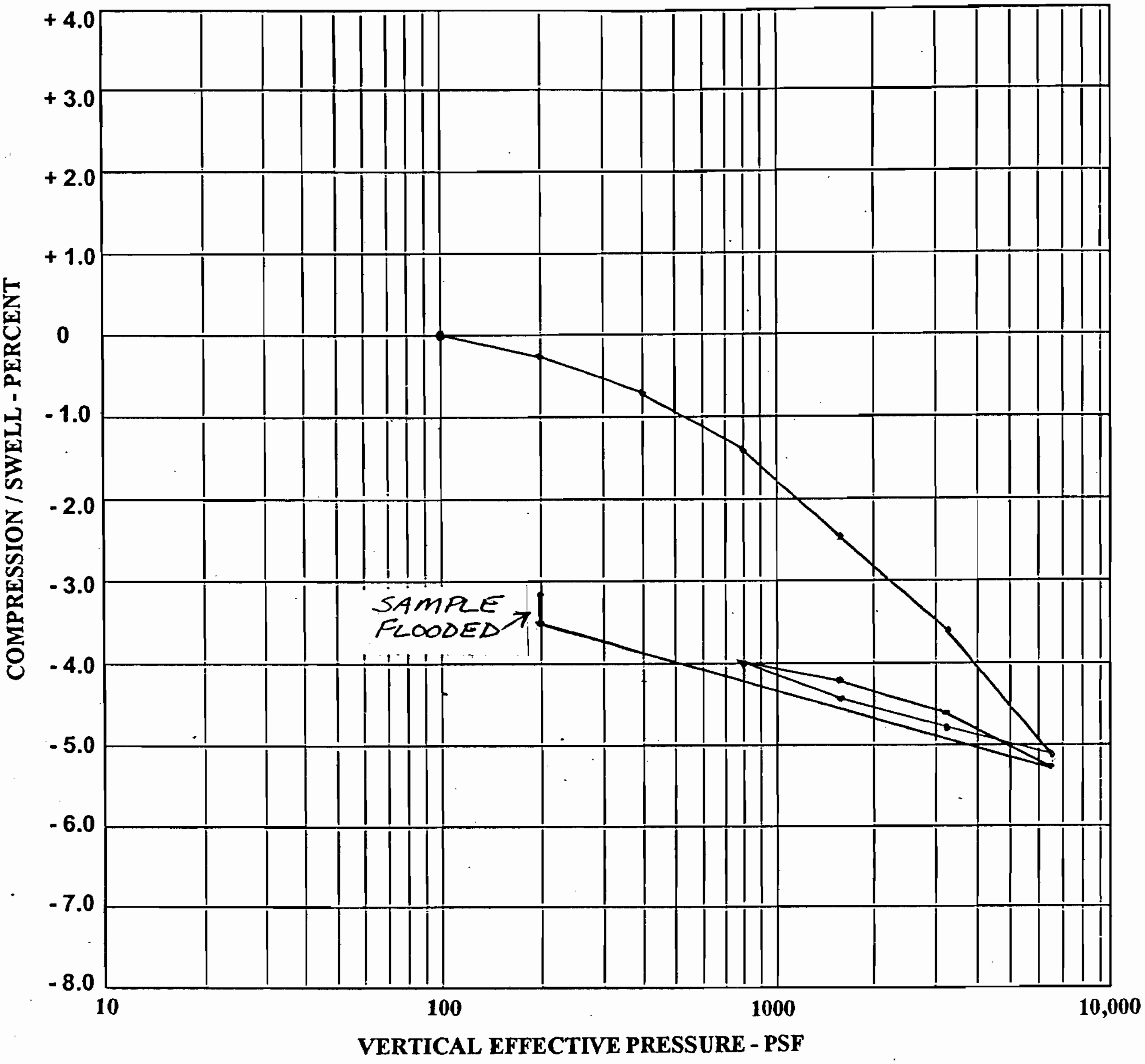
● **Source:** B3 + B4 **Elev./Depth:** 30-40'

Remarks:

COMPACTION TEST REPORT

COOPER TESTING LABORATORY

Plate



BORING NO: B-4

DEPTH (ft): 35.5'

ELEVATION (ft):

DESCRIPTION: OLV AND GRY W/YEL BRN CLAYSTONE

SAMPLE DIAMETER (in): 2.42

SPECIFIC GRAVITY (Gs): 2.70(E)

LIQUID LIMIT (%):

PLASTICITY INDEX (%):

	INITIAL	FINAL
DRY DENSITY (pcf)	112.8	116.5
MOISTURE CONTENT (%)	17.0	18.9
VOID RATIO	0.494	0.446
DEGREE OF SATURATION (%)	93	100
HEIGHT (in)	0.9836	0.9525

$C_c = 0.60$ $C_r = 0.018$

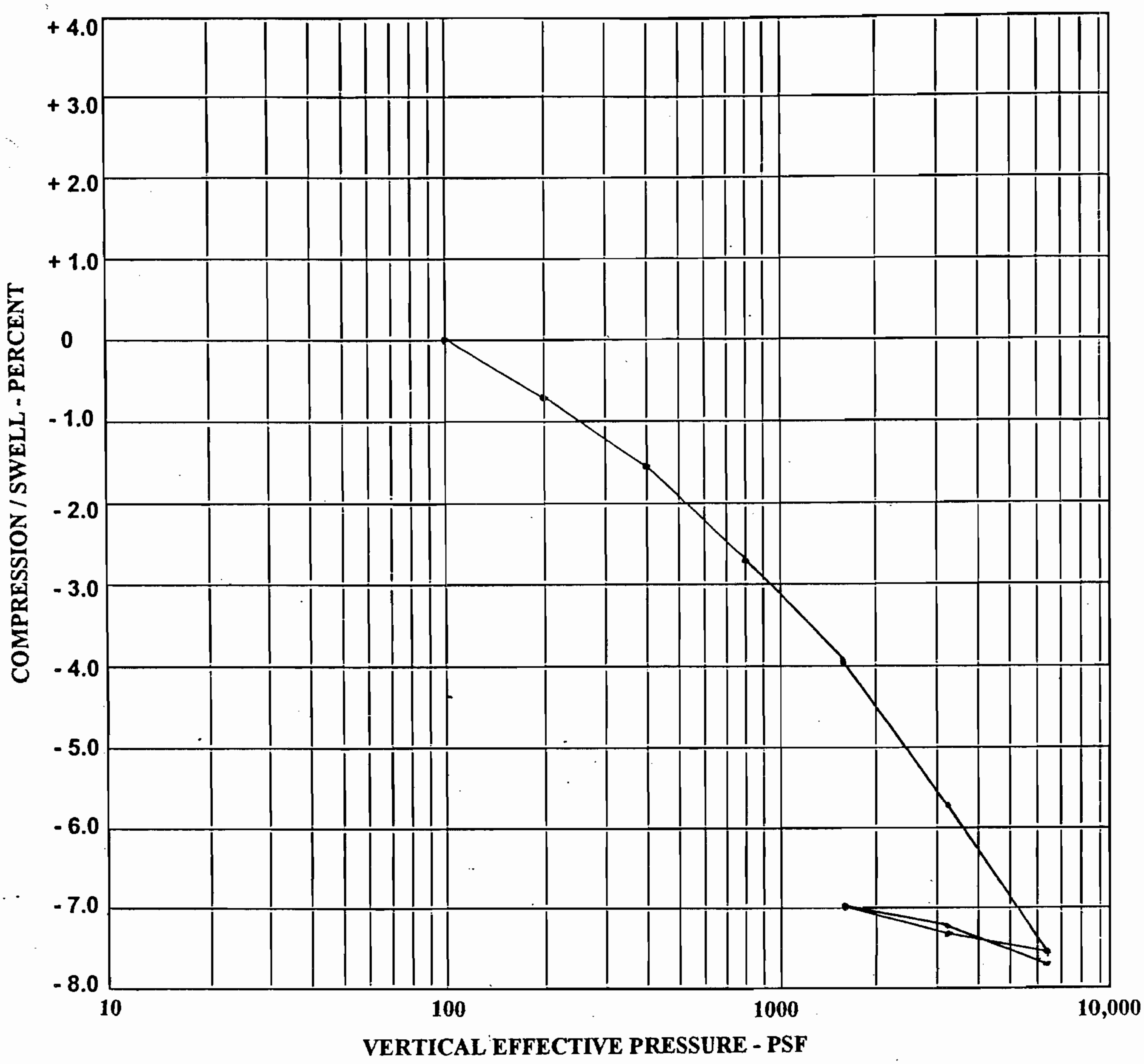
COMPRESSION / SWELL TEST DATA

VASCO RD.

PROJECT NO.: 001860

DATE: 3/16/01

FIGURE:



BORING NO: B-8	
DEPTH (ft): 8.5'	ELEVATION (ft):
DESCRIPTION: DK YEL BRN CLAYEY SAND (SC) (43% FINES)	
SAMPLE DIAMETER (in): 2.42	SPECIFIC GRAVITY (Gs): 2.70(E)
LIQUID LIMIT (%):	PLASTICITY INDEX (%):

	INITIAL	FINAL
DRY DENSITY (pcf)	113.4	122.9
MOISTURE CONTENT (%)	15.4	16.6
VOID RATIO	0.446	0.371
DEGREE OF SATURATION (%)	93	100
HEIGHT (in)	0.9988	0.9219

$C_c = 0.082$ $C_r = 0.014$

COMPRESSION / SWELL TEST DATA

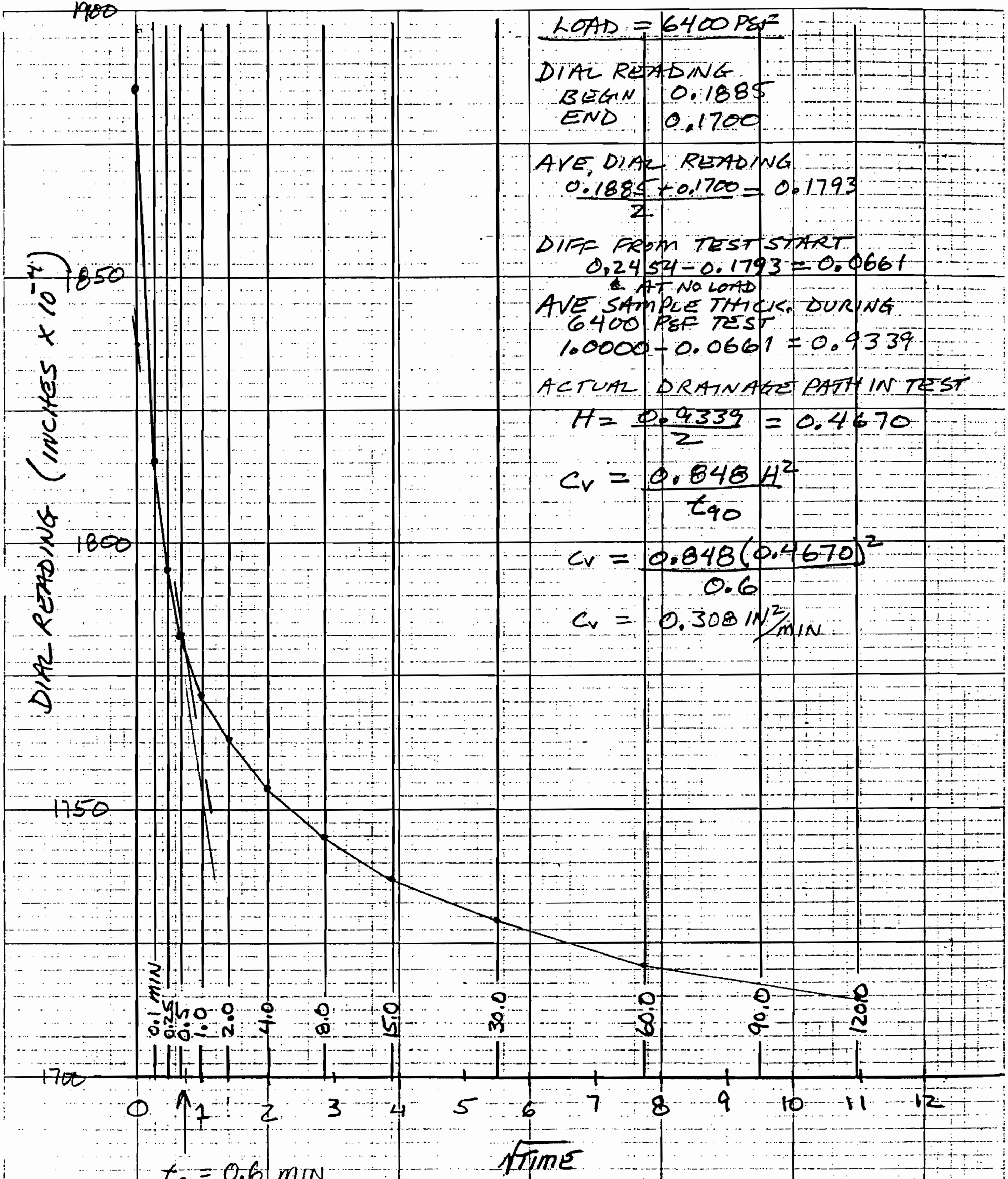
VASCO RD.

PROJECT NO.	DATE	FIGURE:
001860	3/13/01	

BY______ DATE______ SUBJECT VASCO RD B-8@8.5' SHEET NO.______ OF____

CHKD. BY____ DATE______ COMPRESSION TEST DATA JOB NO. 001860

DEFLECTION VS √TIME PLOT



LOAD = 6400 PSF

DIAL READING
BEGIN 0.1885
END 0.1700

AVE. DIAL READING

$$\frac{0.1885+0.1700}{2} = 0.1793$$

DIFF FROM TEST START

0.2454 − 0.1793 = 0.0661

↑ AT NO LOAD

AVE SAMPLE THICK. DURING 6400 PSF TEST

1.0000 − 0.0661 = 0.9339

ACTUAL DRAINAGE PATH IN TEST

$$H = \frac{0.9339}{2} = 0.4670$$

$$C_v = \frac{0.848\,H^2}{t_{90}}$$

$$C_v = \frac{0.848(0.4670)^2}{0.6}$$

C_v = 0.308 IN²/MIN

t_{90} = 0.6 MIN

COOPER TESTING LABORATORIES

R-VALUE TEST

JOB #: 331-014B
DATE: 3/09/2001
CLIENT: Fisher Engineers / 001860
SAMPLE #: TP-5 @ 0-2'
SOIL TYPE: brown clayey SAND with gravel

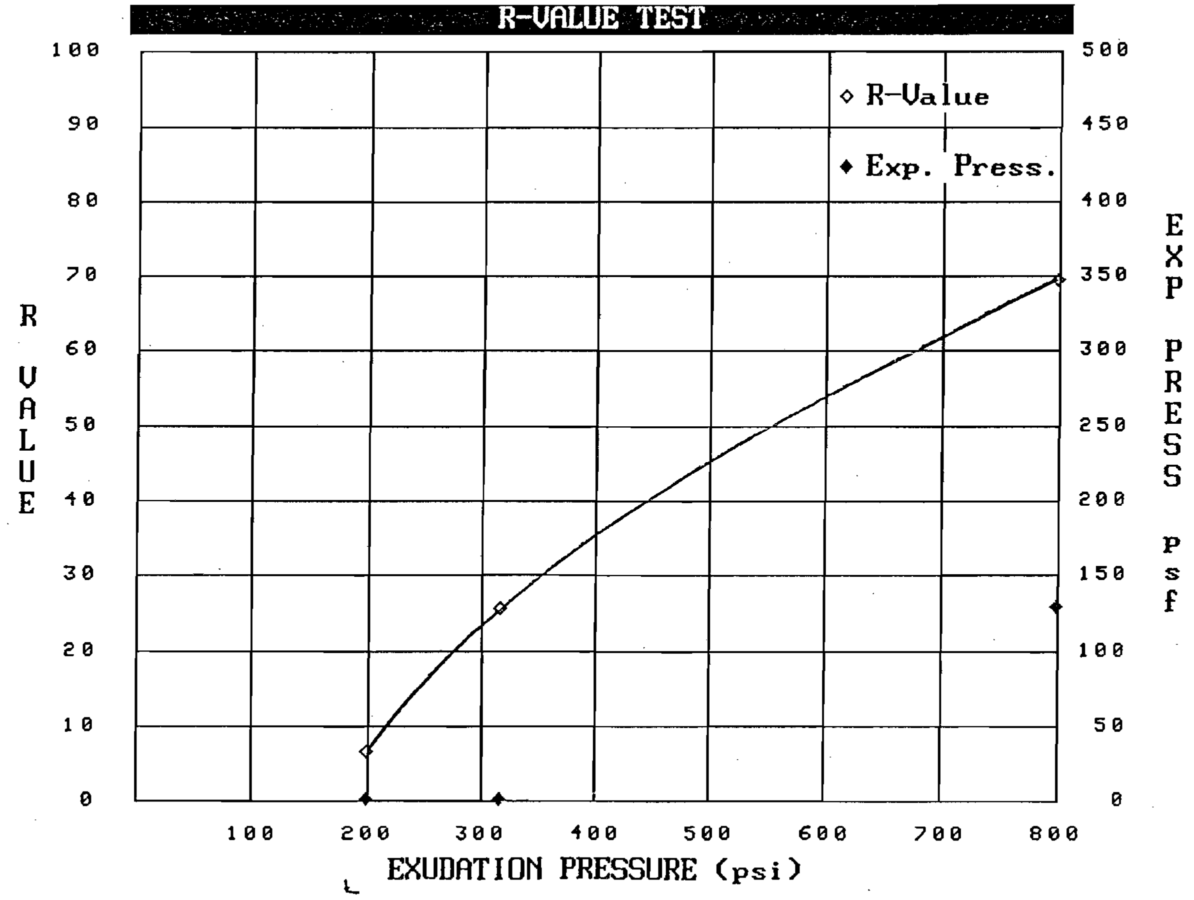
DISH WEIGHT: 36.2
WET: 149.1
DRY: 141.5
INITIAL MOSITURE: 0.0722

SPECIMEN	A	B	C	D
EXUDATION PRESSURE (psi)	800	317	201	0
PREPARED WEIGHT (gm)	1200	1200	1200	1200
FINAL WATER ADDED (gm)	30	60	90	0
WEIGHT, SOIL & MOLD (gm)	3185	3251	3246	0
WEIGHT, MOLD (gm)	2107	2110	2104	0
HEIGHT (in)	2.41	2.63	2.66	0.00
MOISTURE CONTENT (%)	9.9	12.6	15.3	0.0
DRY DENSITY (pcf)	123.2	116.7	112.8	0.0
EXPANSION DIAL	30	0	0	0
EXPANSION PRESSURE (psf)	129	0	0	0
STABILOMETER @ 2000 lb	34	106	144	0
TURNS DISPLACEMENT	3.65	3.93	4.14	0.00
R-VALUE	72	24	6	0
R-VALUE (corrected)	69	25	6	0

VALUES AT 300 EXUDATION

R-VALUE: 23
EXP. PRESSURE: 0

REMARKS



COOPER TESTING LABORATORIES

R-VALUE TEST

OB #: 331-014
DATE: 3/09/2001
CLIENT: Fisher Engineers / 001860
SAMPLE #: TP-2 @ 0-2'
SOIL TYPE: brown clayey SAND

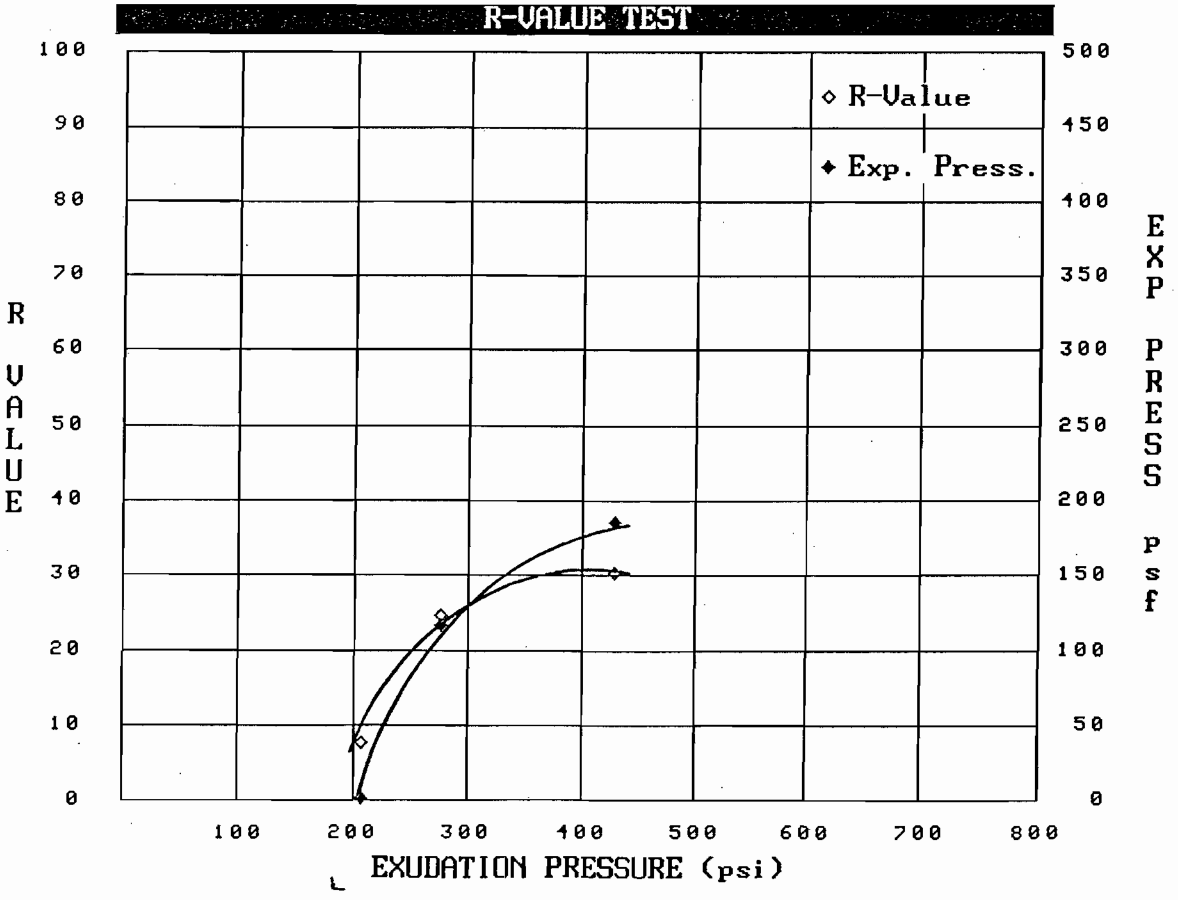
DISH WEIGHT: 42.3
WET: 171.3
DRY: 153.4
INITIAL MOSITURE: 0.1611

SPECIMEN	A	B	C	D
EXUDATION PRESSURE (psi)	209	279	432	0
PREPARED WEIGHT (gm)	1200	1200	1200	1200
FINAL WATER ADDED (gm)	60	30	15	0
WEIGHT, SOIL & MOLD (gm)	3158	3187	3208	0
WEIGHT, MOLD (gm)	2075	2101	2095	0
HEIGHT (in)	2.65	2.55	2.60	0.00
MOISTURE CONTENT (%)	21.9	19.0	17.6	0.0
DRY DENSITY (pcf)	101.5	108.4	110.3	0.0
EXPANSION DIAL	0	27	43	0
EXPANSION PRESSURE (psf)	0	116	185	0
STABILOMETER @ 2000 lb	142	110	102	0
TURNS DISPLACEMENT	3.94	3.56	3.36	0.00
R-VALUE	7	24	30	0
R-VALUE (corrected)	8	24	30	0

VALUES AT 300 EXUDATION

R-VALUE: 25
EXP. PRESSURE: 125

REMARKS



COOPER TESTING LABORATORIES

R-VALUE TEST

B #: 331-014A
DATE: 3/09/2001
CLIENT: Fisher Engineers / 001860
SAMPLE #: TP-4 @ 0-2'
SOIL TYPE: brn. silty SAND slighty
clayey(weather sandstone)

DISH WEIGHT: 42.9
WET: 163.0
DRY: 145.7
INITIAL MOSITURE: 0.1683

SPECIMEN	A	B	C	D
EXUDATION PRESSURE (psi)	131	197	504	0
PREPARED WEIGHT (gm)	1200	1200	1200	1200
FINAL WATER ADDED (gm)	60	30	15	0
WEIGHT, SOIL & MOLD (gm)	3159	3115	3103	0
WEIGHT, MOLD (gm)	2117	2090	2081	0
HEIGHT (in)	2.61	2.51	2.47	0.00
MOISTURE CONTENT (%)	22.7	19.7	18.3	0.0
DRY DENSITY (pcf)	98.5	103.3	105.9	0.0
EXPANSION DIAL	0	2	16	0
EXPANSION PRESSURE (psf)	0	9	69	0
STABILOMETER @ 2000 lb	122	66	49	0
TURNS DISPLACEMENT	4.35	4.22	4.00	0.00
R-VALUE	15	46	59	0
R-VALUE (corrected)	16	46	57	0

VALUES AT 300 EXUDATION

R-VALUE: 55
EXP. PRESSURE: 20

REMARKS

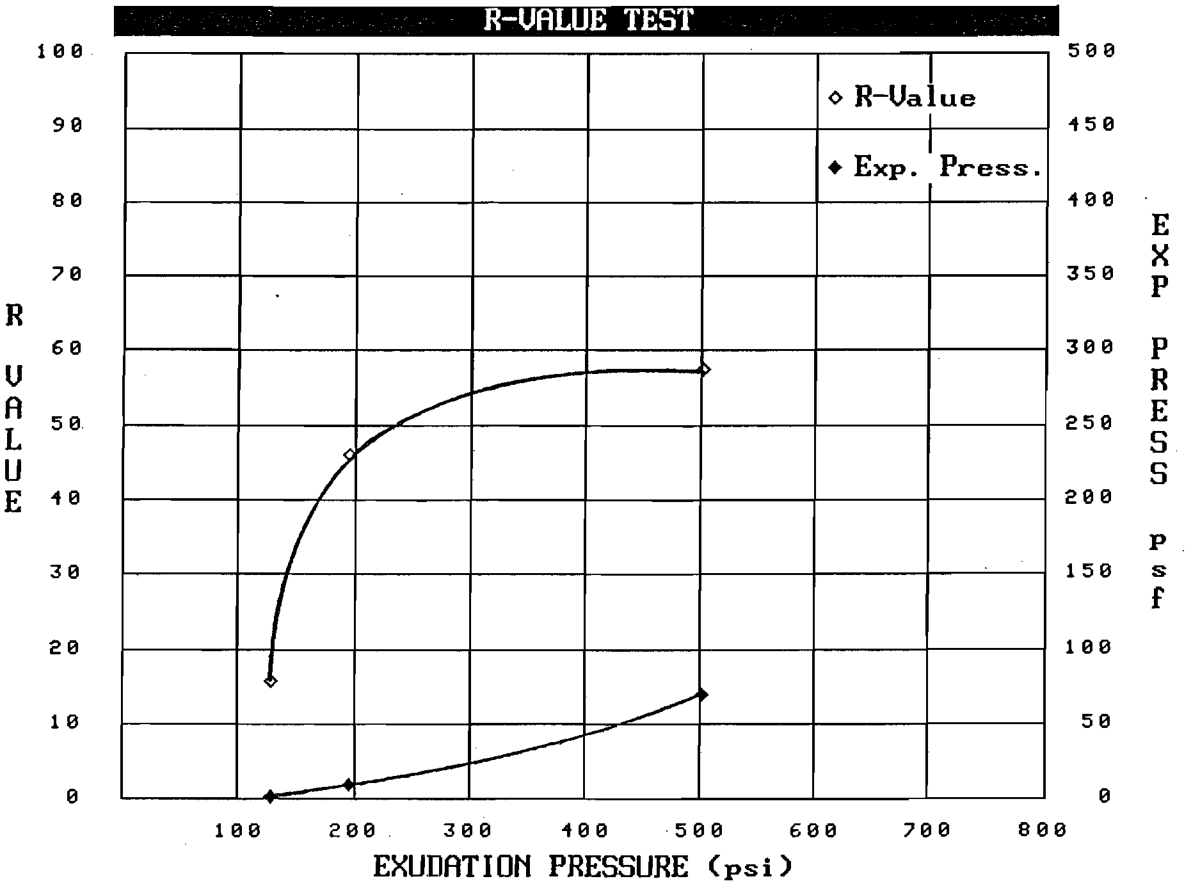


TABLE F-1 SUMMARY OF LABORATORY TEST RESULTS

	Depth		Moisure-Density			Atterberg Limits		Hydrometer	#200 wash (percent passing)	Unconfined Compression			Direct Shear Test						UU- Triaxial Test			Slake Test		Compaction Test (ASTM D1557-91)			Consolidation Test				R- Value Test	Corrosivity Testing				
Boring	ft	m	moisture	Dry Den (pcf)	Dry Den (kg/m3)	LL	PI	<.005mm		q_u (PSF)	q_u (kPa)	% strain	phi-peak	C-peak (psf)	C-peak (kPa)	phi-ult	C-ult (psf)	C-ult (kPa)	C (ksf)	C (kPa)	phi	S_i	I_i	max dry den (psf)	max dry den (kg/m3)	w % optimum	Coeff of Consol (Cv) in2/min	(Cv) cm2/min	Compression Index (Cc)	Recompression Index (Cr)		Soil pH	Min Resistivity (ohm-cm)	Elec Conductivity (micro-mhos/cm)	Sulfate SO4 (ppm)	Chloride CL (ppm)
B-1	5.5	1.7	17.8	103.5	1658					1572	75.3	1.6																								
	13.5	4.1	21.5	104.1	1668					1668	79.9	1.2																								
	29.5	9.0	19.6	111.3	1783					1783	85.4	1.5																								
B-2	17.5	5.3	23.3	104.6	1675	42	24			1228	58.8	1.7																								
	19.0	5.8	17.8	111.3	1783					1783	85.4	1.3																								
	26.5	8.1	17.5	112.7	1805					1805	86.4	2.2																								
	35.0	10.7	20.4	107.1	1716					1715	82.1	1.8																								
	39.5	12.0	18.6	113.9	1825					1825	87.4	1.6																								
	47 to 48	14.3 to 14.6																	3.8	181.9	17.8															
	48.5	14.8	11.3	128.8	2063					2063	98.8	4.1																								
	55.0	16.8	17.2	116.4	1865					1865	89.3	3.9																								
	69.0	21.0	13.3	114.9	1841					1840	88.1	2.1																								
B-3	8.5	2.6	14.6	116.6	1868					10402	498.1	1.8																								
	14.0	4.3	18.9	104.1	1668	45	26			5290	253.3	1.8																								
	21.5	6.6	15.9	115.2	1845	42	26			5290	253.3	2																								
	29.5	9.0	18.6																			87.4	1													
	35.0	10.7	18.8	113.4	1816	50	31			1284	61.5	1.7																								
	45.5	13.9	17.0																			88.5	1													
	46.5	14.2	33.2	90	1442	99	79	73		1317	63.1	2.1																								
	47.0	14.3											20	720	34.5	8	292	14.0																		
	58.0	17.7	25.3	99.6	1595	75	54			5469	261.9	1.8																								
	62.0	18.9	30.2	94.5	1514	86	63	40		3080	147.5	2.2																								
	71.5	21.8	17.4	114	1826	51	30			5512	263.9	1.8																								
	82.0	25.0	17.3	114.4	1833	56	38			3387	162.2	1																								
B-4	3.0	0.9	10.8	115.4	1849					3556	170.3	2.3																								
	12.0	3.7	25.0	100.1	1603	65	47			2324	111.3	1.3																								
	14.0	4.3	12.7	120.8	1935					4958	237.4	2																								
	17.0	5.2	24.8																			85.1	1													
	17.5	5.3	27.9	94.9	1520	56	35	42		1226	58.7	3.3																								
	27.0	8.2	24.6	100.8	1615					2371	113.5	3.5																								
	27.0	8.2	22.5																			78.4	1													
	28.0	8.5											25	474	22.7	29	104	5.0																		
	30.0	9.1	21.3	107.3	1719	45	27	52		1240	59.4	1.7																								
	35.5	10.8																												0.060	0.018						
	37 to 38	11.3 to 11.6																	1.36	65.1	9.6															
	39.0	11.9	18.6	112.2	1797	47	27			5042	241.4	1.7																								
	40.0	12.2											26	538	25.8	26	538	25.8																		
	44.0	13.4	17.3	115.7	1853	42	22	58		2254	107.9	0.8																								
	44.5	13.6	17.2																			80.3	1													
	49.0	14.9	18.3	112.5	1802					6234	298.5	6																								
	56.0	17.1	17.2	114.9	1841	41	25			3227	154.5	4																								
	62.5	19.1											35	1543	73.9	32	199	9.5																		
	64.5	19.7	13.8	120.7	1933	36	24			13236	633.7	1.9																								
	64.5	19.7	13.2																			85.4	1													
	66.5	20.3	19.4	111.7	1789	46	31			11400	545.8	5.2																								
	70.5	21.5	17.3	115.4	1849	35	23	40		13326	638.1	3.7																								
	75.5	23.0	17.5	115.1	1844					17206	823.8	5.7																								
	79.5	24.2	15.5	117.9	1889	39	26			11804	565.2	5.4																								
	83.4	25.4	16.6	114.6	1836					17723	848.6	2.3																								
B-5	0.5	0.2																														6.58	1140	[880]	54	5
	8.0	2.4	25.5	97.9	1568					3309	158.4	2.3																								
	25.0	7.6																														6.5	1520	[660]	117	5
	27.0	8.2	18.7	113.3	1815					4062	194.5	4.2																								
	31.5	9.6																														6.87	1280	[782]	312	8
	36.5	11.1	11.0	128.2	2054					6583	315.2	1.3																								
	41.0	12.5	19.9	110.6	1772					11541	552.6	2.5																								
	44.0	13.4																														6.67	1520	[658]	105	6
	44.5	13.6											38	419	20.1	35	122	5.8																		
	47.5	14.5	17.9	114.2	1829					8370	400.8	2.3																								
	55.0	16.8	19.0	112.3	1799					10645	509.7	4.9																								
	62.0	18.9											34	1105	52.9	35	0	0.0																		
	62.5	19.1	16.9	115.7	1853					10714	513.0	1.7																								
	66.5	20.3	17.1	115.9	1857					14620	700.0	2.8																								
	69.5	21.2																														6.41	1020	[982]	840	6
	75.0	22.9	15.2	117.5	1882					12042	576.6	1.9																								
	79.0	24.1																														5.71	909	[1100]	1800	9
	80.5	24.5	14.6	115.7	1853					10213	489.0	1.9																								
	81.5																															5.96	943	[1060]	1860	7
	84.5																															5.69	2020	[494]	105	24
	30 to 66	9.1 to 20.1																						118	1890	13										
B-6	6.5	2.0																														7.05	1690	[591]	<1	<1
	17.5	5.3	15.0	115.2	1845																															
	18.5	5.6																														6.31	3250	[308]	24	5
	28.5	8.7	18.5	105.4	1688					2479	118.7	2.2																								
B-7	13.0	4.0	5.8	134.1	2148					31512	1508.8	0.9																								
	18.0	5.5	8.6	131.8	2111					22284	1067.0	1.3																								

TABLE F-1 SUMMARY OF LABORATORY TEST RESULTS

	Depth		Moisure-Density			Atterberg Limits		Hydrometer		Unconfined Compression			Direct Shear Test						UU- Triaxial Test			Slake Test		Compaction Test (ASTM D1557-91)			Consolidation Test				R- Value Test	Corrosivity Testing				
Boring	ft	m	moisture	Dry Den (pcf)	Dry Den (kg/m3)	LL	PI	<.005mm	#200 wash (percent passing)	q_u (PSF)	q_u (kPa)	% strain	phi-peak	C-peak (psf)	C-peak (kPa)	phi-ult	C-ult (psf)	C-ult (kPa)	C (ksf)	C (kPa)	phi	S_i	I_i	max dry den (psf)	max dry den (kg/m3)	w % optimum	Coeff of Consol (Cv) in2/min	(Cv) cm2/min	Compression Index (Cc)	Recompression Index (Cr)		Soil pH	Min Resistivity (ohm-cm)	Elec Conductivity (micro-mhos/cm)	Sulfate SO4 (ppm)	Chloride CL (ppm)
B-8	3.0	0.9	8.9	101.9	1632																															
	6.0	1.8	9.6	114.2	1829																															
	8.5	2.6	14.4	108.8	1743				43																		0.308 (@6400psf)	1.99 (@306kPa)	0.082	0.014						
	10.5	3.2	21.6	105.7	1693																															
	11.0	3.4	9.1	123.7	1981																															
	13.5	4.1	11.0	117.7	1885																															
	15.3	4.6	15.9	114.2	1829					1763	84.4	1.9																								
	18.5	5.6	15.9	115.3	1847					1633	78.2	1.9																								
	20.0	6.1	18.0	109.6	1756																															
B-9	3.5	1.1	13.0	112.4	1800																															
B-10	6.5	2.0	5.4	112.8	1807																															
	10.0	3.0	6.0	117.5	1882																															
	14.5	4.4	15.0	106.7	1709								46	184	8.8	35.8	0	0.0																		
B-11	2.5	0.8	6.0	110.1	1764																															
	5.0	1.5	8.0	118.4	1897																															
B-12	3.5	1.1	4.3	114.3	1831																															
	5.5	1.7	5.7	122.3	1959																															
	10.5	3.2	4.8	128.2	2054																															
B-13	3.5	1.1	16.8	106.8	1711																															
	5.0	1.5																														3.05	3310	[3022]	69	42
	5.5	1.7	17.5	101.7	1629																															
	10.5	3.2	6.9	110.8	1775																															
B-14	3.0	0.9	10.2	114.4	1833																															
	9.0	2.7	18.6	110.7	1773					18364	879.3	4.9																								
	14.0	4.3	21.2	105.2	1685					6415	307.2	6.1																								
	19.0	5.8	16.9	104	1666																															
B-15	1.0	0.3	4.5	101.8	1631																															
	6.0	1.8	6.8	111.4	1784																															
	10.0	3.0	7.5	122.4	1961																															
TP-1																																6.46	2410	[415]	45	8
TP-2																								117	1874	12					25					
TP-4																								110	1762	15					55					
TP-5																								125	2002	9					23	3.8	4880	[205]	81	33
B-3 and B-4																								118	1890	13										

Appendix G

E T S

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COMPANY: Fisher Civil & Geotech. Eng., 1746 San Migule Drive, Walnut Creek, CA 94596
ATTN: Ray Fisher
JOB SITE: Vasco Road, Livermore, California.
JOB #: 001860

DATE RECEIVED	DATE of COMPLETION	ANALYST(S)	SUPERVISOR
2/13/01	2/21/01	S. Theodore S. Banwait	D. Jacobson LAB DIRECTOR G.S. Conrad PhD

LAB SAMPLE NUMBER	SAMPLE ID	DESCRIPTION of SOIL and/or SEDIMENT	SOIL pH -log[H+]	MINIMUM RESISTIVITY ohm-cm	ELECTRICAL CONDUCTIVITY μmhos/cm	SULFATE SO4 ppm	CHLORIDE Cl ppm
01-02-0192	VR1	B-5 @ 0.5'	6.58	1140	[880]	54	5
01-02-0193	VR2	B-5 @ 25.0'	6.50	1520	[660]	117	5
01-02-0194	VR3	B-5 @ 31.5'	6.87	1280	[782]	312	8
01-02-0195	VR4	B-5 @ 44.0'	6.67	1520	[658]	105	6
01-02-0196	VR5	B-5 @ 69.5'	6.41	1020	[982]	840	6
01-02-0197	VR6	B-5 @ 79.0'	5.71	909	[1100]	1800	9
01-02-0198	VR7	B-5 @ 81.5'	5.96	943	[1060]	1860	7
01-02-0199	VR8	B-5 @ 84.5'	5.69	2020	[494]	105	24
Method	Detection	Limits —>	—	1	0.1	1	1

LAB SAMPLE MBER	SAMPLE ID	DESCRIPTION of SOIL and/or SEDIMENT	SALINITY ECe mmhos/cm	SOLUBLE SULFIDES (S=) ppm	SOLUBLE CYANIDES (CN=) ppm	REDOX mV	PERCENT MOISTURE %
Method	Detection	Limits —>	—	0.1	0.1	1	0.1

******************************** COMMENTS *********************************

Resistivities vary all the way from around 900 to 2000 ohm-cm, and pHs are in the 5-7 range; a few sulfates are high, but all chlorides are very low. The Cal Trans times to perforation for 18 ga and 12 ga, respectively, for these are as follows: VR1 @ 13.4 & 29.4 yrs; VR2 @ 14.5 & 31.8 yrs; VR3 @ 16.9 & 43.7 yrs; VR4 @ 15.8 & 34.8 yrs; VR5 @ 11.4 & 25.2 yrs; VR6 @ 7.1 and 15.7 yrs; VR7 @ 8.5 and 18.6 yrs; plus VR8 @ 11.8 and 26.0 yrs. As you can see, most of these are mediocre times at best being in the -17 yr range for 18 ga; and two samples have poor perf times at less than 10 years. All chlorides are very low, and thus are not a problem in the least. The situation is a little more complicated for sulfates. Two sulfates are fairly high approaching 2,000 ppm which is the minimum considered to be problematic in terms of producing gypsification of cement and concrete. Note that both of these samples also had low (i.e., acidic) pHs and resistivities below 1,000 ohm-cm resulting in two of the under 10 yr times; and VR8 also had a less than 6 pH in this series of samples. Lime stabilization at depth may not be as practical as adjusting the concrete mix to accommodate the harsher conditions at depth in order to protect reinforcement; and/or changing the type of construction metal, or thickness, to resist acid attack. The average time to perf. for the B-5 series is about 12.5 yrs; also, notice the change in pH (perf. times) at about 80 feet.

\\\\NOTES: Methods are from following sources: extractions by Cal Trans protocols as per Cal Test 417 (SO4), 422 (Cl), a 532/643 (pH & resistivity); &/or by ASTM Vol. 4.08 & ASTM Vol. 11.01 (=EPA Meth Chem Anal, or Standard Methods); p ASTM G 51; Spec. Cond. - ASTM D 1125; resistivity - ASTM G 57; redox - Pt probe/ISE; sulfate - extraction Title 22, detection ASTM D 516 (=EPA 375.4); chloride - extraction Title 22, detection ASTM D 512 (=EPA 325.3); sulfides - extrac. Title 22, detection EPA 376.2 (=SMEWW 4500-S D); cyanides - extraction Title 22, detection ASTM D 4374 (=EPA 335.2).

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COMPANY: Fisher Civil & Geotech. Eng., 1746 San Miguel Drive, Walnut Creek, CA 94596
ATTN: Ray Fisher
JOB SITE: Vasco Road, Livermore, California.
JOB #: 001860

DATE RECEIVED	DATE of COMPLETION	ANALYST(S)	SUPERVISOR
3/6/01	3/12/01	S. Theodore S. Banwait	D. Jacobson LAB DIRECTOR G.S. Conrad PhD

LAB SAMPLE NUMBER	SAMPLE ID	DESCRIPTION of SOIL and/or SEDIMENT	SOIL pH -log[H+]	MINIMUM RESISTIVITY ohm-cm	ELECTRICAL CONDUCTIVITY µmhos/cm	SULFATE SO4 ppm	CHLORIDE Cl ppm
01-02-0192	VR9	B-6 @ 6.5'	7.05	1690	[591]	<1	<1
01-02-0194	VR10	B-6 @ 18.5'	6.31	3250	[308]	24	5
01-02-0196	VR11	B-13 @ 5'	3.05	3310	[3022]	69	42
01-02-0198	VR12	TP-1 @ 2-65'	6.46	2410	[415]	45	8
01-02-0198	VR13	TP-5 @ 0-4'	3.80	4880	[205]	81	33
Method	Detection	Limits —>	—	1	0.1	1	1

LAB SAMPLE NUMBER	SAMPLE ID	DESCRIPTION of SOIL and/or SEDIMENT	SALINITY ECe mmhos/cm	SOLUBLE SULFIDES (S=) ppm	SOLUBLE CYANIDES (CN=) ppm	REDOX mV	PERCENT MOISTURE %
Method	Detection	Limits —>	—	0.1	0.1	1	0.1

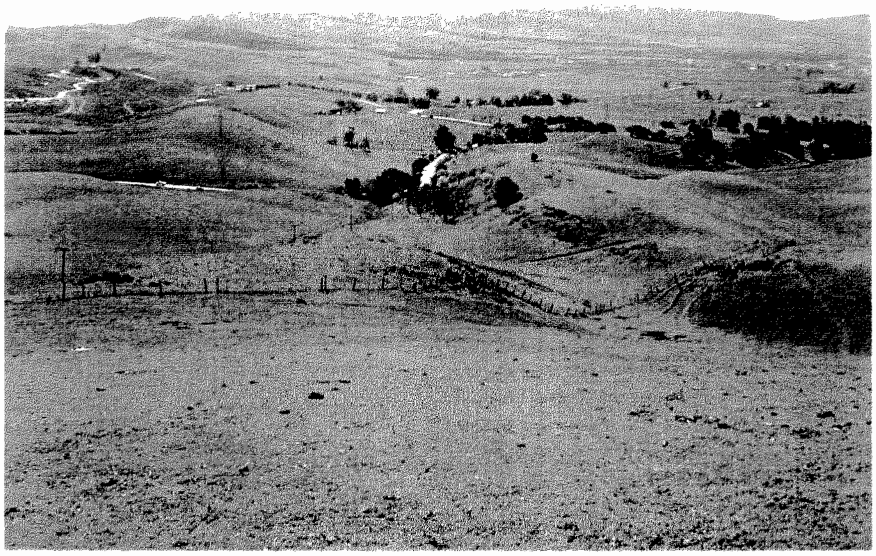
******************************** COMMENTS ********************************

Resistivities are all well over 1,000 ohm-cm, but pHs vary from 3 to 7; all sulfates and chlorides are low. The Cal Trans times to perforation for both 18 ga and 12 ga steel, respectively, for these soil samples are as follows: VR9 @ 21.3 & 46.9 yrs; VR10 @ 17.7 & 39.0 yrs; VR11 @ 7.5 & 16.4 yrs; VR12 @ 16.9 & 37.3 yrs; and VR13 @ 11.5 & 25.3 yrs. As you can see, most of these are mediocre times being in the 10-20 year range (for 18 ga); one sample has poor perf time of less than 10 years; and another sample has fair time of a little over 20 years. Neither sulfates or chlorides really come into play here at all. So, although the resistivities are all pretty good in these five samples, notice that two of them have extremely acidic pHs, i.e., in this case in the threes! To improve the times to perforation for these soils in terms of their activity against exposed steel, add lime to condition the soil up to a pH of 7.5 or so; or specify acid resistant steel. Make sure concrete is also acid resistant if the soil is not lime treated.

\\\\NOTES: Methods are from following sources: extractions by Cal Trans protocols as per Cal Test 417 (SO4), 422 (Cl), and 532/643 (pH & resistivity); &/or by ASTM Vol. 4.08 & ASTM Vol. 11.01 (=EPA Meth Chem Anal, or Standard Methods); pH - ASTM G 51; Spec. Cond. - ASTM D 1125; resistivity - ASTM G 57; redox - Pt probe/ISE; sulfate - extraction Title 22, detection ASTM D 516 (=EPA 375.4); chloride - extraction Title 22, detection ASTM D 512 (=EPA 325.3); sulfides - extrac. Title 22, detection EPA 376.2 (=SMEWW 4500-S D); cyanides - extraction Title 22, detection ASTM D 4374 (=EPA 335.2).

Appendix H

Name: Photo #1
Description: Looking southeast toward Vasco Road Landfill.



Name: Photo #2
Description: View south toward conform area. Center of photo approximates location of a trace of the Greenville fault.

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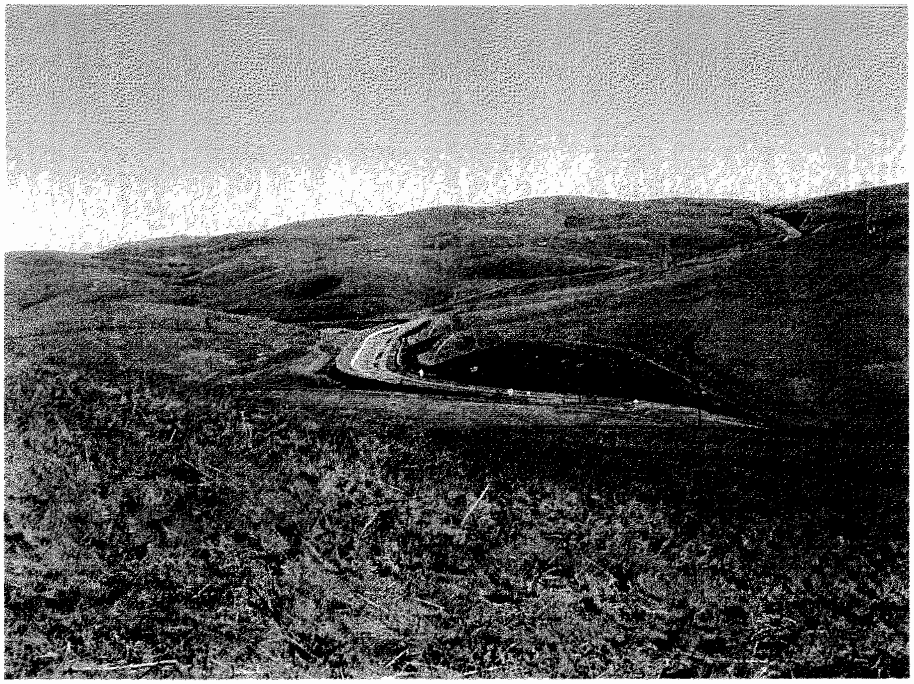

Name: Photo #3
Description: The north conform area.

Sample from Boring B-7 collected between a depth of 30 and 40 feet.

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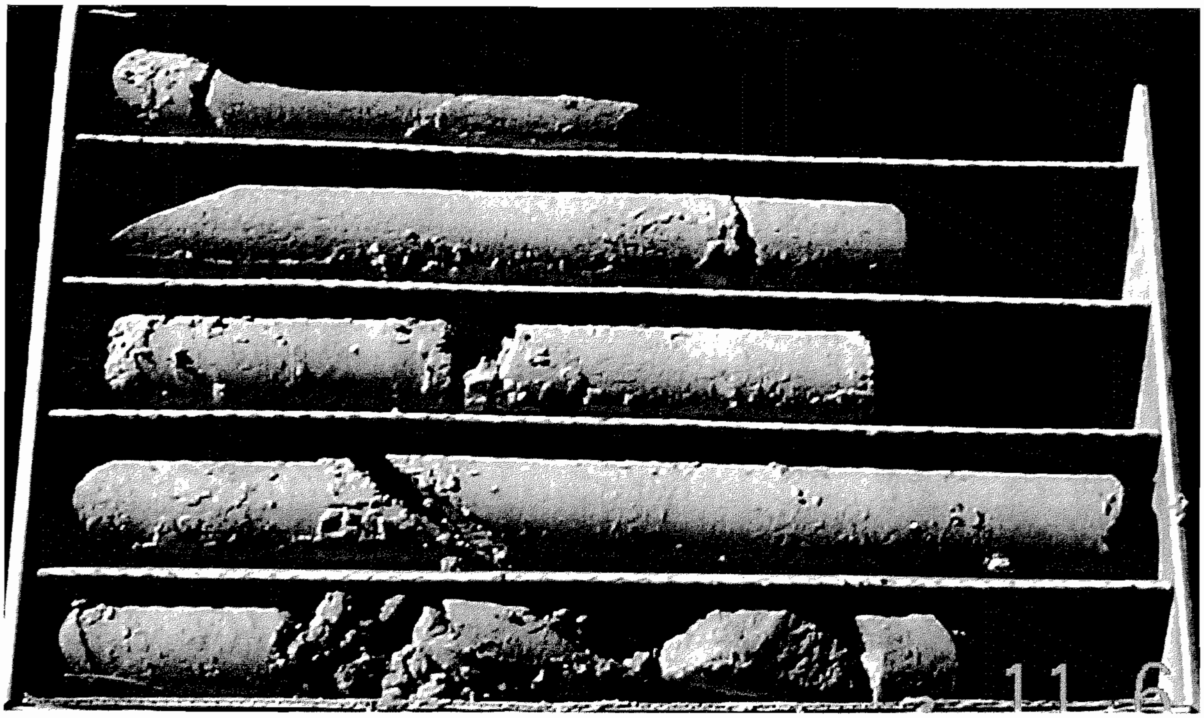

Sample from Boring B-7 collected between a depth of 12 and 20 feet.

Sample from Boring B-7 collected between a depth of 20 and 30 feet.

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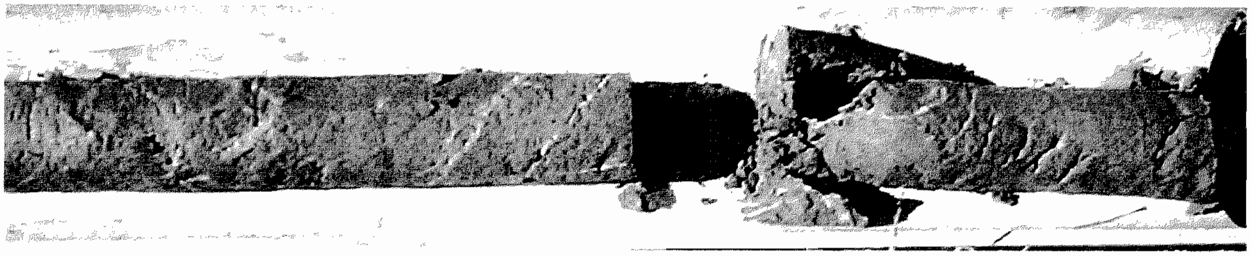
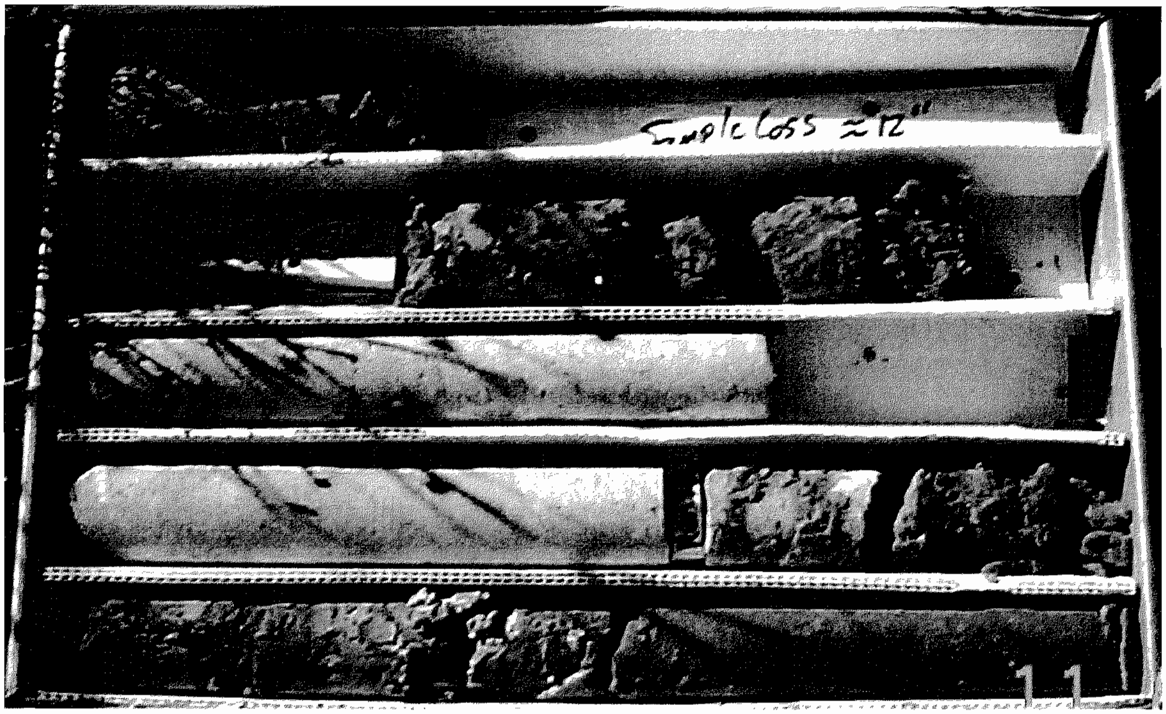


Sample from Boring B-5 collected between a depth of 83 and 85 feet.



Sample from Boring B-7 collected between a depth of 3 and 12 feet.

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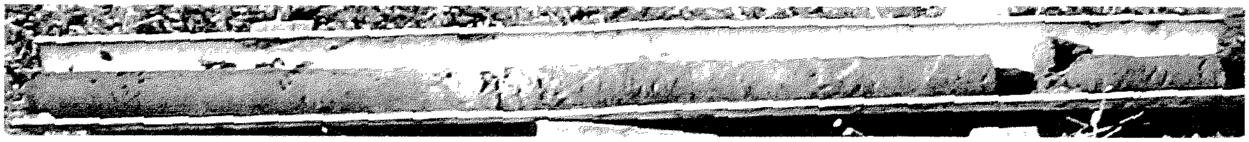
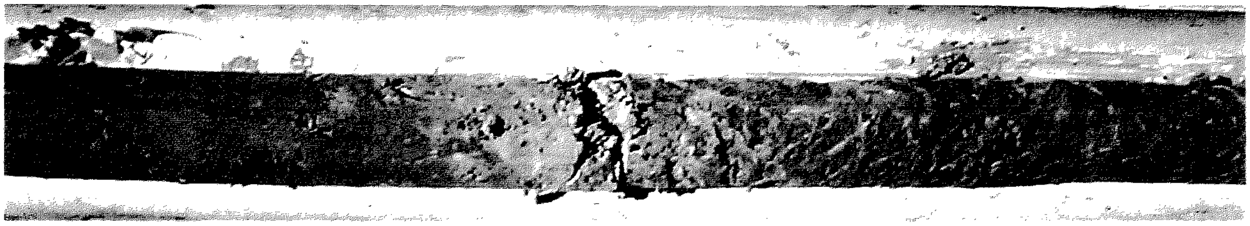


Sample from Boring B-5 collected between a depth of 80 and 85 feet.



Sample from Boring B-5 collected between a depth of 81 and 83 feet.

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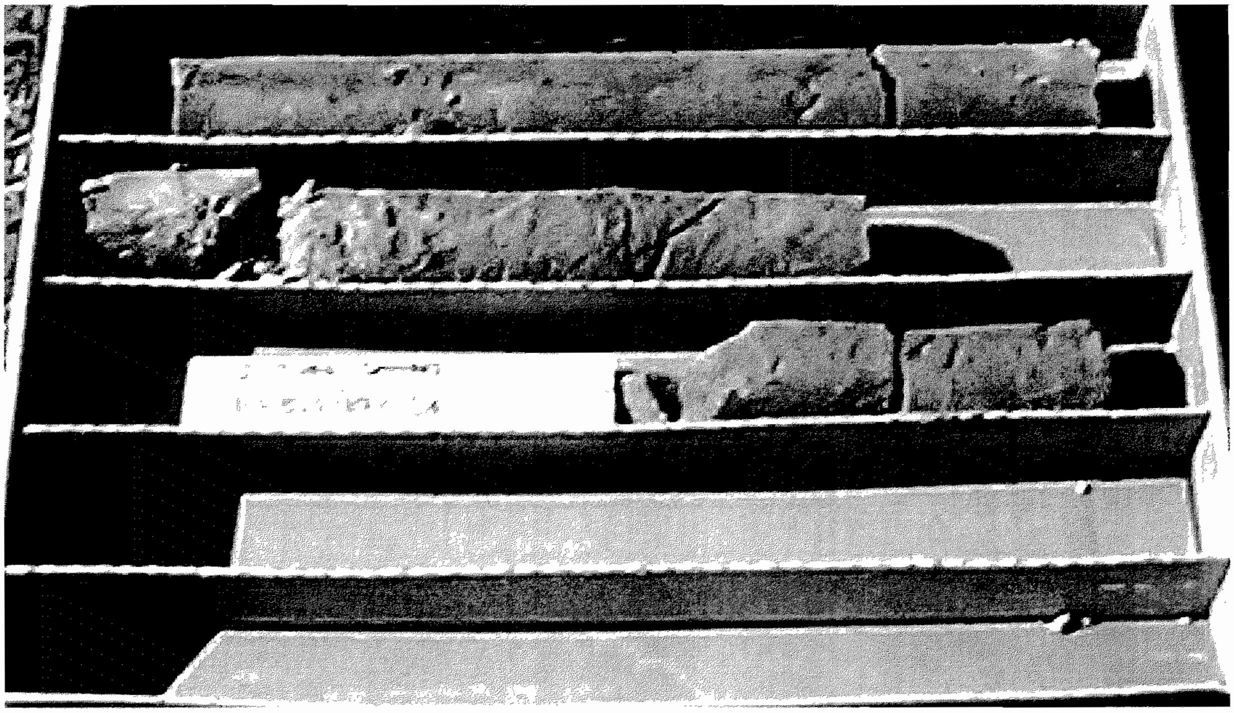
Sample from Boring B-5 collected between a depth of 75 and 80 feet.



Sample from Boring B-5 collected between a depth of 80 and 85 feet.

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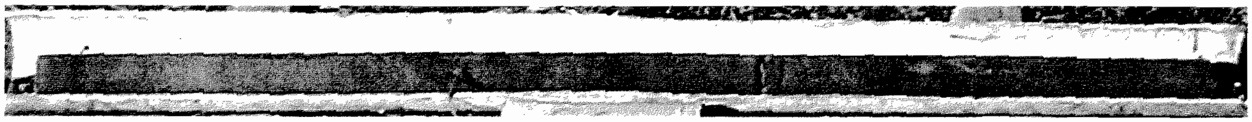
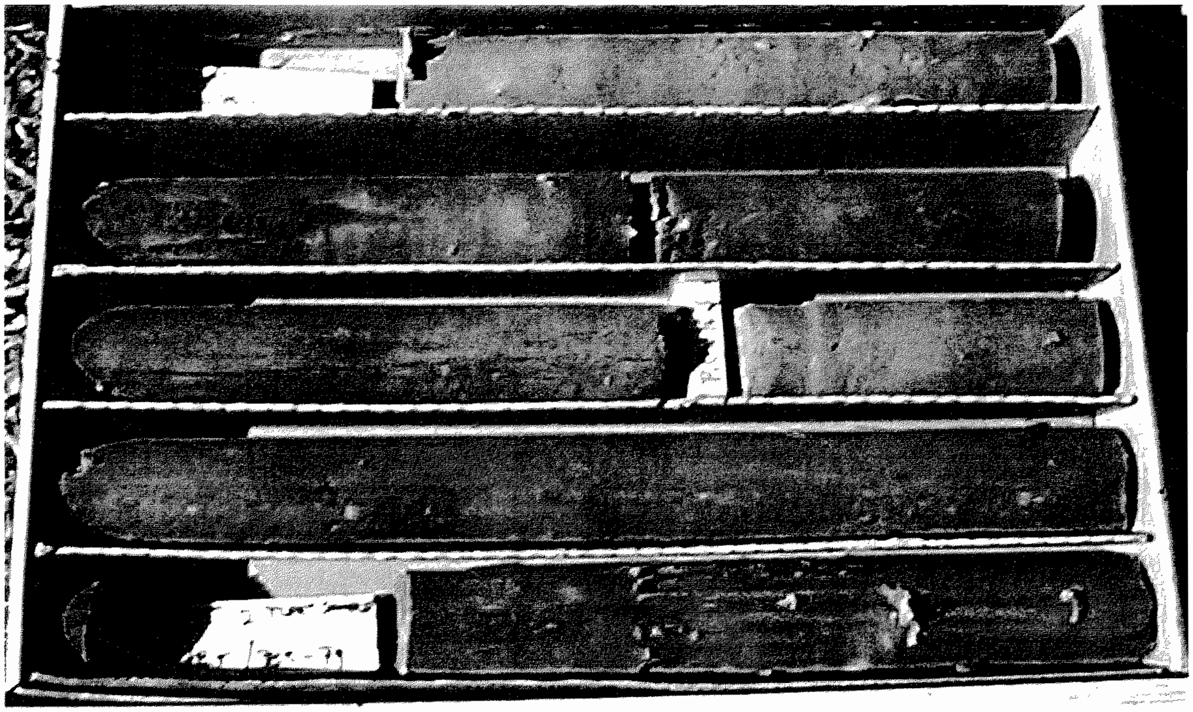


Sample from Boring B-5 collected between a depth of 70 and 75 feet.



Sample from Boring B-5 collected between a depth of 70 and 80 feet.

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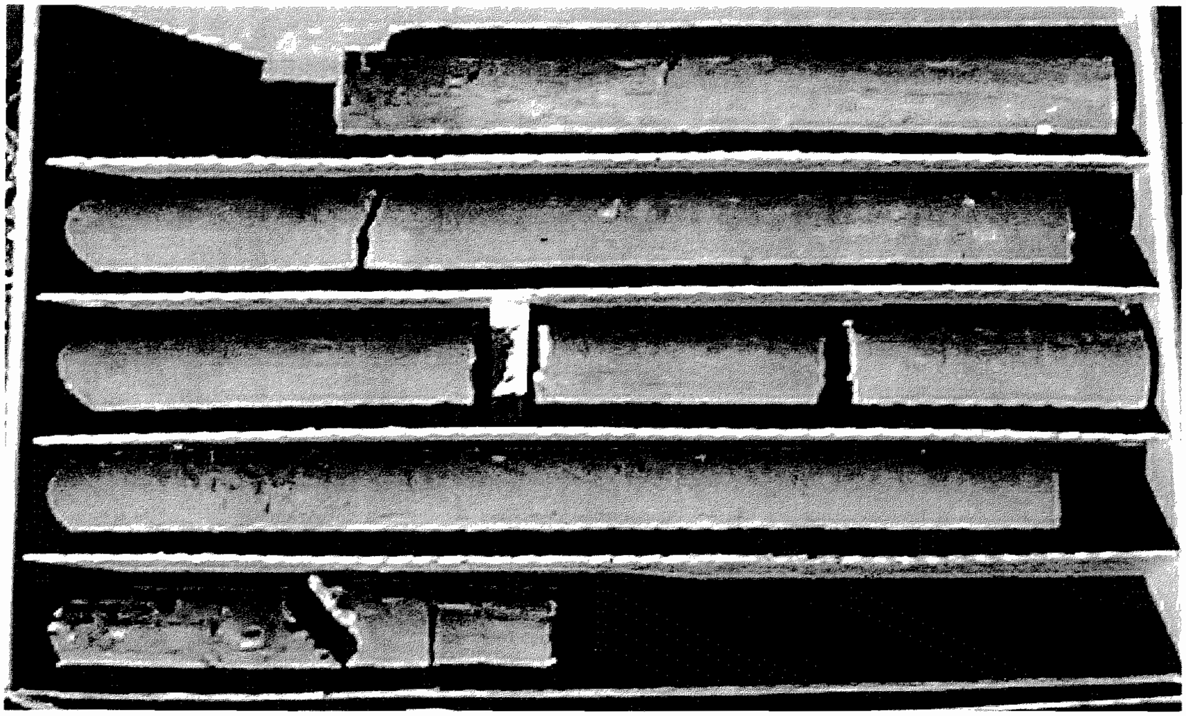

Sample from Boring B-5 collected between a depth of 50 and 60 feet.

Sample from Boring B-5 collected between a depth of 60 and 70 feet.

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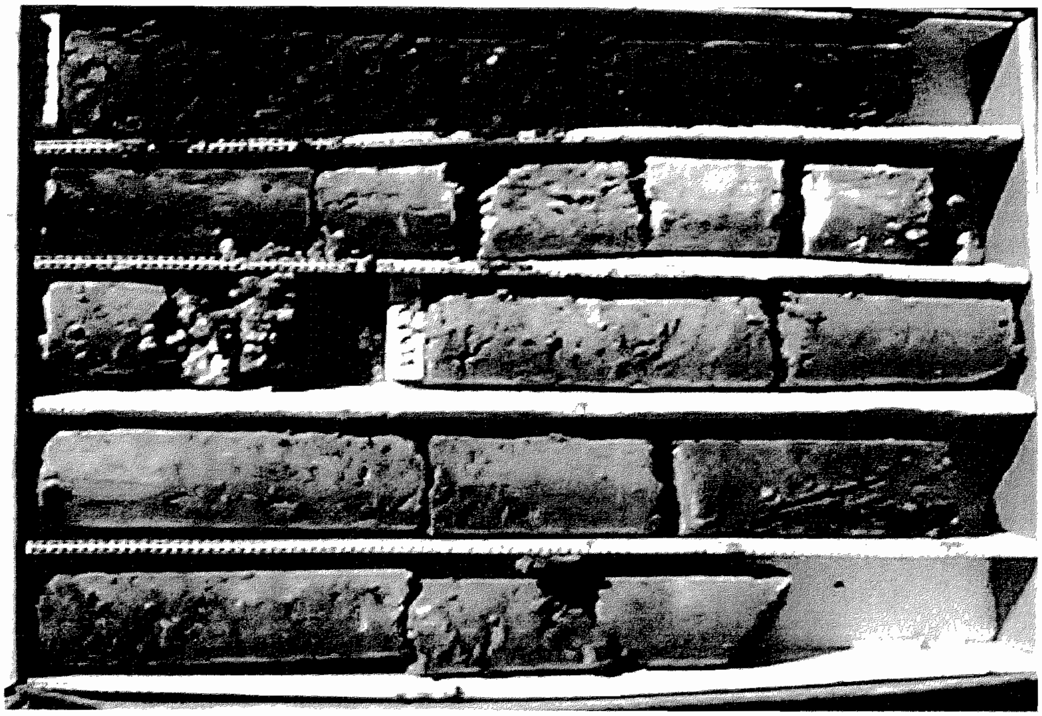
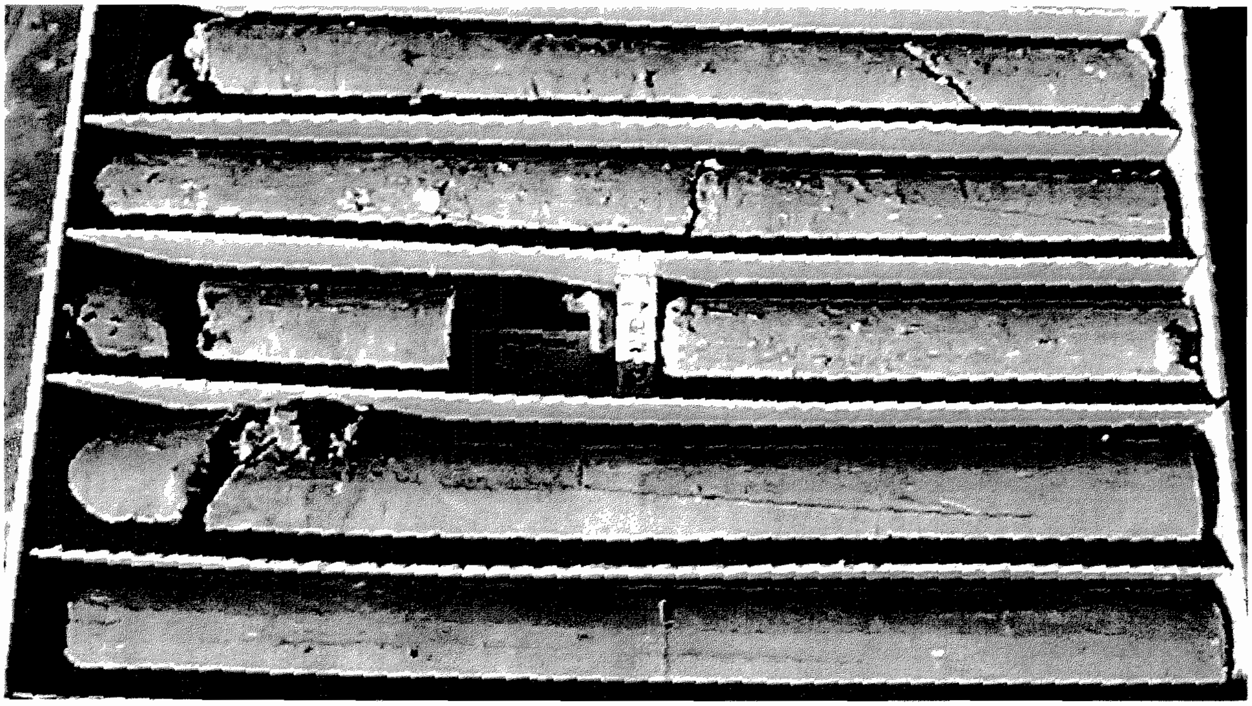


Sample from Boring B-5 collected between a depth of 0 and 10 feet.



Sample from Boring B-5 collected between a depth of 40 and 50 feet.

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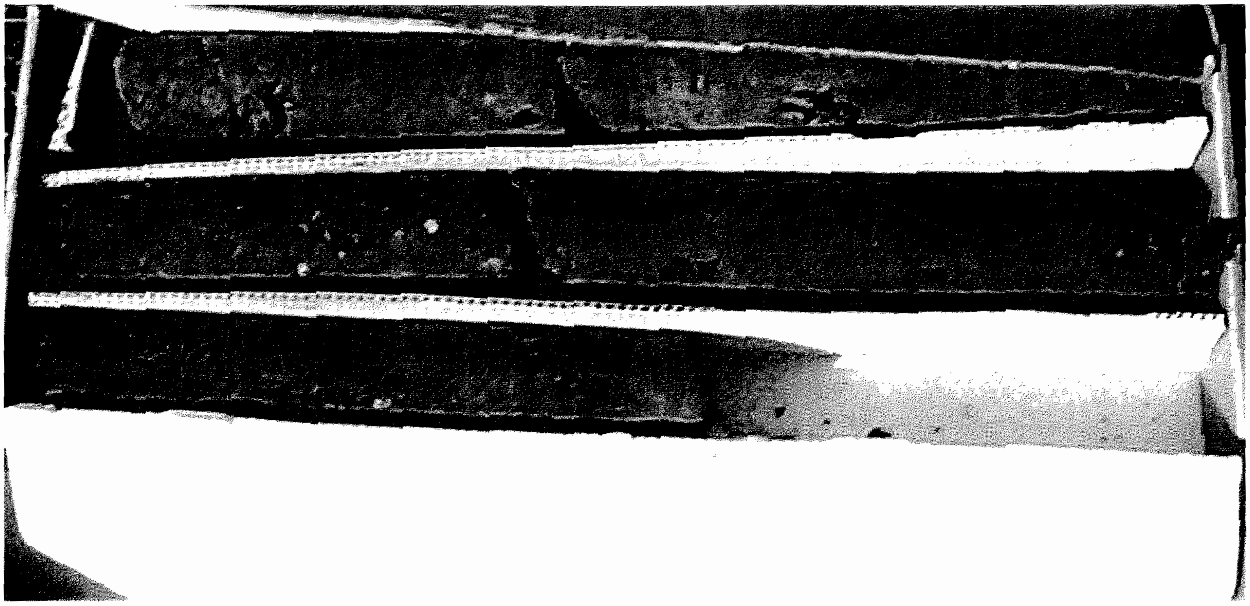
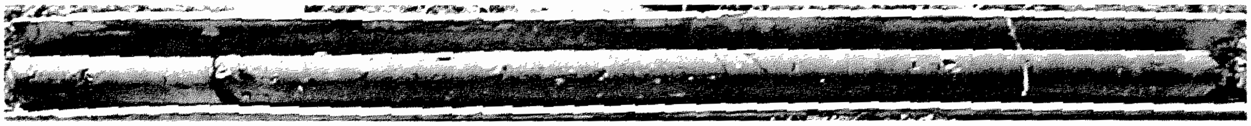


Sample from Boring B-4 collected between a depth of 80 and 85 feet.



Sample from Boring B-4 collected between a depth of 80 and 85 feet.

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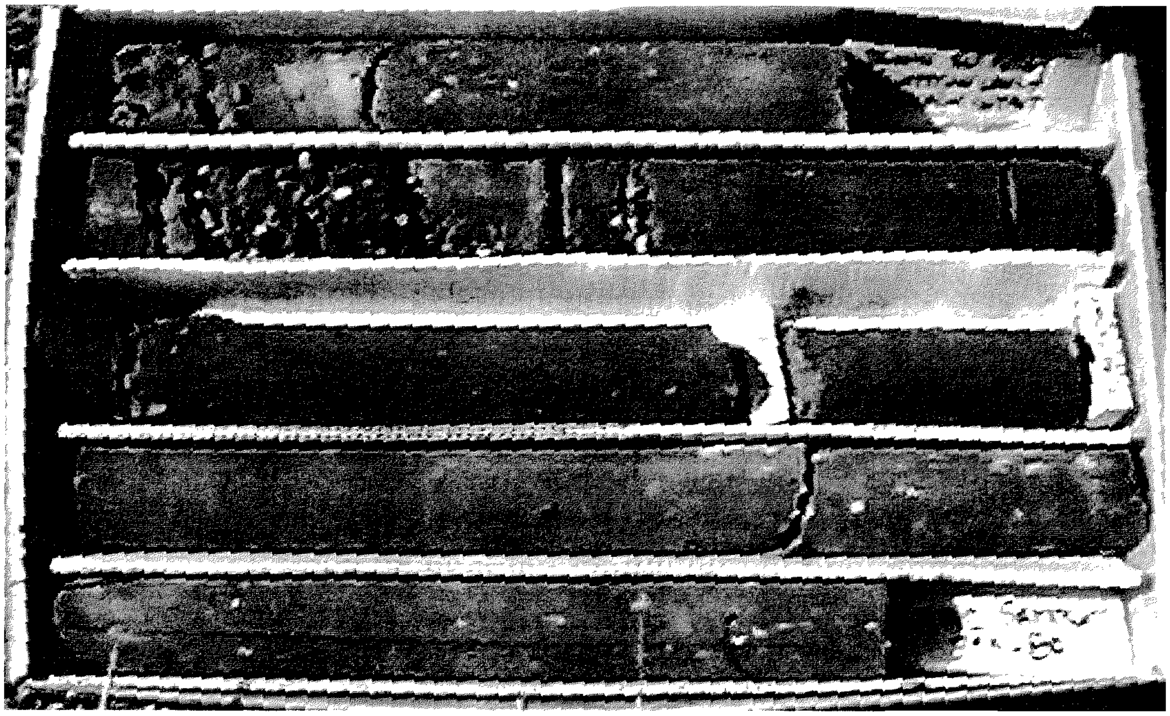
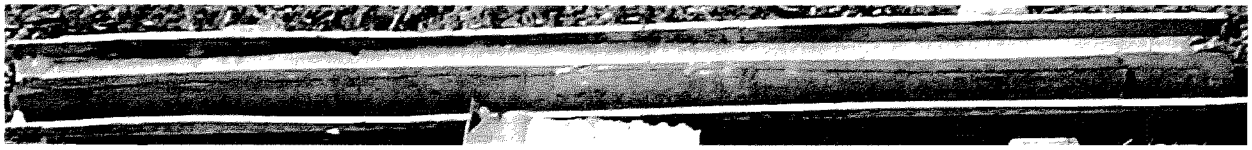


Sample from Boring B-4 collected between a depth of 70 and 80 feet.



Sample from Boring B-4 collected between a depth of 75 and 80 feet.

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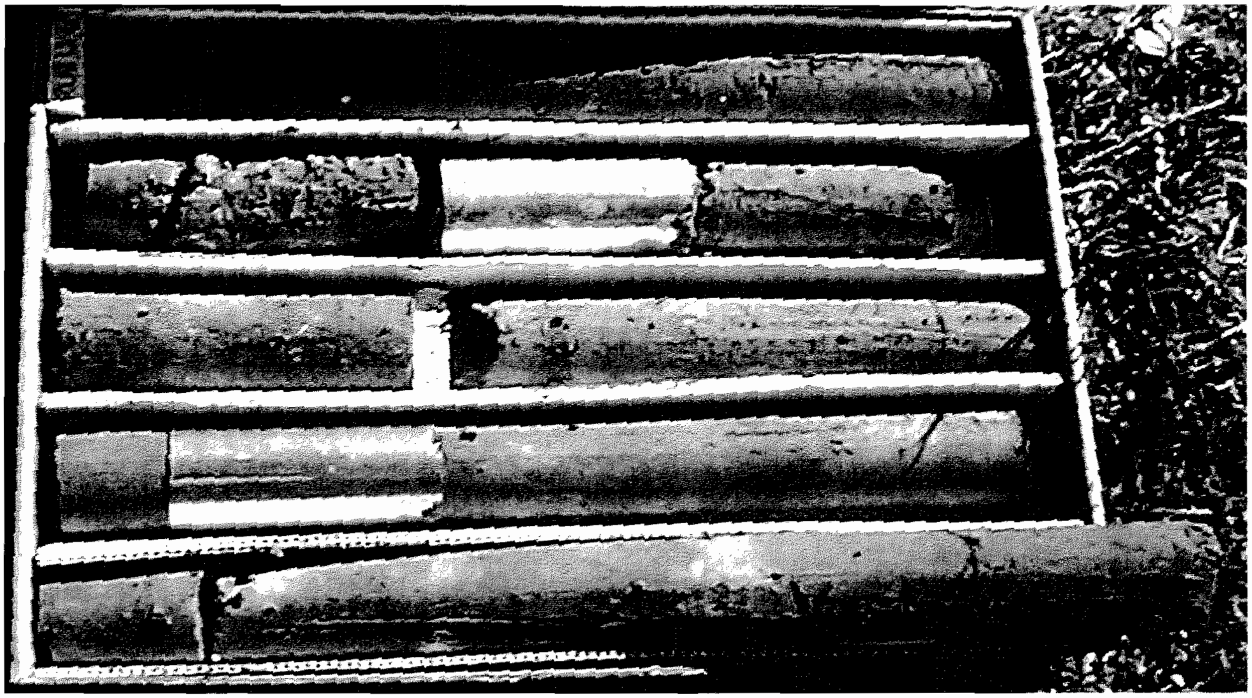
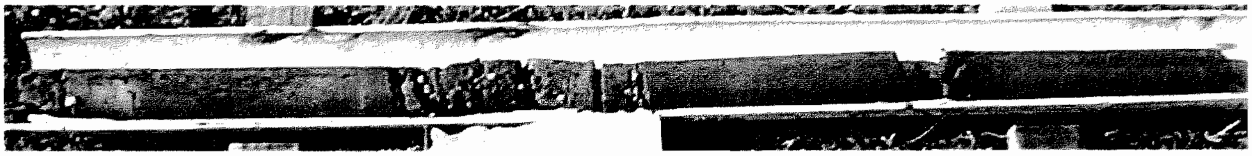
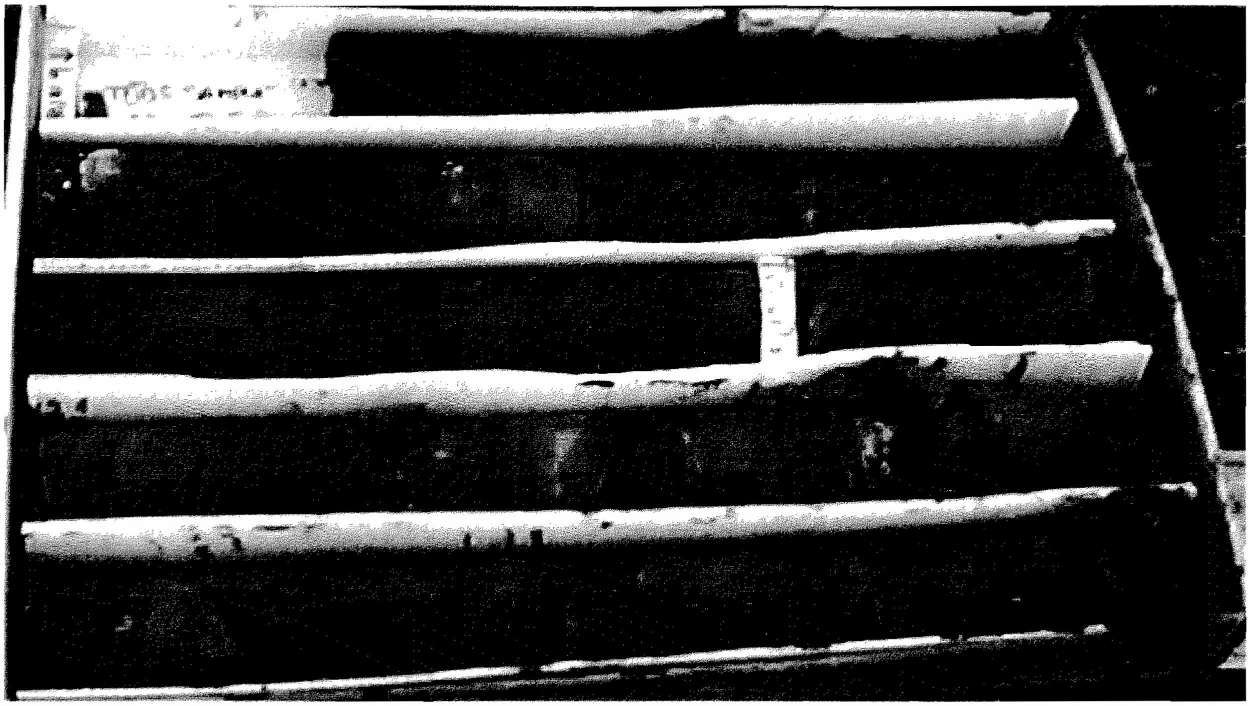


Sample from Boring B-4 collected between a depth of 60 and 70 feet.



Sample from Boring B-4 collected between a depth of 70 and 75 feet.



Sample from Boring B-4 collected between a depth of 40 and 50 feet.

Sample from Boring B-4 collected between a depth of 50 and 60 feet.

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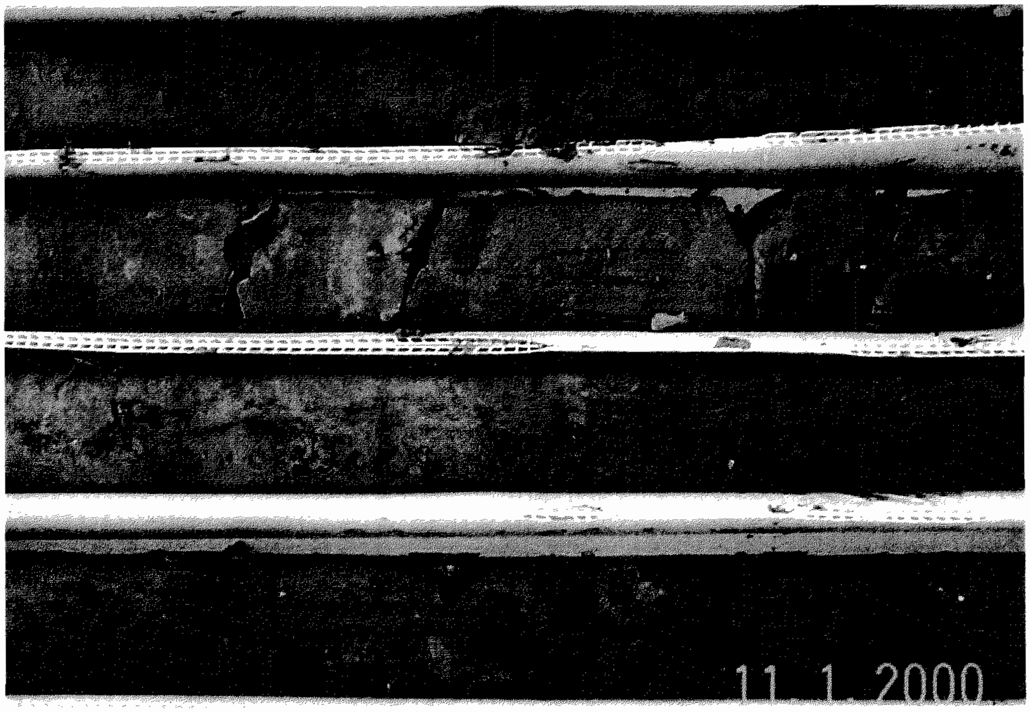
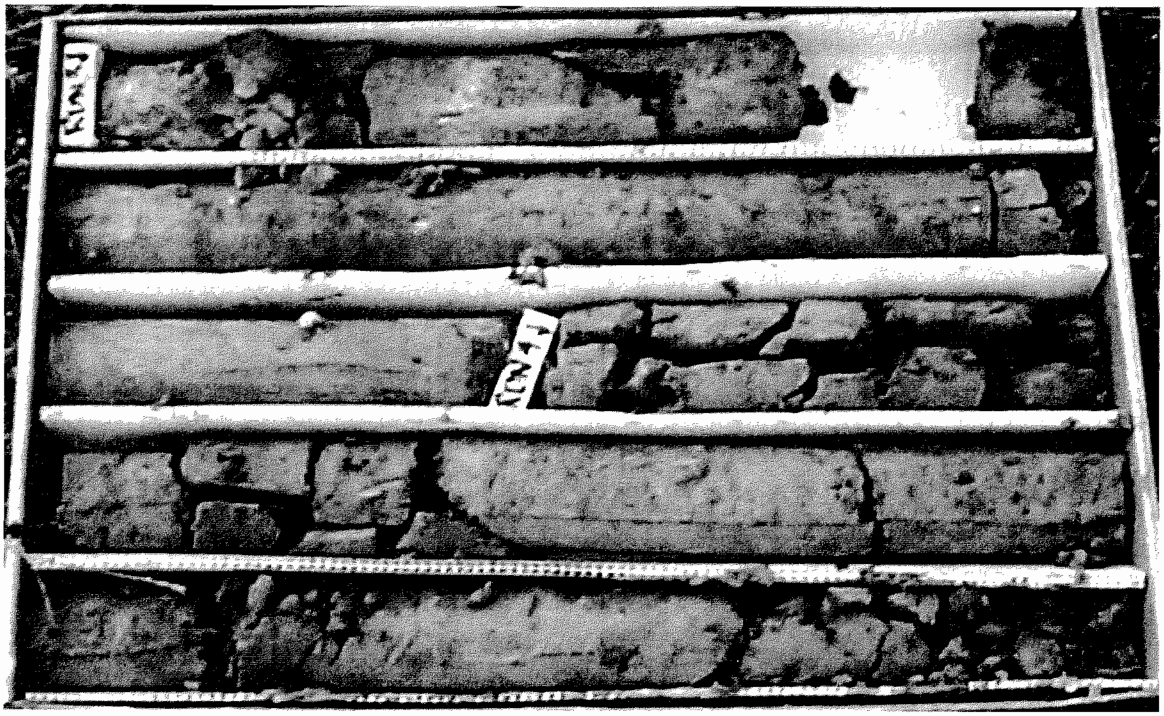
Sample from Boring B-4 collected between a depth of 30 and 40 feet.



Sample from Boring B-4 collected between a depth of 31 and 40 feet.



Sample from Boring B-4 collected between a depth of 10 and 20 feet.

Sample from Boring B-4 collected between a depth of 20 and 30 feet.

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Sample from Boring B-3 collected at a depth of 83 feet.

Sample from Boring B-4 collected between a depth of 0 and 10 feet.

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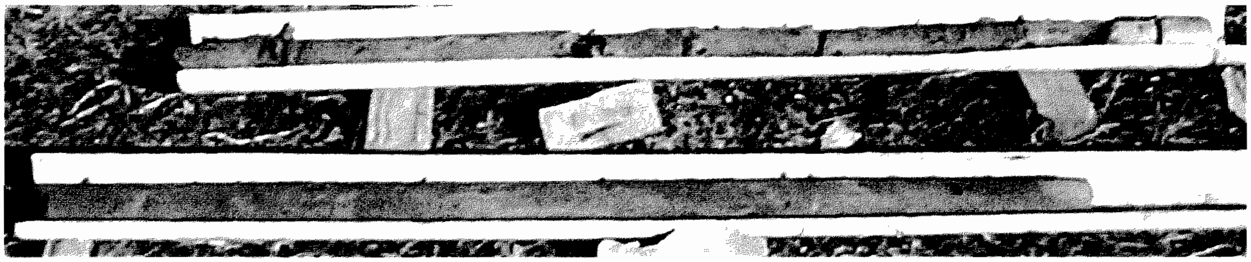
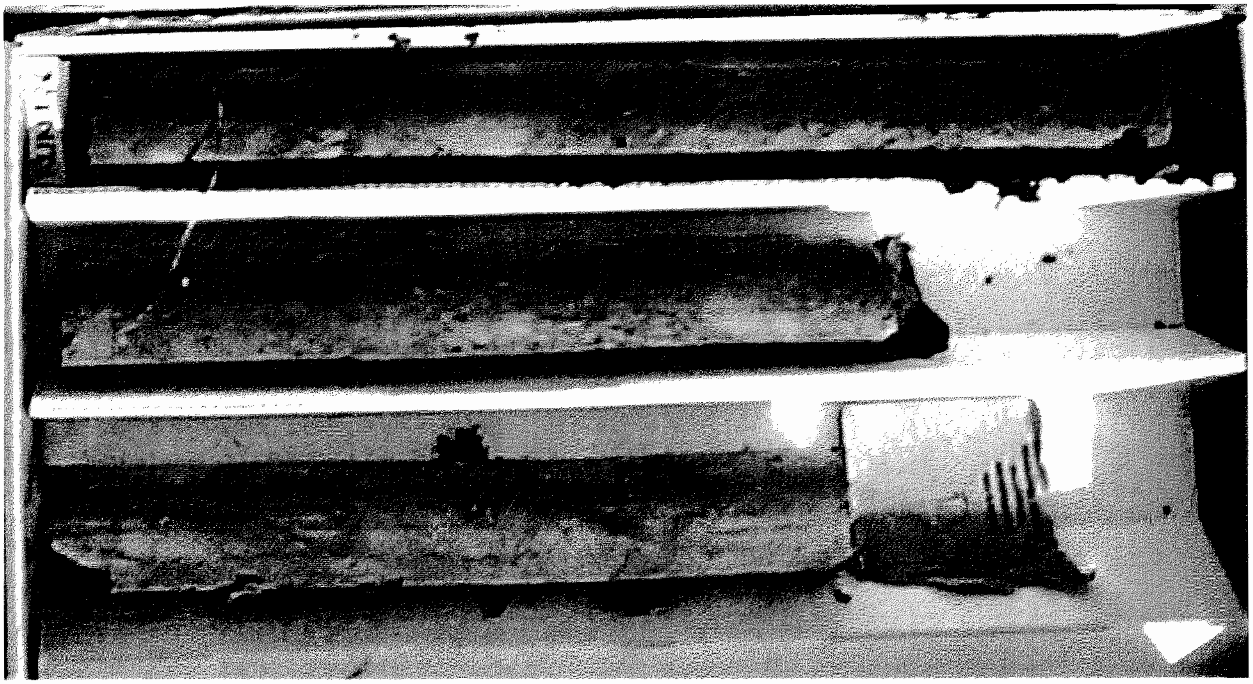


Sample from Boring B-3 collected between a depth of 75 and 85 feet.



Sample from Boring B-3 collected between a depth of 80 and 85 feet.

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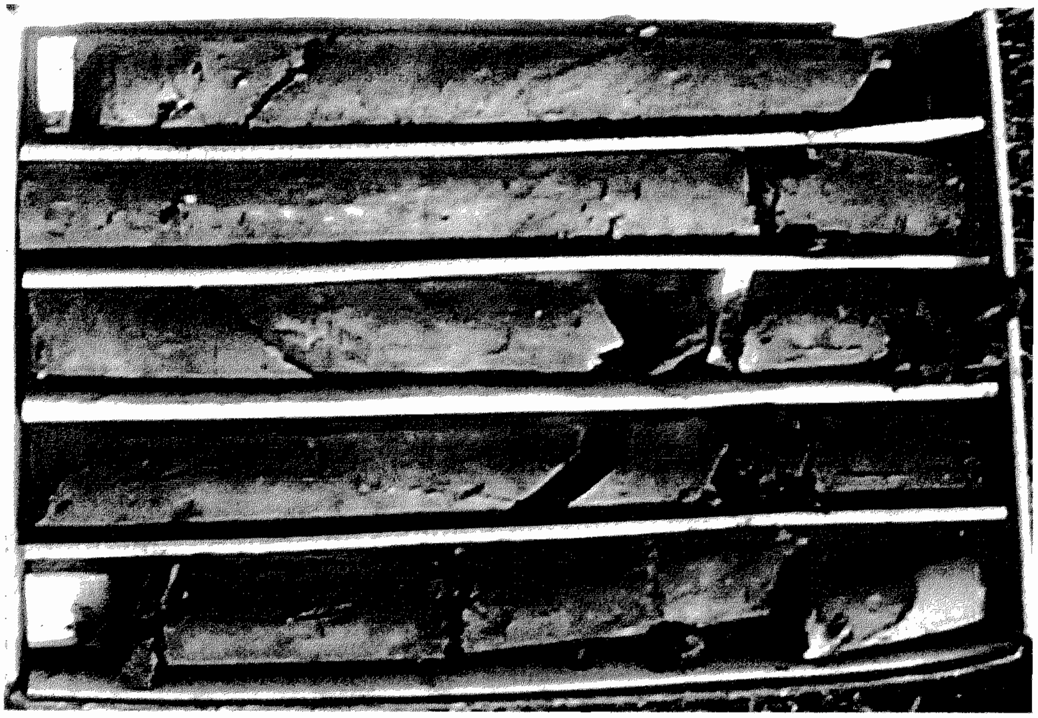

Sample from Boring B-3 collected between a depth of 70 and 80 feet.

Sample from Boring B-3 collected at a depth of 74 feet.

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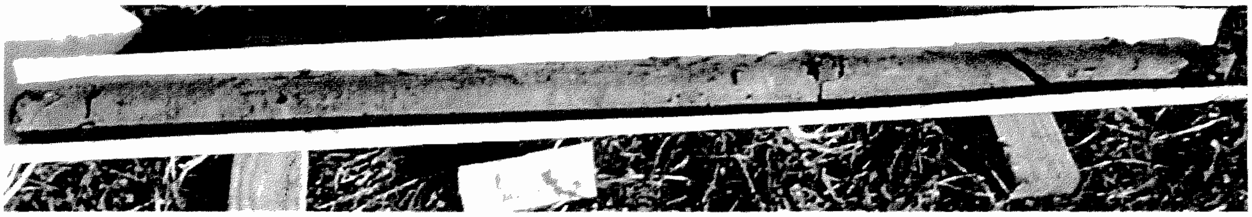
Sample from Boring B-3 collected at a depth of 68 feet.



Sample from Boring B-3 collected between a depth of 70 and 75 feet.

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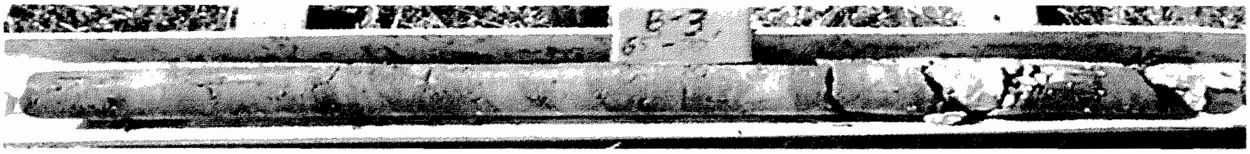
JN: 001860	*AUGUST 2001*

Sample from Boring B-3 collected at a depth of 62 feet.



Sample from Boring B-3 collected between a depth of 65 and 70 feet.

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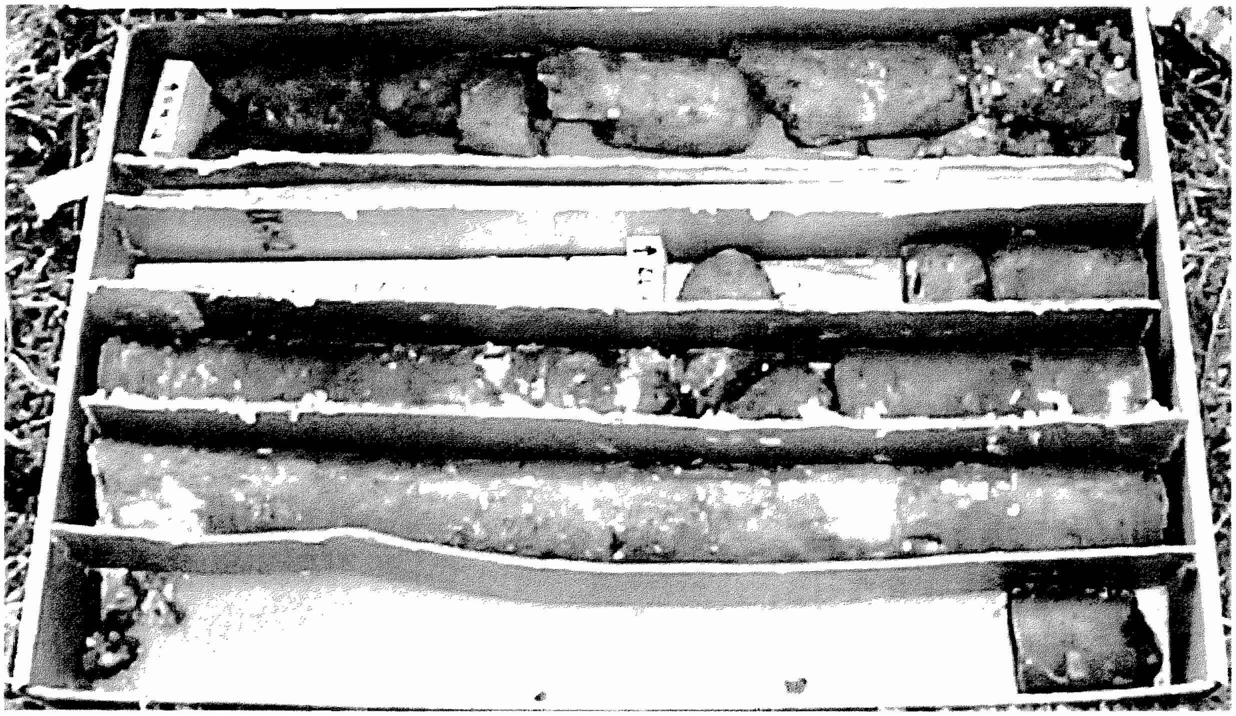
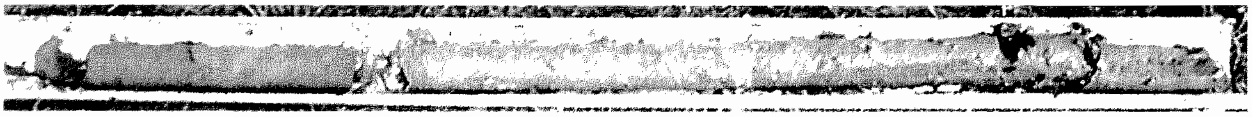
CAL ENGINEERING & GEOLOGY

CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-3 collected between a depth of 50 and 60 feet.



Sample from Boring B-3 collected between a depth of 60 and 65 feet.

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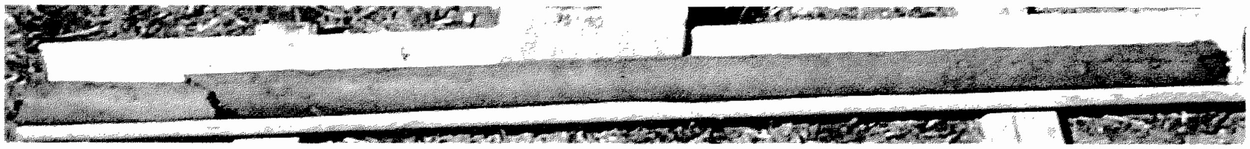
CAL ENGINEERING & GEOLOGY

CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-3 collected between a depth of 35 and 40 feet.

Sample from Boring B-3 collected between a depth of 40 and 50 feet.

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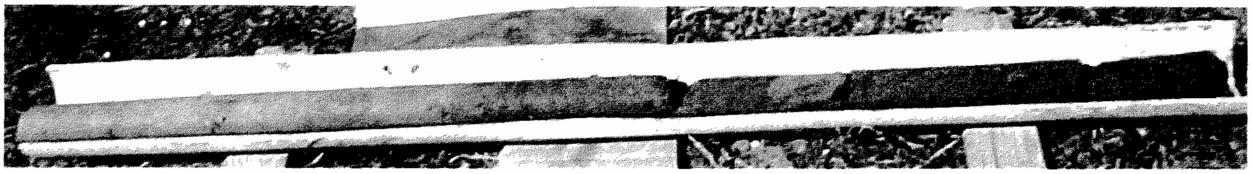
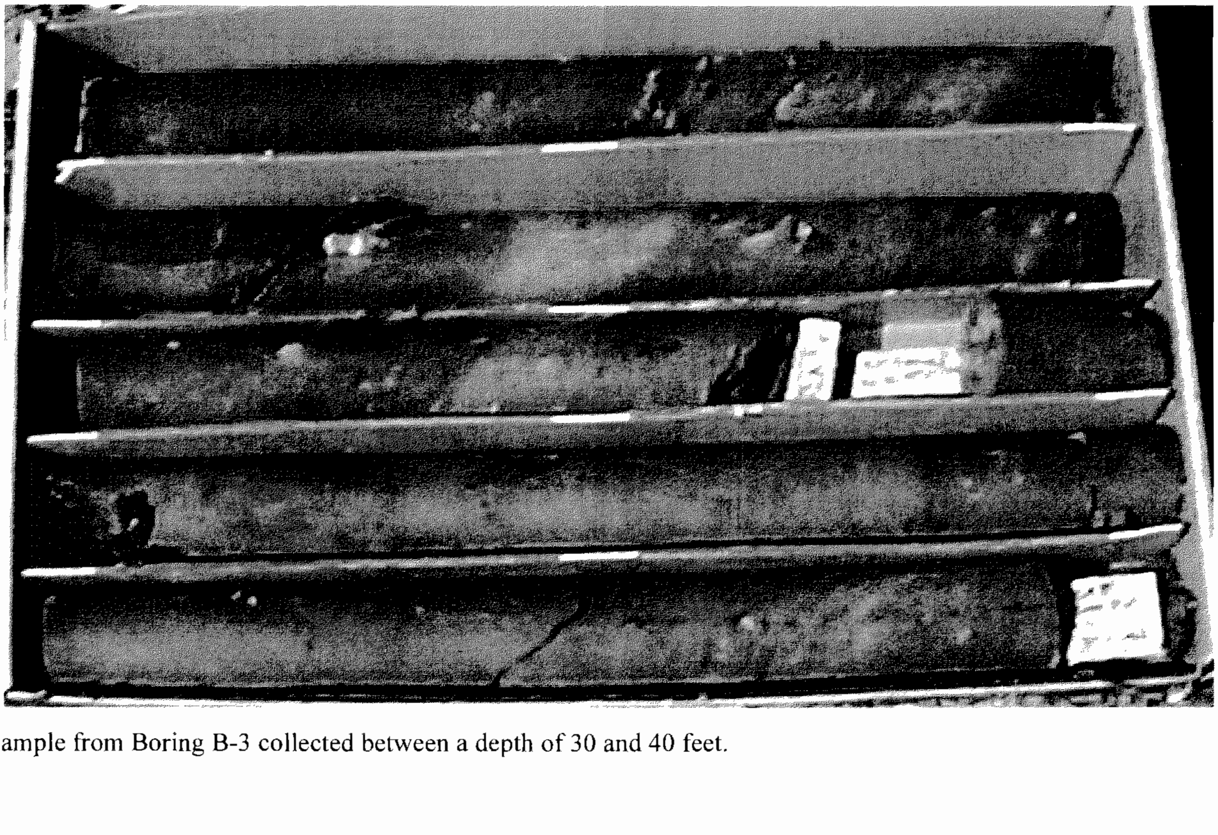
CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



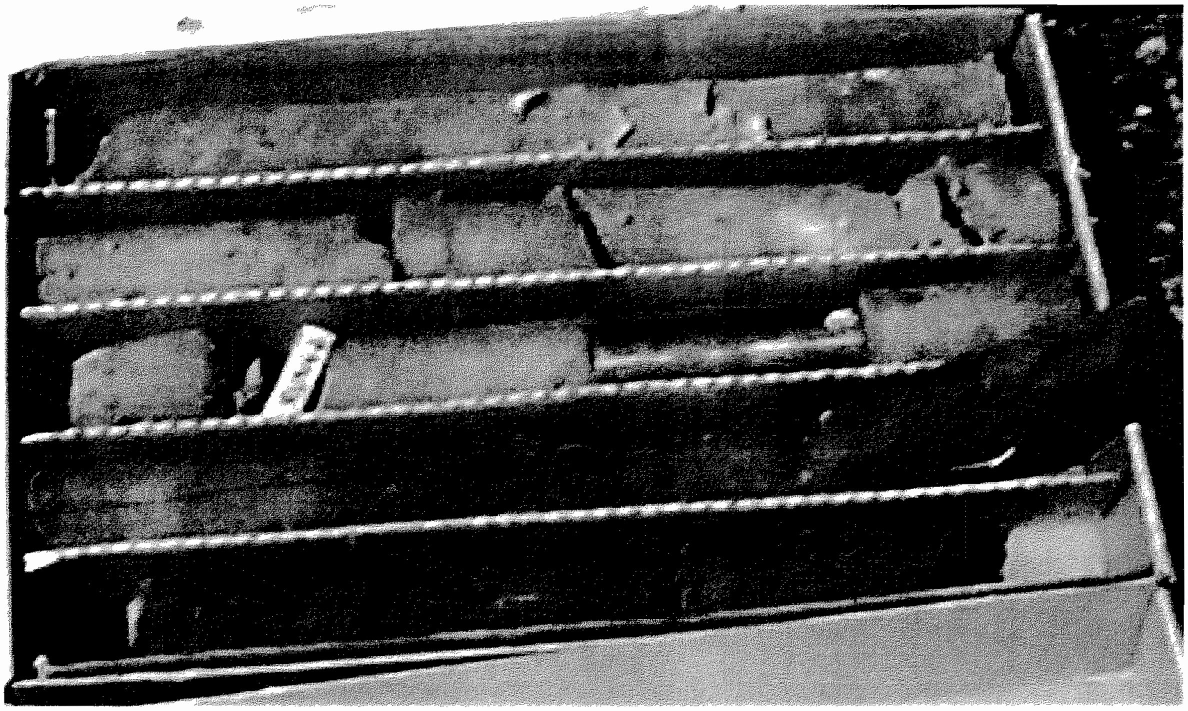
Sample from Boring B-3 collected between a depth of 25 and 30 feet.



Sample from Boring B-3 collected between a depth of 30 and 40 feet.

CE&G CAL ENGINEERING & GEOLOGY	CORE SAMPLE PHOTOGRAPHS	
	VASCO ROAD SAFETY IMPROVEMENTS	
	JN: 001860	AUGUST 2001

Sample from Boring B-3 collected between a depth of 10 and 20 feet.



Sample from Boring B-3 collected between a depth of 20 and 30 feet.

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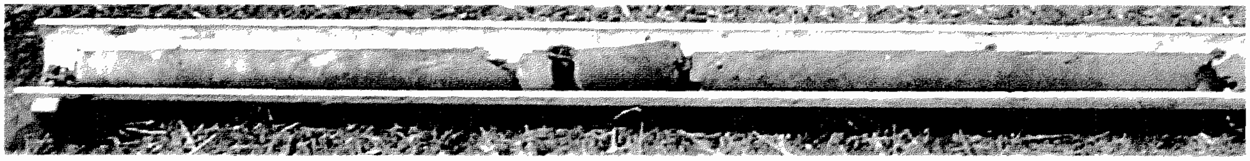
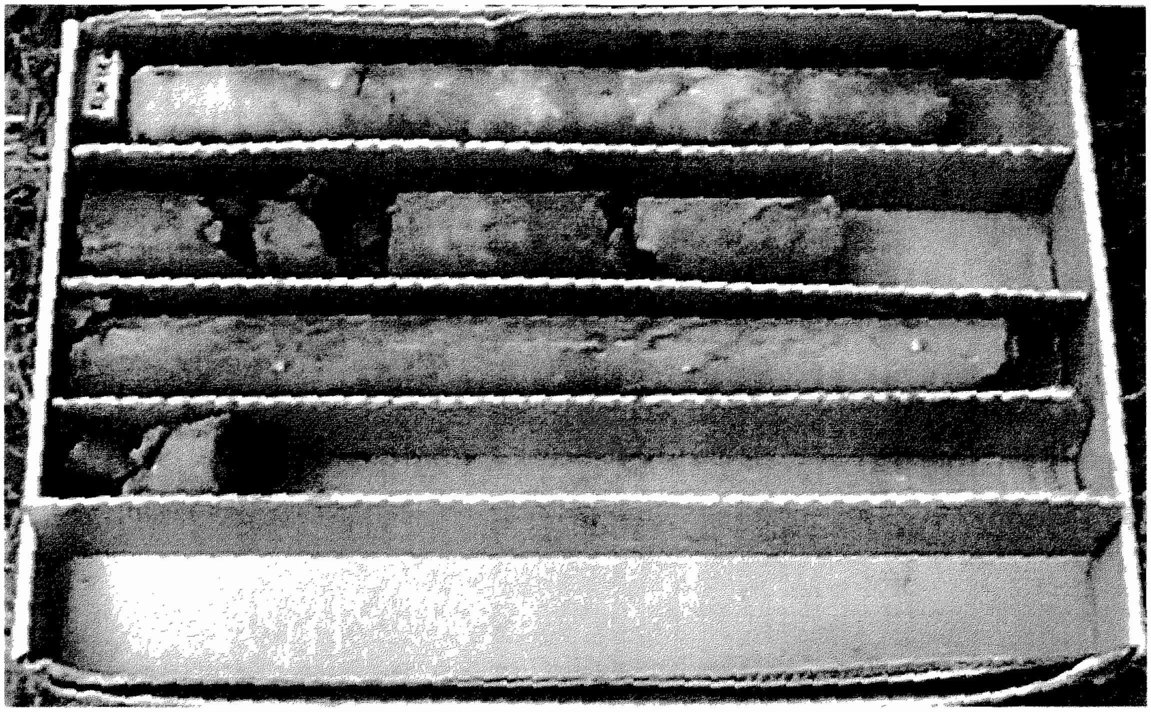
CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-2 collected between a depth of 65 and 70 feet.

Sample from Boring B-3 collected between a depth of 0 and 10 feet.

Sample from Boring B-2 collected between a depth of 55 and 65 feet.



Sample from Boring B-2 collected between a depth of 65 and 70 feet.

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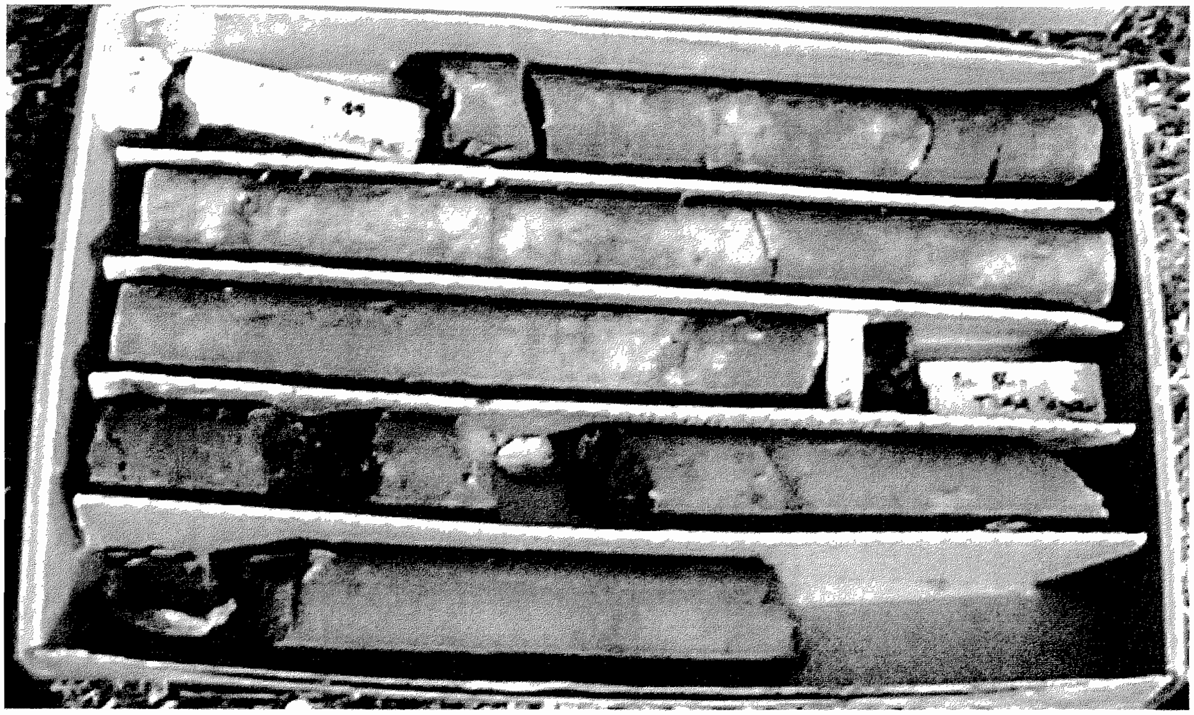
CAL ENGINEERING & GEOLOGY

CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-2 collected between a depth of 45 and 55 feet.

Sample from Boring B-2 collected between a depth of 48 and 50 feet.

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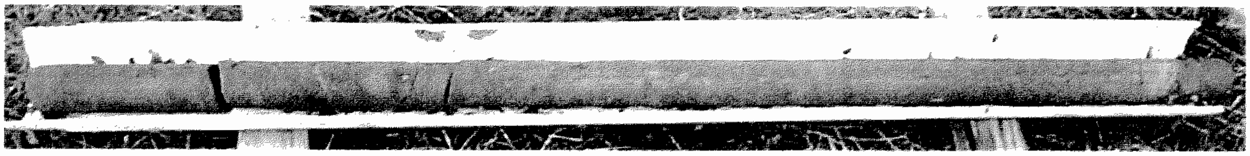
CORE SAMPLE PHOTOGRAPHS

VASCO ROAD SAFETY IMPROVEMENTS

JN: 001860	*AUGUST 2001*



Sample from Boring B-2 collected between a depth of 45 and 50 feet.

Sample from Boring B-2 collected between a depth of 45 and 55 feet.

CORE SAMPLE PHOTOGRAPHS

VASCO ROAD SAFETY IMPROVEMENTS

JN: 001860

AUGUST 2001

Sample from Boring B-2 collected between a depth of 20 and 30 feet.

Sample from Boring B-2 collected between a depth of 30 and 35 feet.

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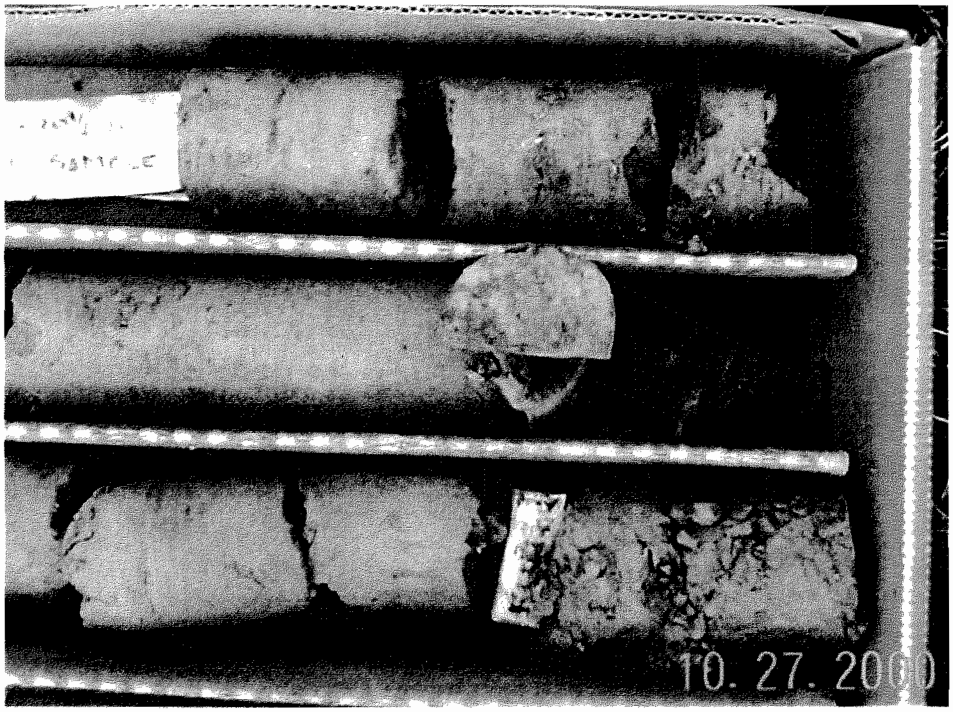
CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	AUGUST 2001

Sample from Boring B-2 collected between a depth of 10 and 20 feet.



10. 27. 2000

Sample from Boring B-2 collected between a depth of 20 and 25 feet.

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CORE SAMPLE PHOTOGRAPHS

VASCO ROAD SAFETY IMPROVEMENTS

JN: 001860 | *AUGUST 2001*

Sample from boring B-1 taken between a depth of 30 and 35 feet.

Sample from Boring B-2 collected between a depth of 0 and 10 feet.

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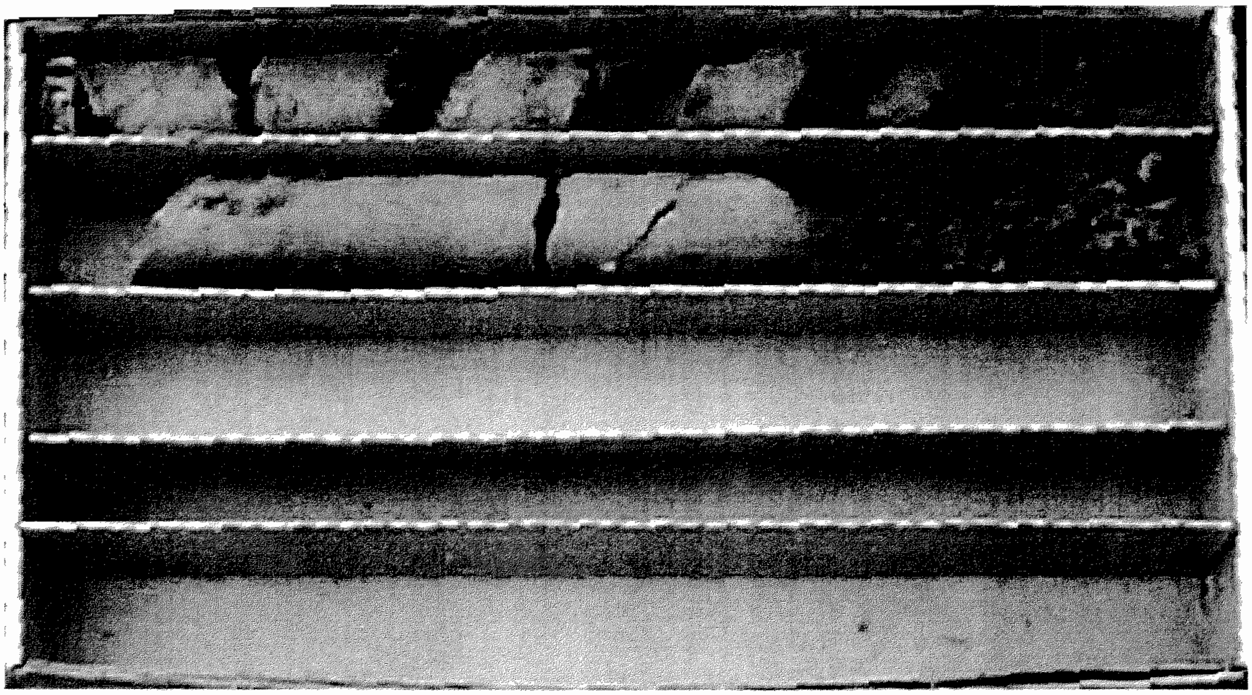
CORE SAMPLE PHOTOGRAPHS

VASCO ROAD SAFETY IMPROVEMENTS

JN: 001860	*AUGUST 2001*

Sample from boring B-1 taken between a depth of 29 and 30 feet.



Sample from Boring B-1 collected between a depth of 30 and 35 feet.

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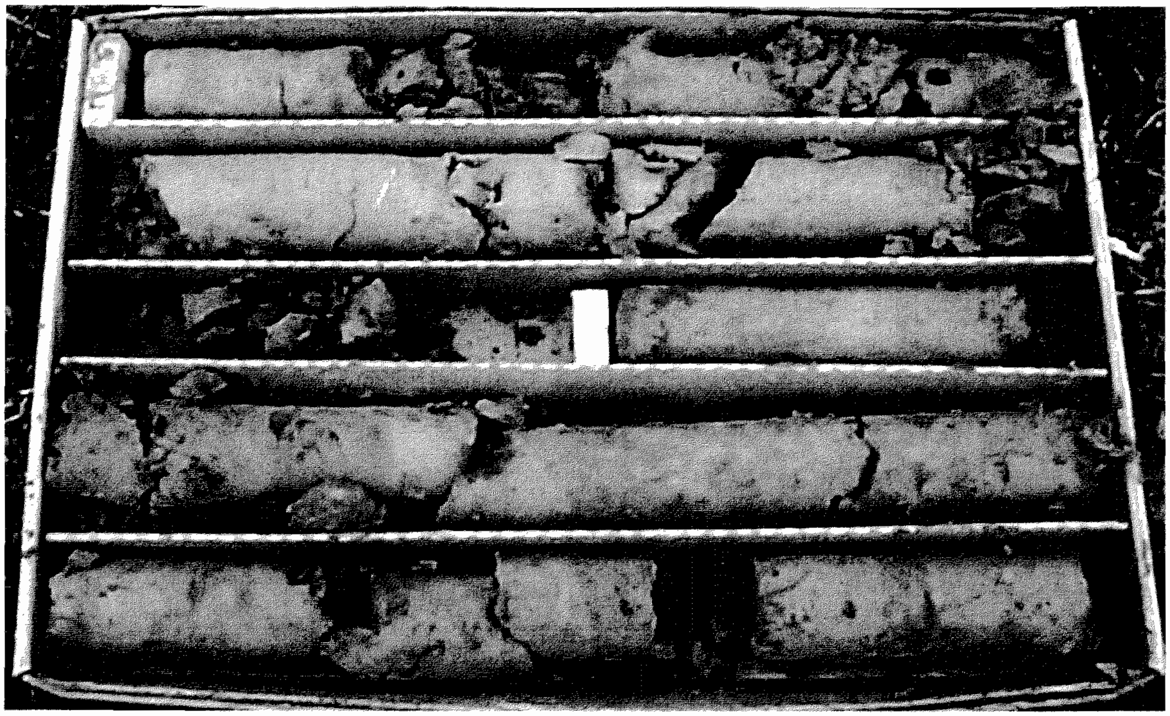
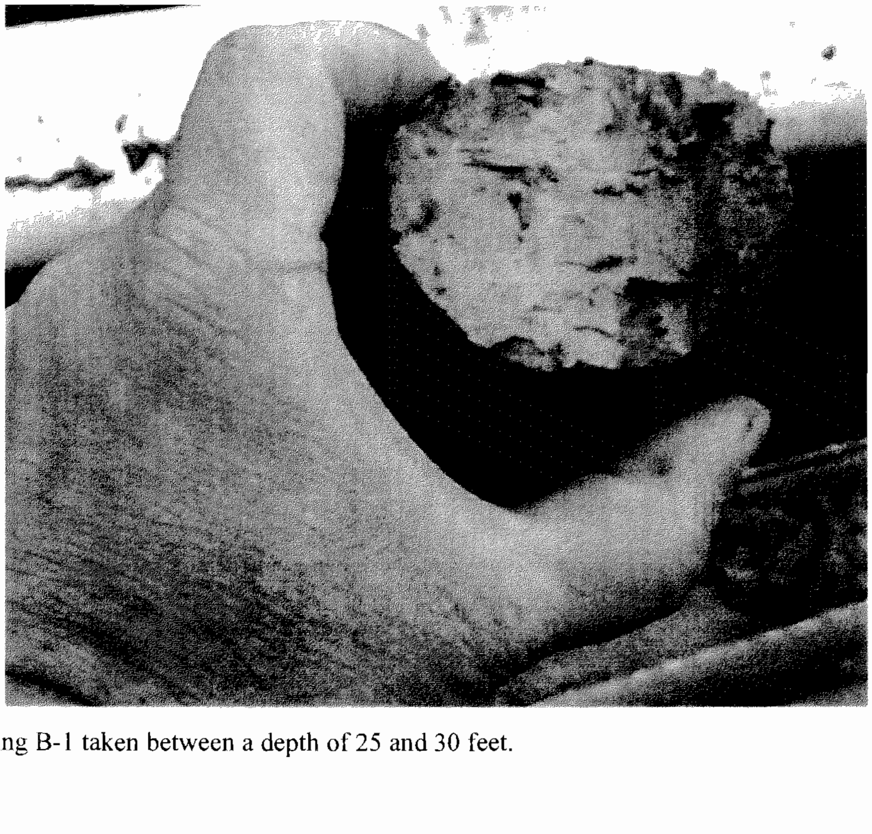
CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-1 collected between a depth of 20 and 30 feet.



Sample from boring B-1 taken between a depth of 25 and 30 feet.

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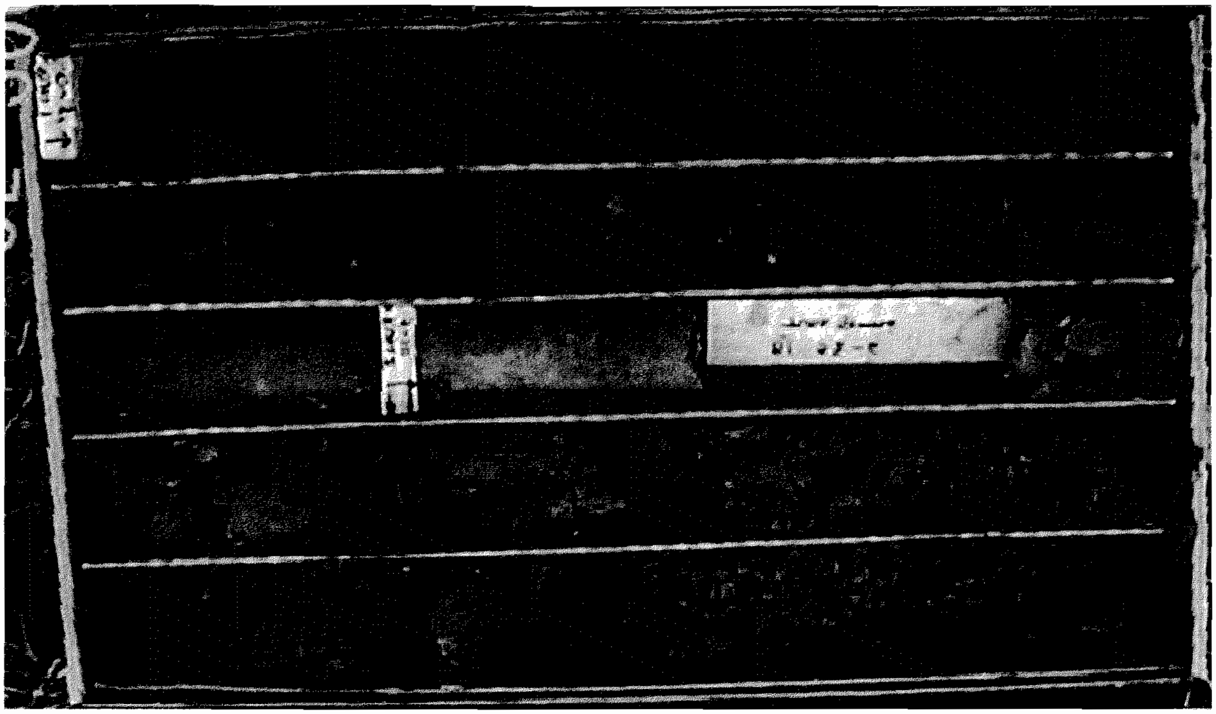
CAL ENGINEERING & GEOLOGY

CORE SAMPLE PHOTOGRAPHS	
VASCO ROAD SAFETY IMPROVEMENTS	
JN: 001860	*AUGUST 2001*



Sample from Boring B-1 collected between a depth of 0 and 10 feet.

Sample from Boring B-1 collected between a depth of 10 and 20 feet.

CE&G CAL ENGINEERING & GEOLOGY	CORE SAMPLE PHOTOGRAPHS	
	VASCO ROAD SAFETY IMPROVEMENTS	
	JN: 001860	AUGUST 2001

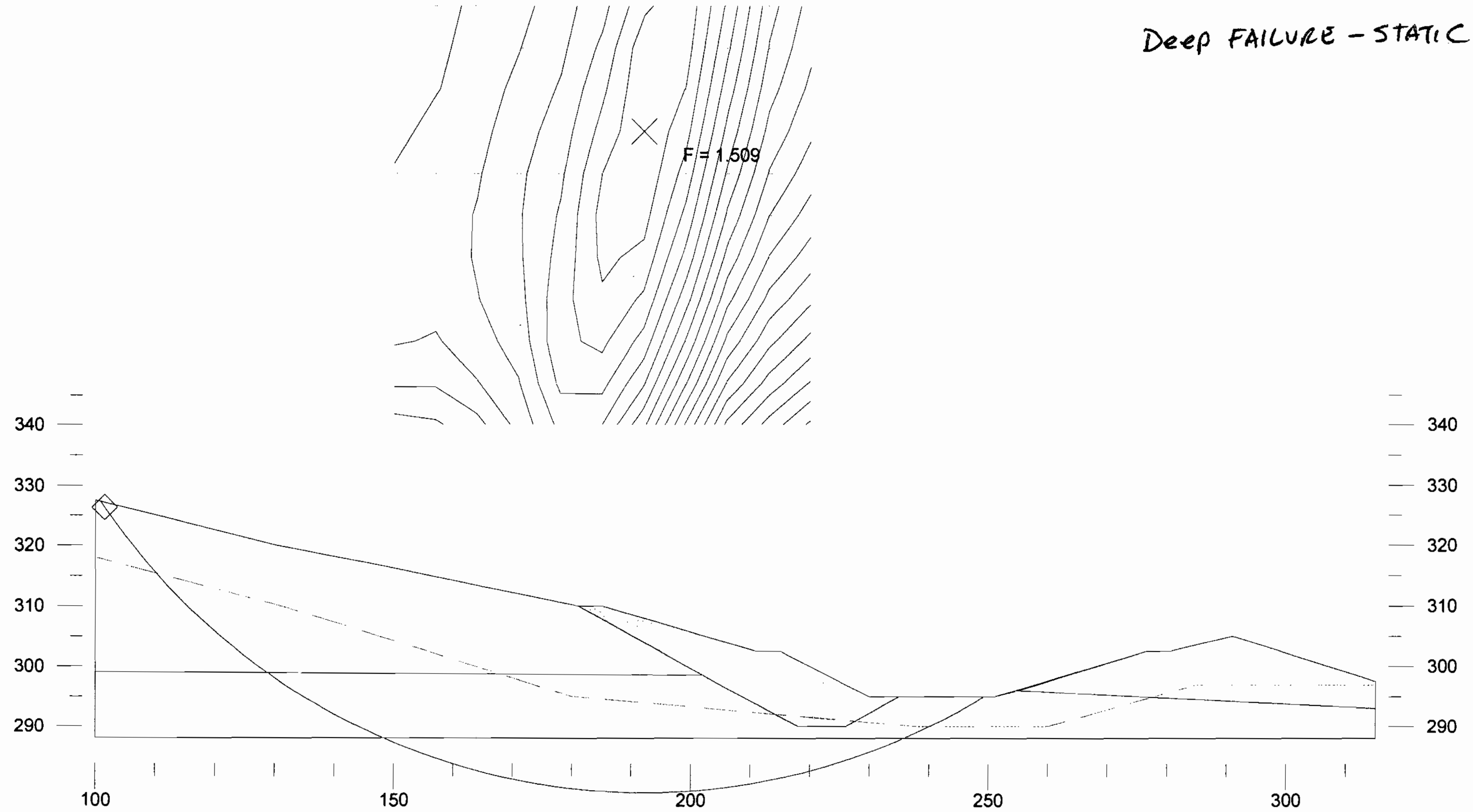
Appendix I

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50~~ft.~~m hydraugers
butress

Deep FAILURE - STATIC



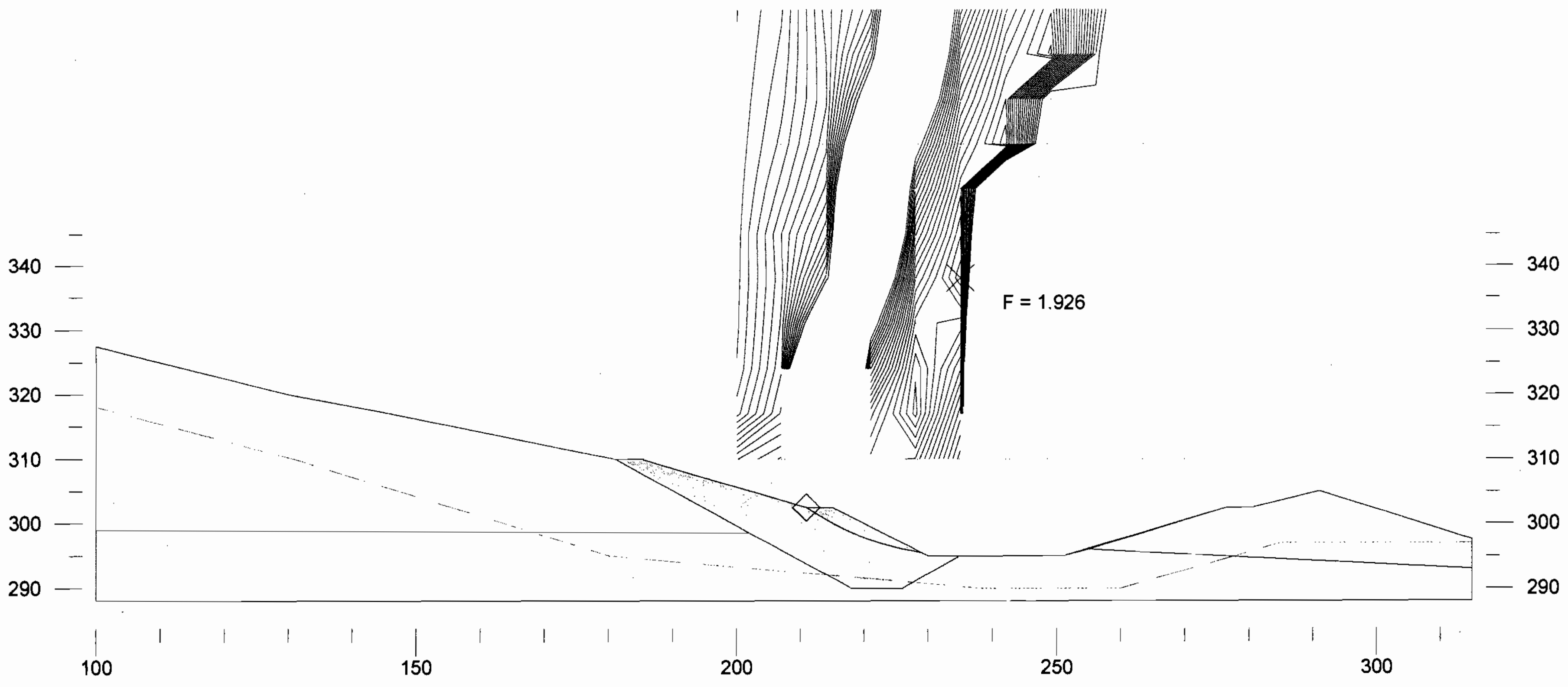
6/22/2001 1:26:04 PM C:\CALENG\A_GEOT~1\001860~1\V-BUTRS.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.509

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 ~~ft.~~ m hydraugers
butress

SHALLOW FAILURE - STATIC



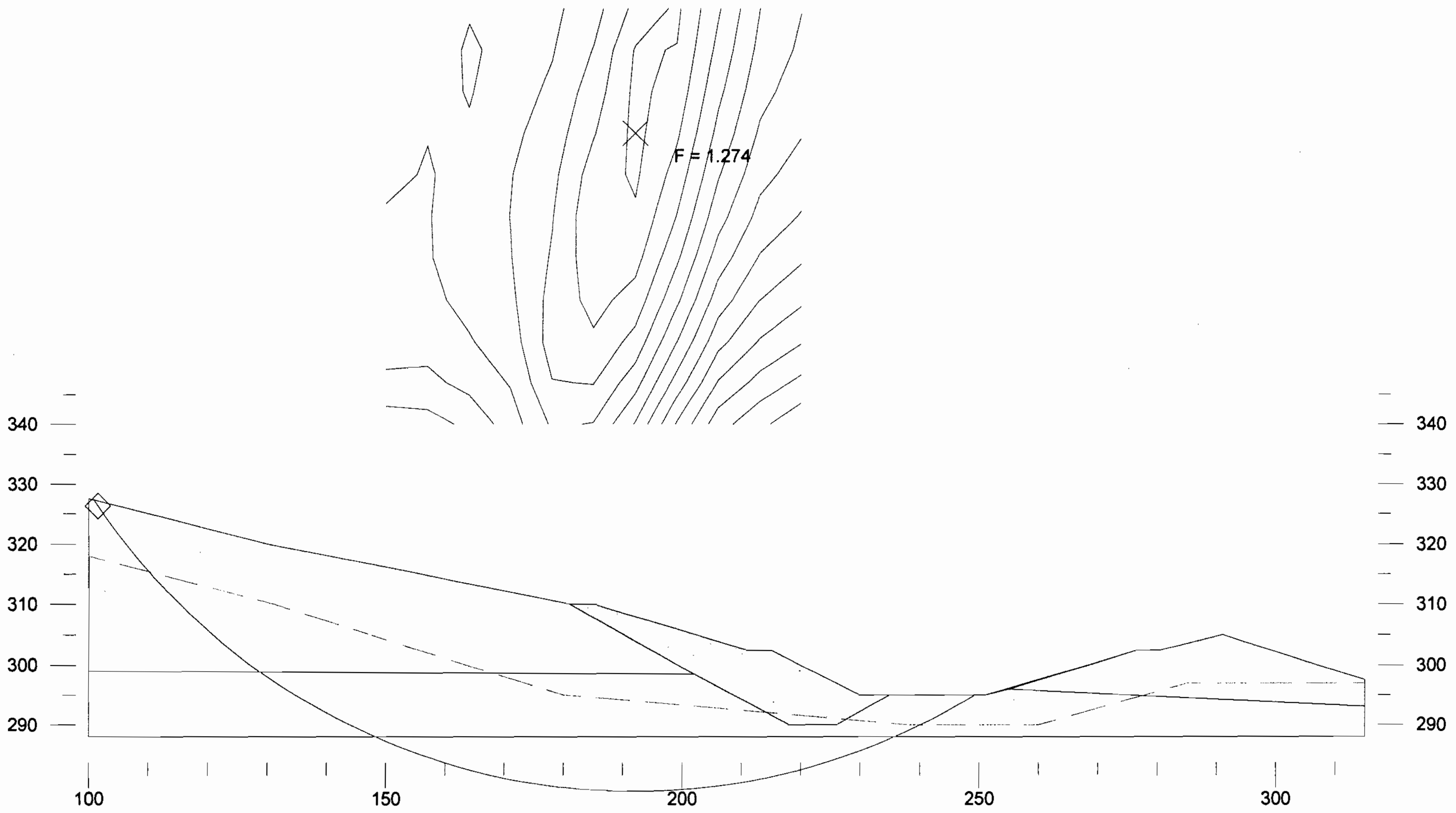
6/^^/2001 11:49:30 AM C:\CALENG\A_GEOT~1\001860~1\GLOBAL~1\V-BUTRS.GSL CAL Engineering and Geolo^ ^nc. - Walnut Creek, CA F = 1.926

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

Seismic coefficient = 0.04

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 m hydraugers
butress-seismic far field



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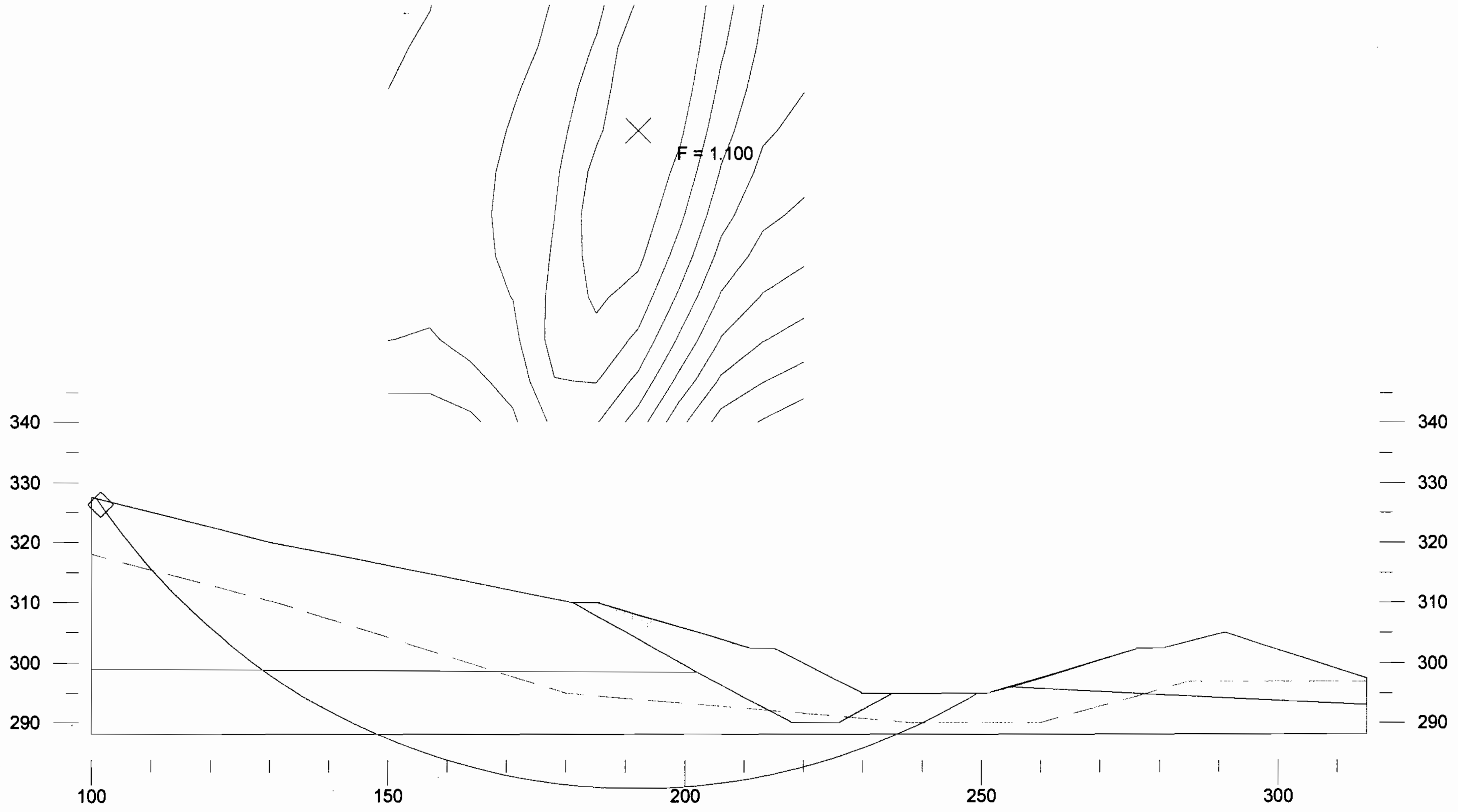
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

Seismic coefficient = 0.08

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 m hydraugers
butress-seismic intermediate field



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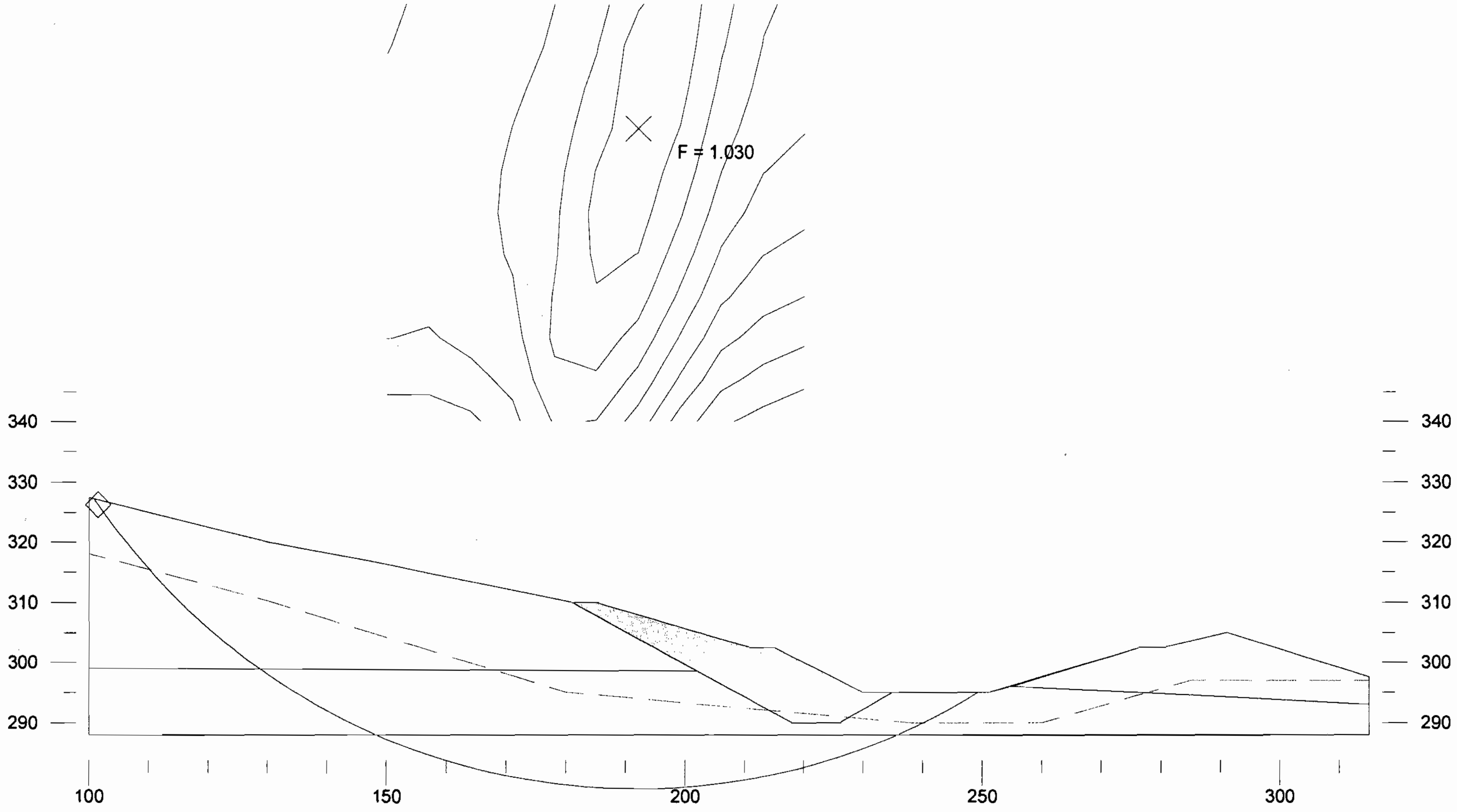
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

Seismic coefficient = 0.10

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 m hydraugers
butress-seismic near field



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	Gamma	C	Phi	Piezo	Ru
	kN/m3	kPa	deg	Surf.	
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	2.39	20	1	0

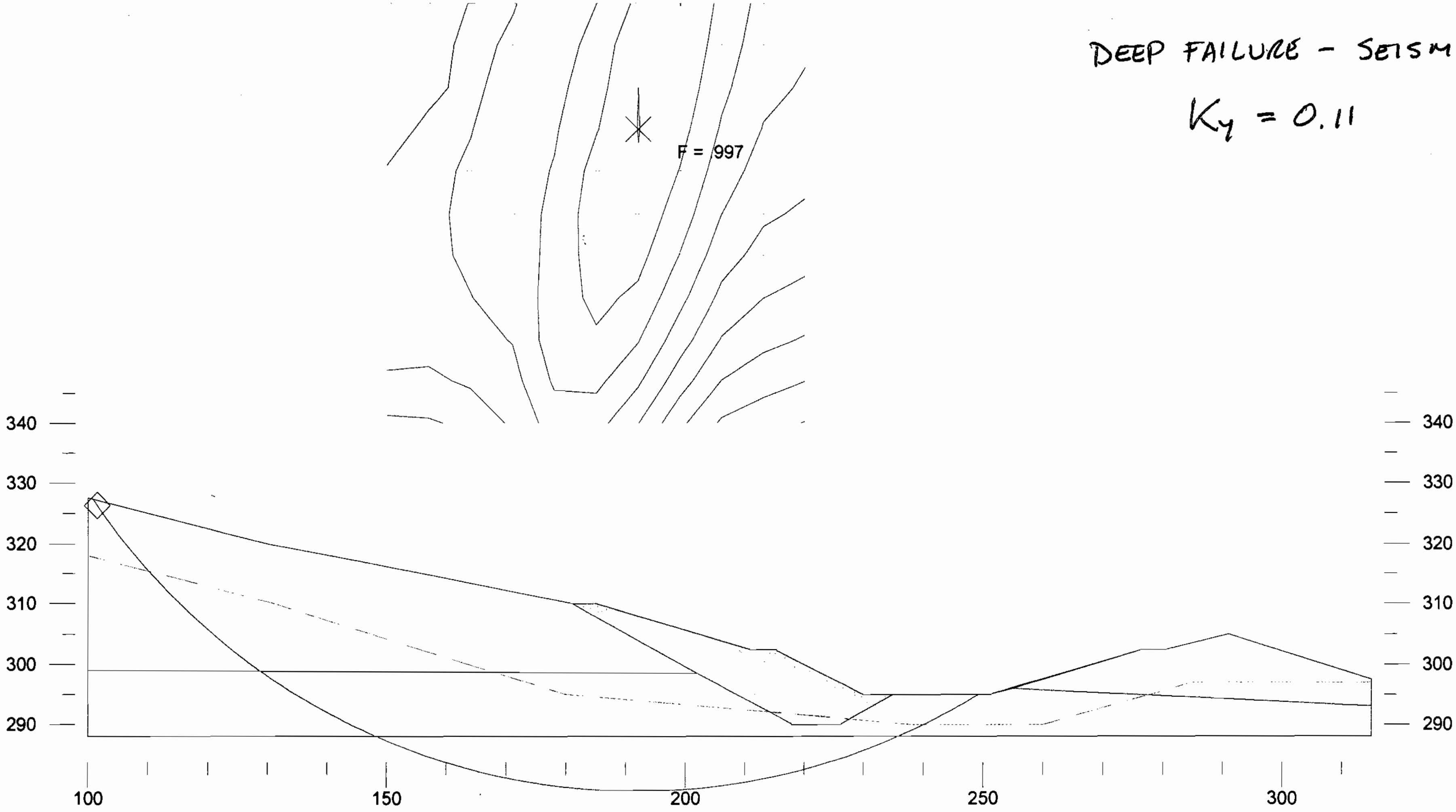
Seismic coefficient = 0.11

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 ~~ft.~~ hydraugers
m butress

DEEP FAILURE - SEISMIC

$K_y = 0.11$



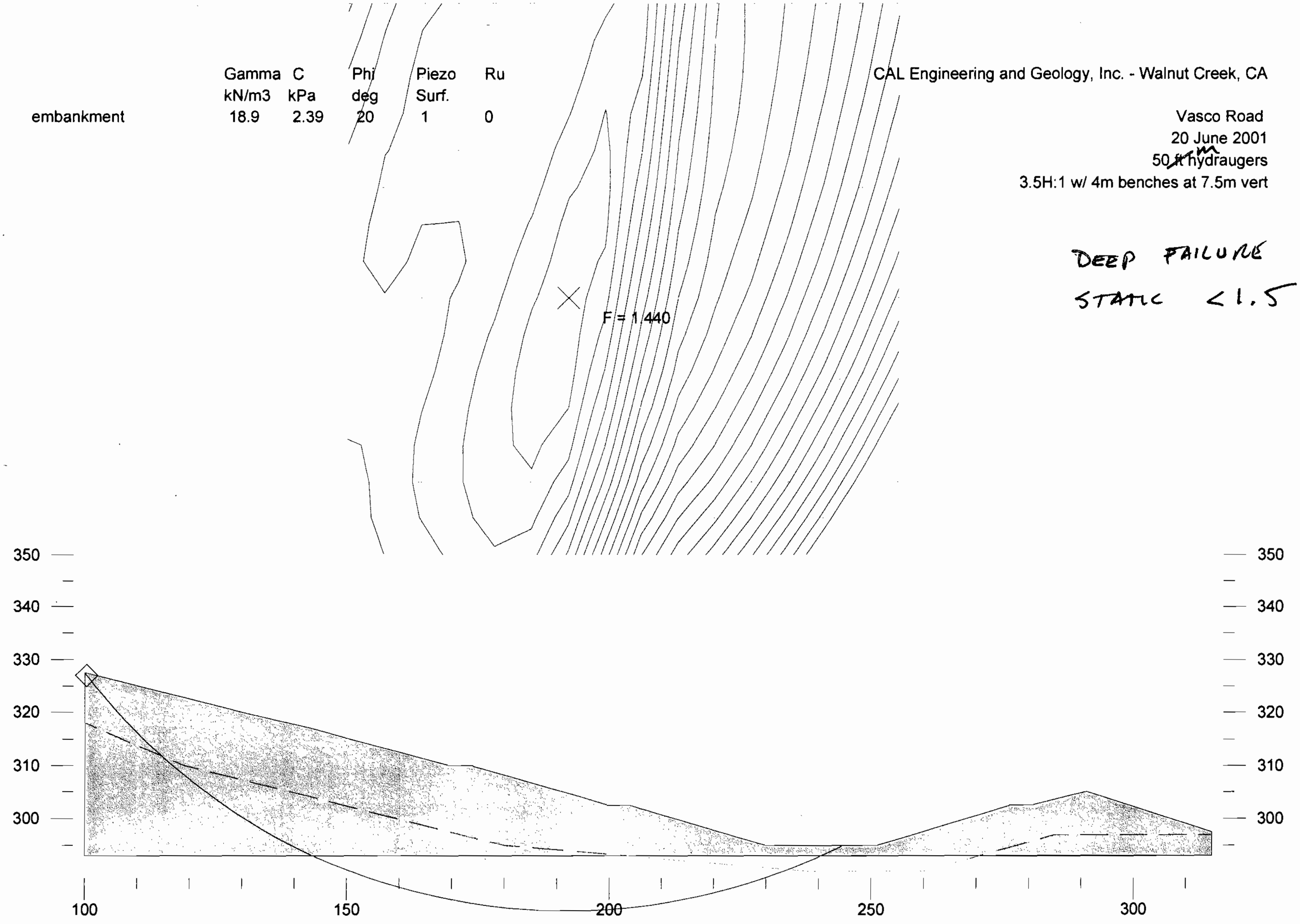
6/22/2001 1:30:04 PM C:\CALENG\A_GEOT~1\001860~1\V-BUTRS.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = .997

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 ~~ft~~ m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

DEEP FAILURE
STATIC <1.5



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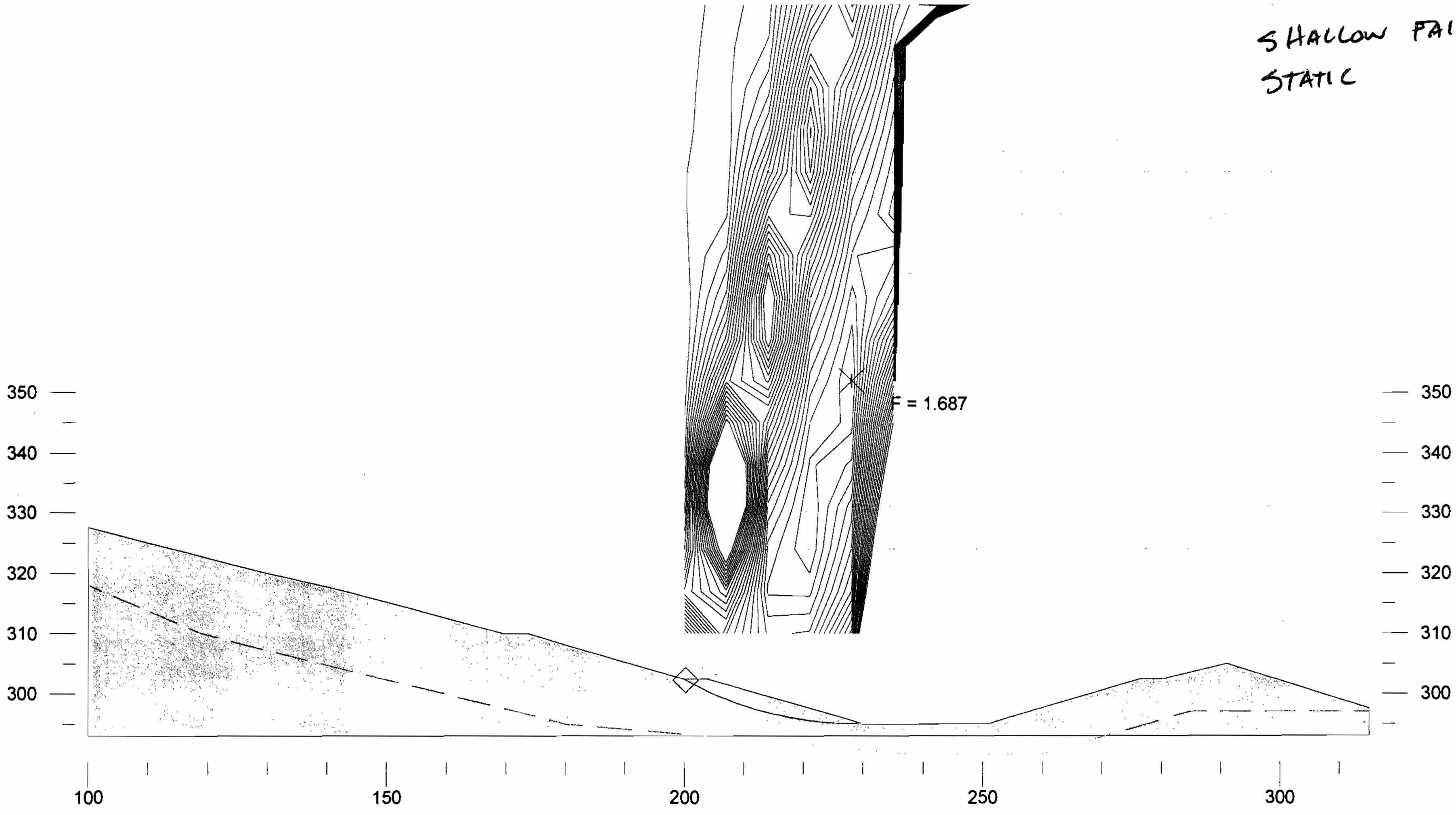
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50 ~~ft~~ m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

SHALLOW FAILURE
STATIC



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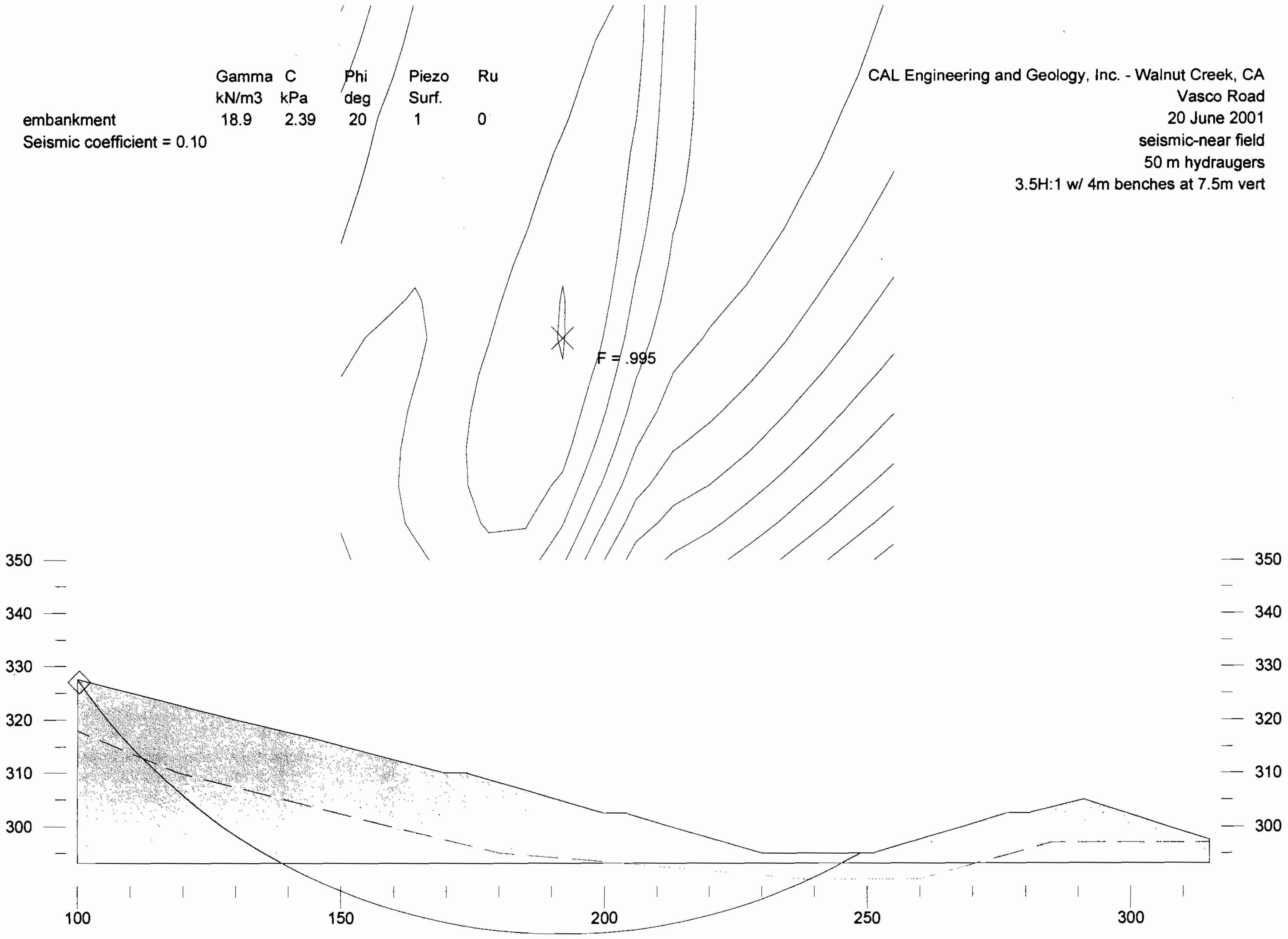


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.10

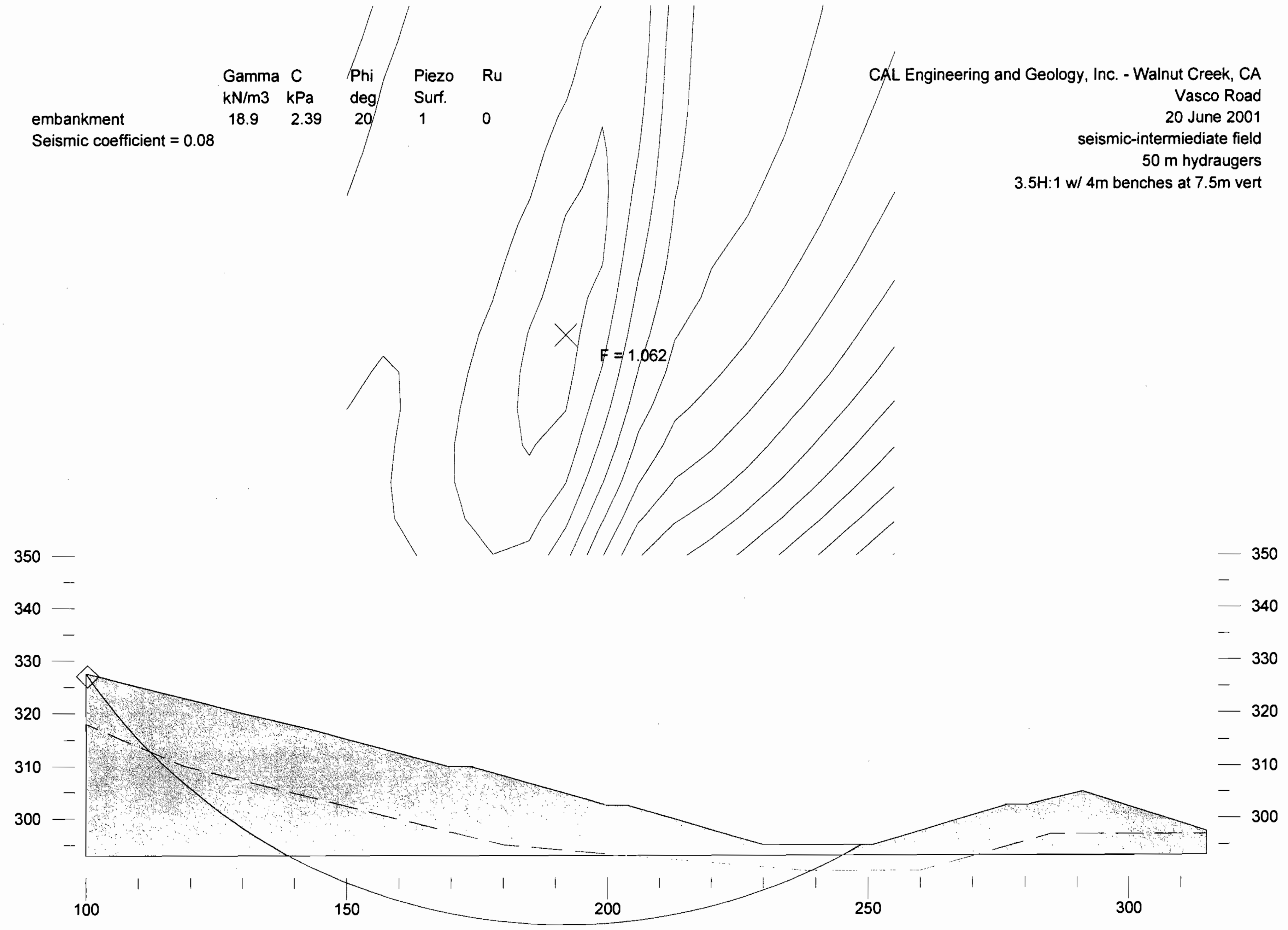
CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
seismic-near field
50 m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

8/2/2001 11:08:21 AM C:\CALENG\A_GEOT~1\001860~1\GLOBAL~1\3TO150M.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = .995

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
seismic-intermiediate field
50 m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.08



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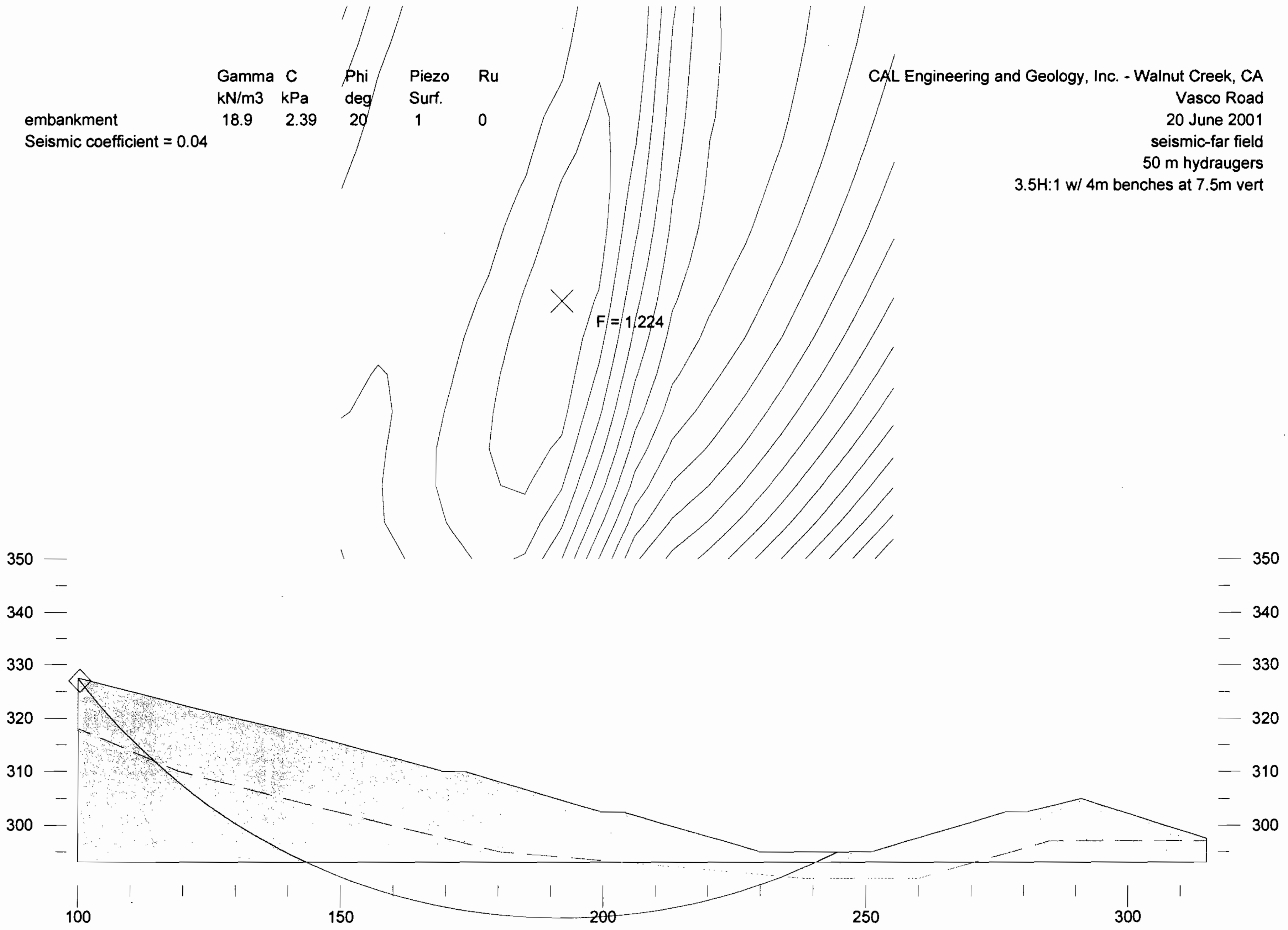
	Gamma	C	Phi	Piezo	Ru
	kN/m3	kPa	deg	Surf.	
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.04

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
seismic-far field
50 m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert



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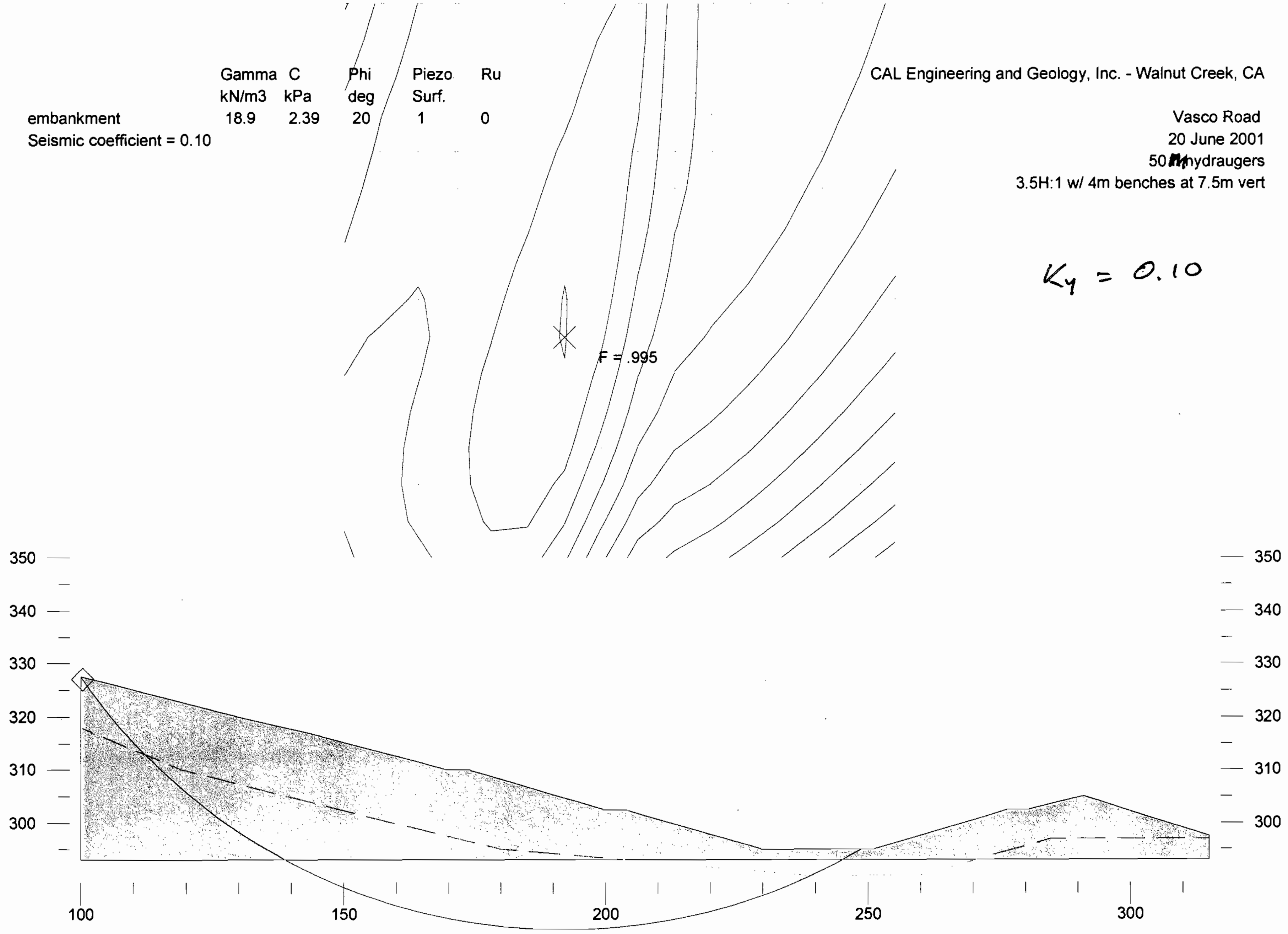
CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
50m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

Ky = 0.10

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.10

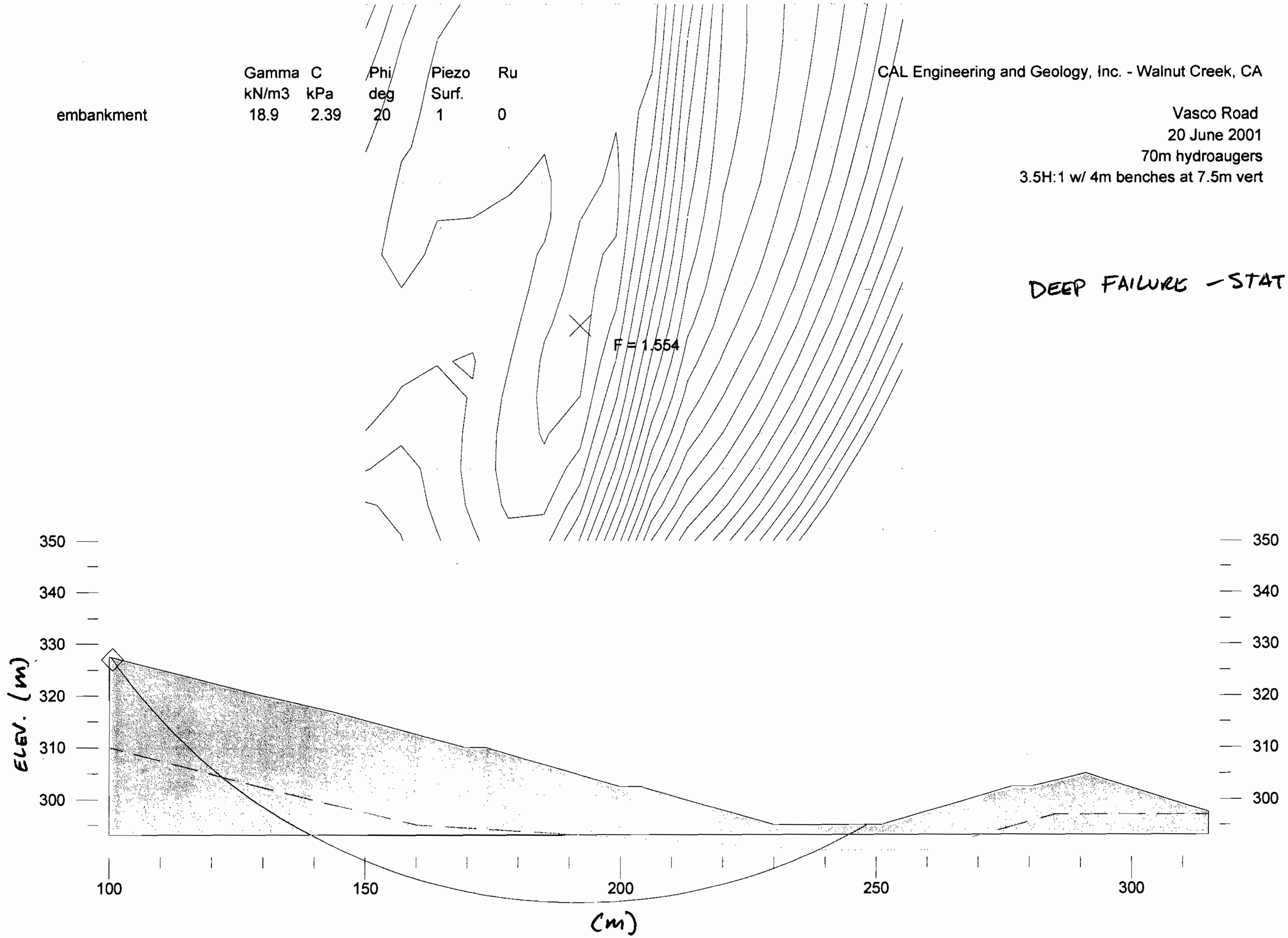


CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

DEEP FAILURE – STATIC

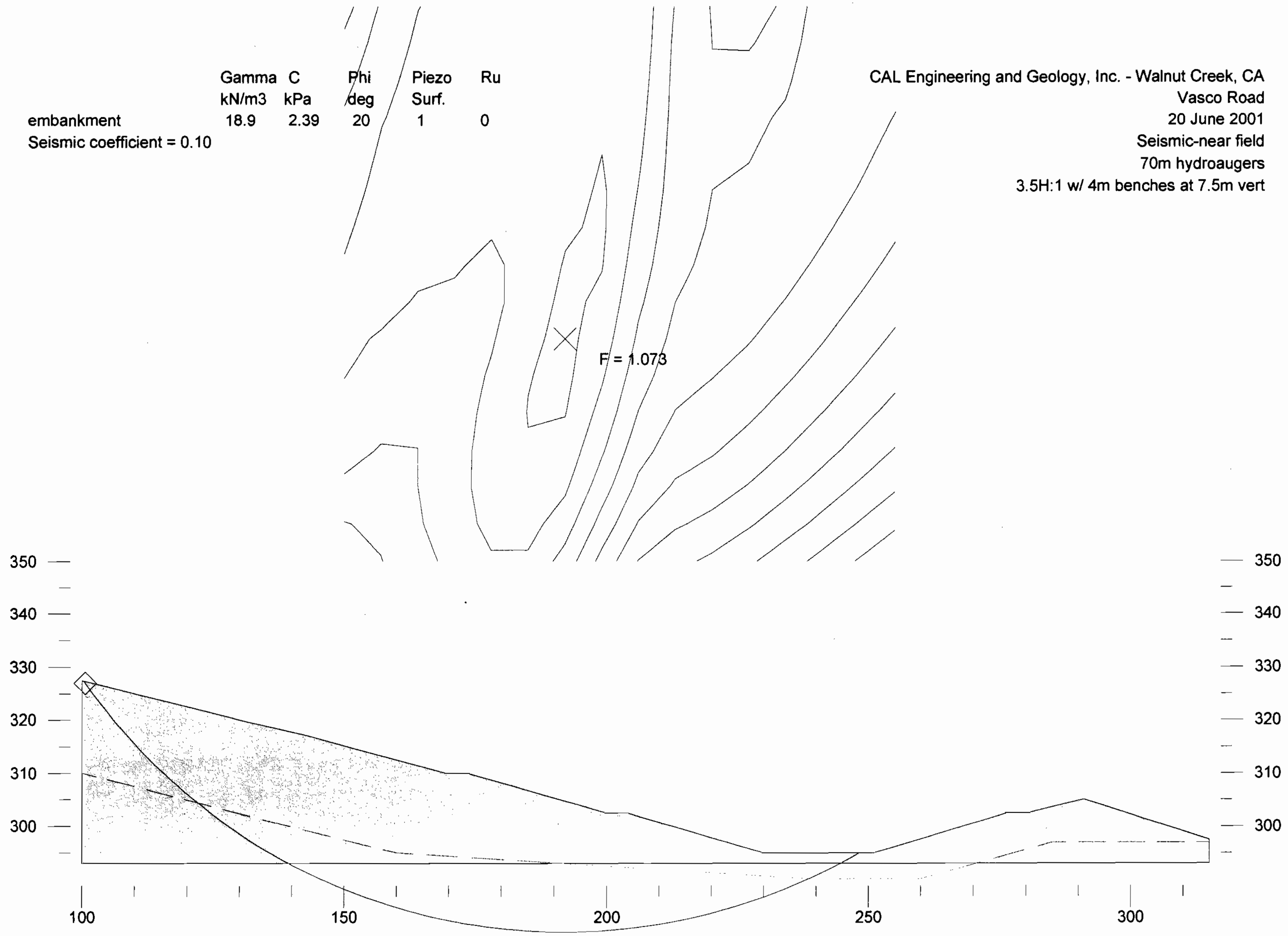


6/22/2001 12:40:03 PM C:\CALENG\A_GEOT~1\001860~1\3TO170FT.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.554

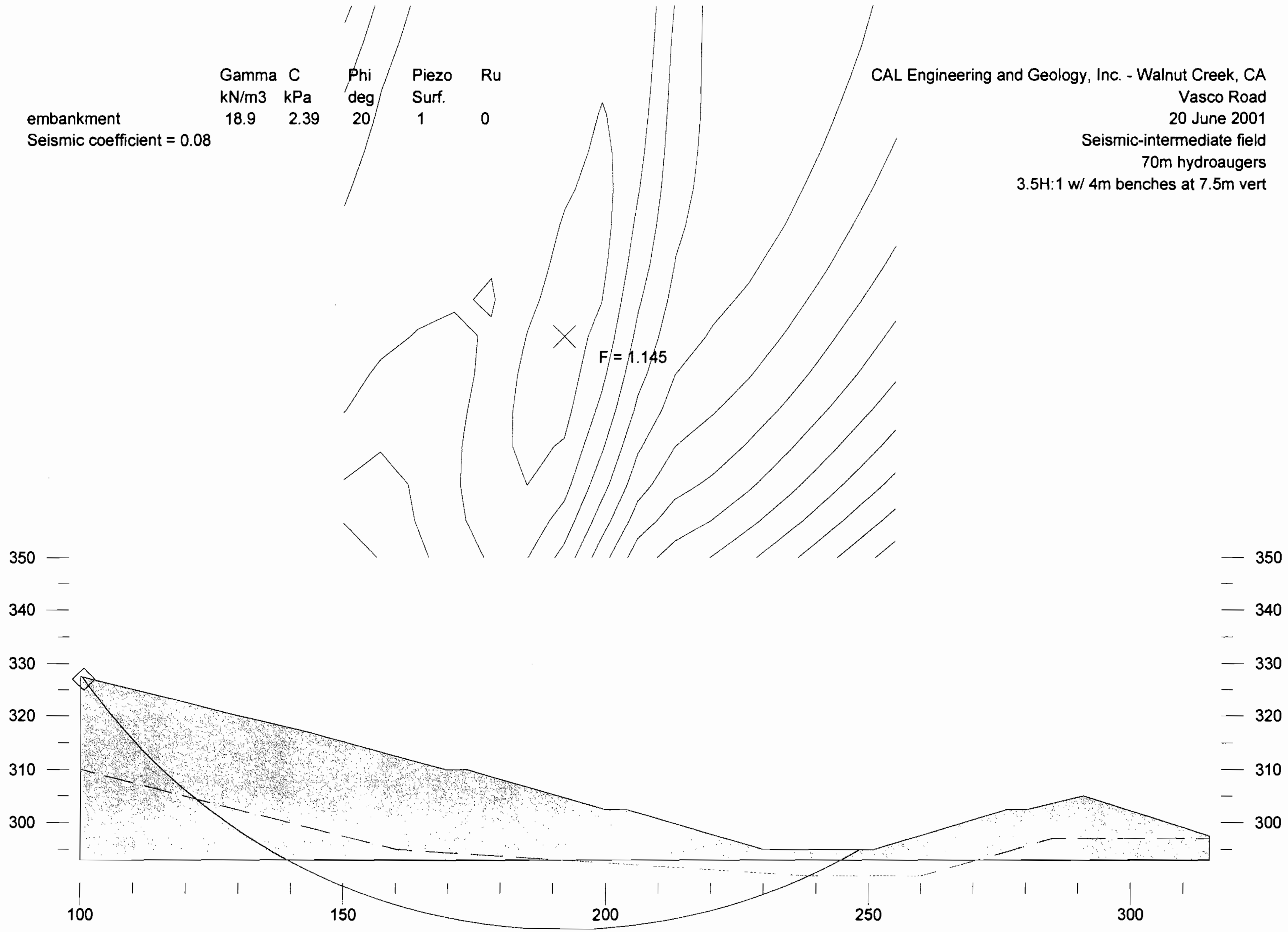
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.10

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
Seismic-near field
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert



8/2/2001 11:14:14 AM C:\CALENG\A_GEOT~1\001860~1\GLOBAL~1\3TO170M.GSL CAL Engineering and Geology Inc. - Walnut Creek, CA F = 1.073



	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.08

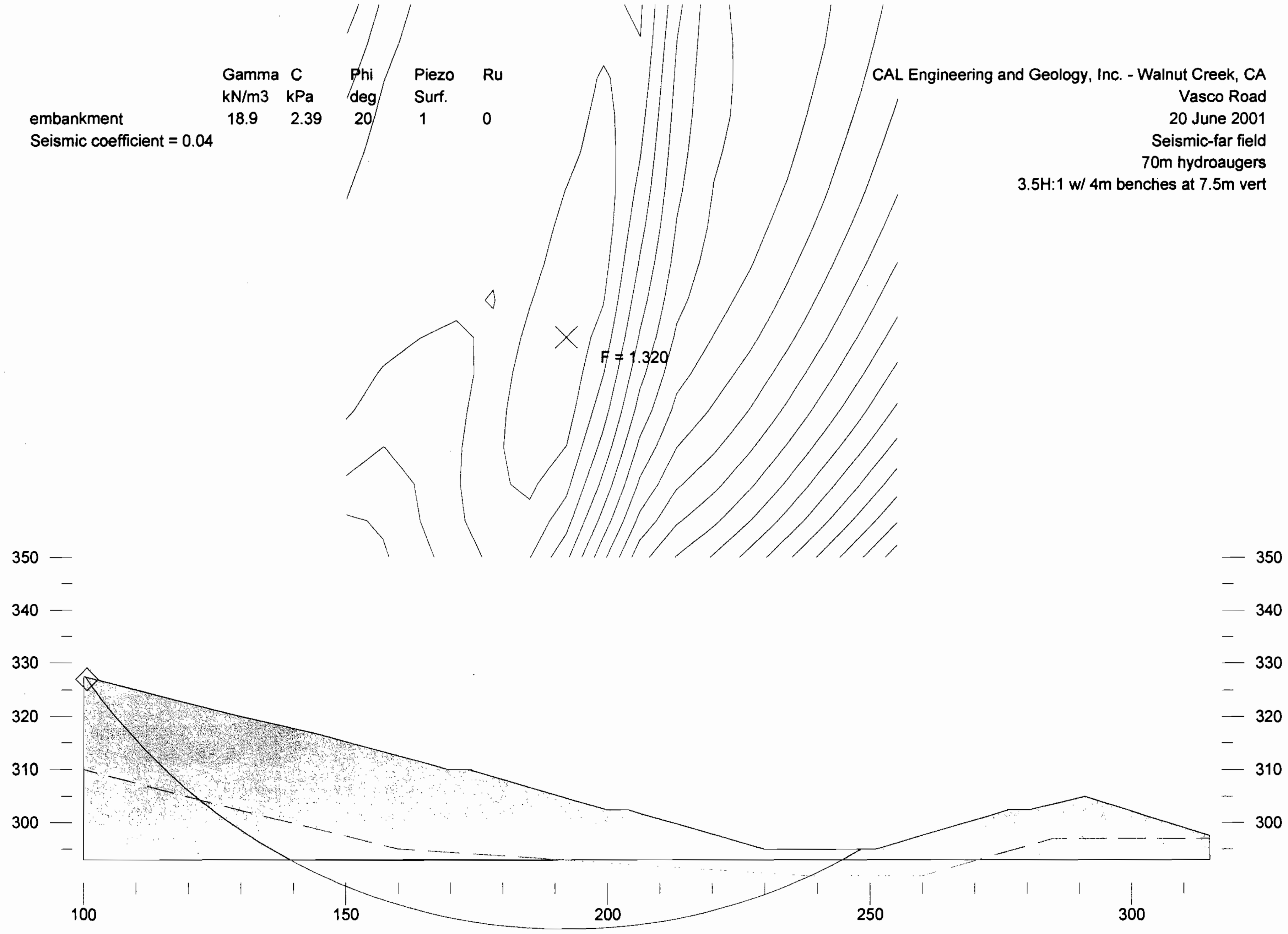
CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
Seismic-intermediate field
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert

8/2/2001 11:13:38 AM C:\CALENG\A_GEOT~1\001860~1\GLOBAL~1\3TO170M.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.145

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.04

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
20 June 2001
Seismic-far field
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert



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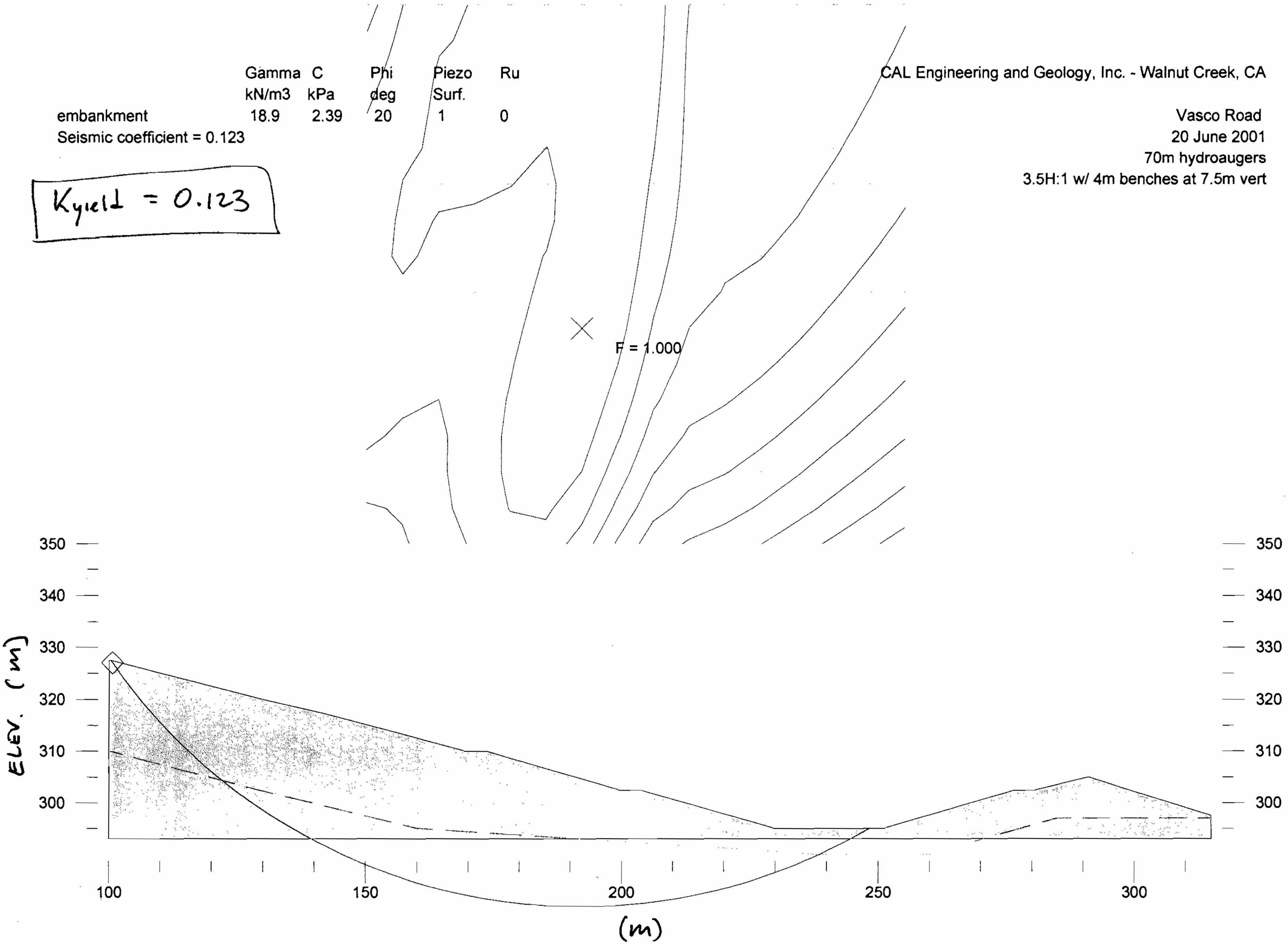
CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
20 June 2001
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	20	1	0

Seismic coefficient = 0.123

Kyield = 0.123



6/22/2001 12:39:22 PM C:\CALENG\A_GEOT~1\001860~1\3TO170FT.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.000

DISPLACEMENT ANALYSIS

Publication No. FHWA-SA-97-076

U.S. Department
of Transportation
**Federal Highway
Administration**

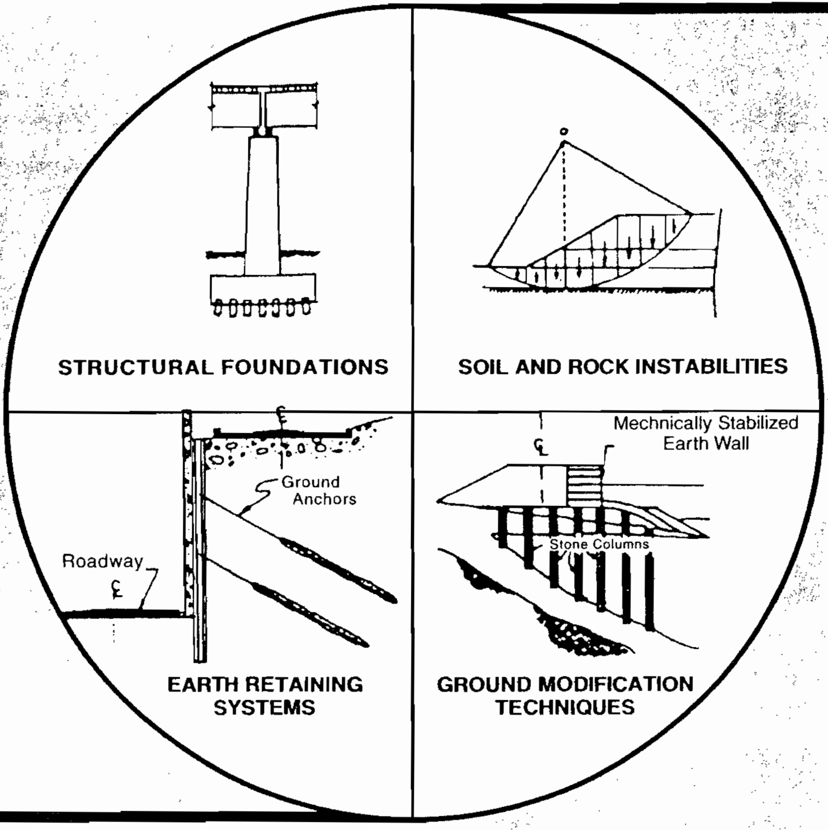
May 1997

OFFICE OF ENGINEERING
OFFICE OF TECHNOLOGY APPLICATIONS
400 SEVENTH STREET, SW
WASHINGTON, DC 20590

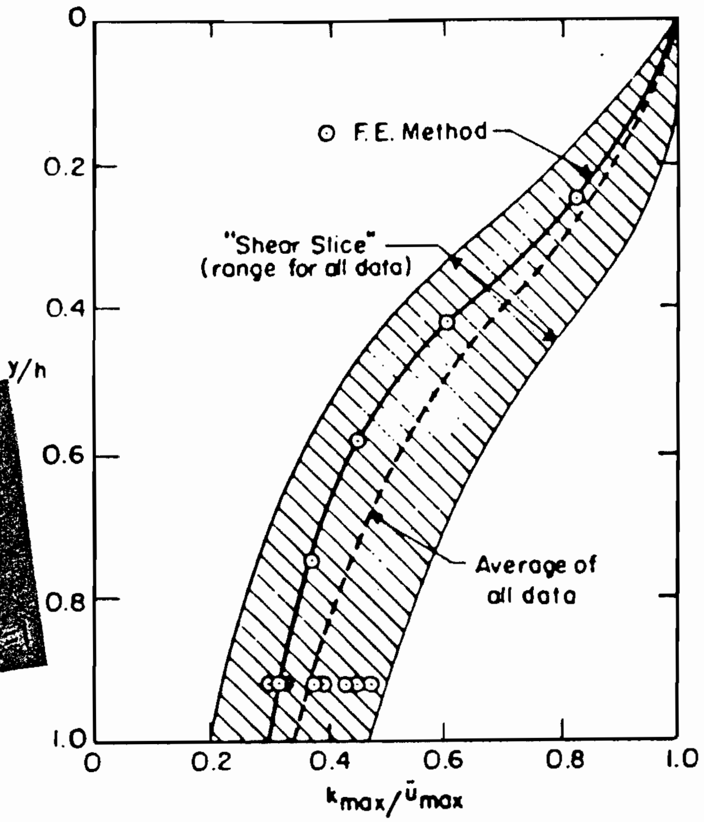
GEOTECHNICAL ENGINEERING CIRCULAR NO. 3

DESIGN GUIDANCE: GEOTECHNICAL EARTHQUAKE ENGINEERING FOR HIGHWAYS

VOLUME I - DESIGN PRINCIPLES



Y IS THE TOTAL DEPTH OF SLIDING MASS IN EMBANKMENT [illegible] (IF FAILURE [illegible] TO BASE FROM CREST)



Y IS TOTAL DEPTH OF SLIDING MASS IN EMBANKMENT

FIG. 9 VARIATION OF "MAXIMUM ACCELERATION RATIO" WITH DEPTH OF SLIDING MASS

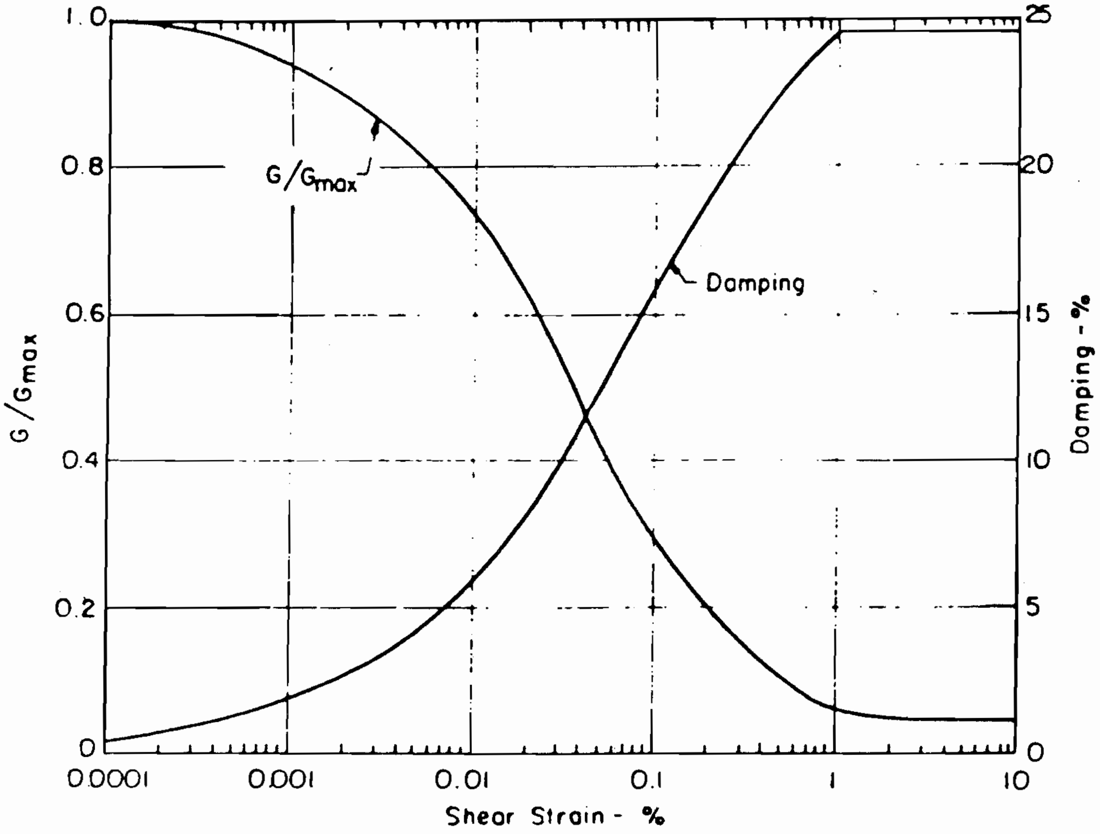


FIG. 10 SHEAR MODULUS AND DAMPING CHARACTERISTICS USED IN RESPONSE COMPUTATIONS

In using the acceleration time history from a one-dimensional site response analysis as the excitation in a Newmark sliding block analysis, the seismic response of a soil has been decoupled from its permanent seismic deformation. In other words, the influence of yielding and the accumulation of permanent seismic deformation has not been accounted for in the evaluation of the seismic response of the soil mass. Lin and Whitman (1986) have shown that this type of decoupled analysis overestimates seismic deformation by a minimum of 20 percent and by as much as a factor of 2 or 3 when the predominant period of the earthquake motion is close to the resonant period of the soil deposit. The predominant period of the earthquake motion can be determined from the acceleration response spectrum as the period at which the spectral acceleration is a maximum. The *fundamental period* of the soil deposit, T_0, can be evaluated using equation 4-5 as $T_0 = 1/f_o$.

While the residual shear strength is typically employed in practice to evaluate the yield acceleration, this common practice is another source of conservatism in permanent seismic deformation analyses. Deformations should not begin to accumulate until the seismic acceleration exceeds the yield acceleration corresponding to the peak shear strength. Furthermore, several centimeters of deformation may have to accumulate before the shear strength (and yield acceleration) fall from peak to residual values. Therefore, particularly for small calculated deformations, the use of residual shear strength to evaluate the yield acceleration for a Newmark deformation analysis can introduce considerable conservatism into the analysis.

7.4 UNIFIED METHODOLOGY FOR SEISMIC STABILITY AND DEFORMATION ANALYSIS

The seismic coefficient-factor of safety and permanent seismic deformation analysis methods for seismic slope stability may be combined into a single, unified method for evaluation of slopes and embankments. First, a seismic coefficient-factor of safety analysis is performed using a suitably conservative value for the seismic coefficient. Then, if the seismic coefficient-factor of safety analysis results in an unacceptable factor of safety, a permanent seismic deformation analysis is performed.

The "unified" seismic stability and deformation analysis is carried out using the same basic model(s) of slopes used in the static analysis. Note, however, that the critical surface with the lowest yield acceleration or pseudo-static factor of safety may be very different from the surface with the lowest static factor of safety. The following steps are carried out to perform the unified seismic slope stability and deformation analysis:

Step 1: Reinterpret the cross-sections analyzed in the static stability analysis and assign appropriate dynamic residual strength parameters. In cases where it is not clear whether drained or undrained shear strength parameters are appropriate for the dynamic analysis, follow guidelines presented in Duncan (1992) or use a composite consolidated drained-consolidated undrained strength envelope proposed by the Corps of Engineers for pervious soils and the consolidated undrained strength envelope for silts and clays. For fully saturated or sensitive silts or clays, multiply the undrained peak shear strength by 0.8 for the analysis.

Step 2: Select a seismic coefficient, k_s, for a minimum factor of safety of 1.0 based upon the work of Hynes and Franklin. If a permanent seismic deformation of 1 m is acceptable, a value of k_s equal to $0.5 \cdot a_{max}/g$, where a_{max} is peak horizontal acceleration at the ground surface, may be used for embankments If a site response analysis has been performed to evaluate the peak average acceleration of the failure mass, a value of k_s equal to $0.17 \cdot a_{max}/g$ may be used. For natural and cut slopes, where amplification effects are expected to be minimal, a value of k_s equal to $0.17 \cdot a_{max}/g$ may also be used (see discussion in section 7.3.2).

Step 3: Perform the pseudo-static stability analysis. If the minimum factor of safety, FS_{min}, exceeds 1.0, the seismic stability analysis is completed.

Step 4: If the pseudo-static factor of safety is less than 1.0, perform a Newmark deformation analysis. This is done using the following three steps:

1) Calculate the yield acceleration, k_y. The yield acceleration is calculated using a trial and error procedure in which the seismic coefficient is varied until $FS_{min} = 1.0$ is obtained.

2) Calculate the permanent seismic deformation. The permanent seismic deformation may be calculated using either simplified design charts (e.g., figure 51), as described below, or by performing a formal time-history analysis in which the excursions of the average acceleration time history above the yield acceleration are double integrated.

3) Compare the calculated permanent seismic deformation to the allowable maximum permanent displacement, u_{max}.

Several investigators have presented simplified charts based upon the results of Newmark deformation analyses for estimating permanent seismic deformations. The chart developed by Hynes and Franklin (1984) was presented in figure 51. The Hynes and Franklin chart does not consider either site amplification or earthquake magnitude effects. Therefore, the Hynes and Franklin charts may be expected to give reasonable values for natural and cut slopes and low, broad embankments where amplification effects are expected to be small when subject to large earthquakes. For small earthquakes, the Hynes and Franklin charts may yield conservative values for such cases.

Makdisi and Seed (1978) developed the seismic deformation chart shown in figure 53 from the results of two-dimensional finite element analyses of embankments. This chart includes the effect of amplification of seismic motions by the embankment and provides upper and lower bounds on the permanent deformation as a function of magnitude.

If a seismic response analysis has been performed, a formal Newmark seismic deformation analysis can be performed by using the acceleration or shear stress time histories from the seismic site response analysis. Jibson (1993) describes the analytical procedure for performing such an analysis. To evaluate the permanent displacement of the sliding mass, the average acceleration time history of mass above the critical failure plane (the failure surface with the lowest yield acceleration) should be used.

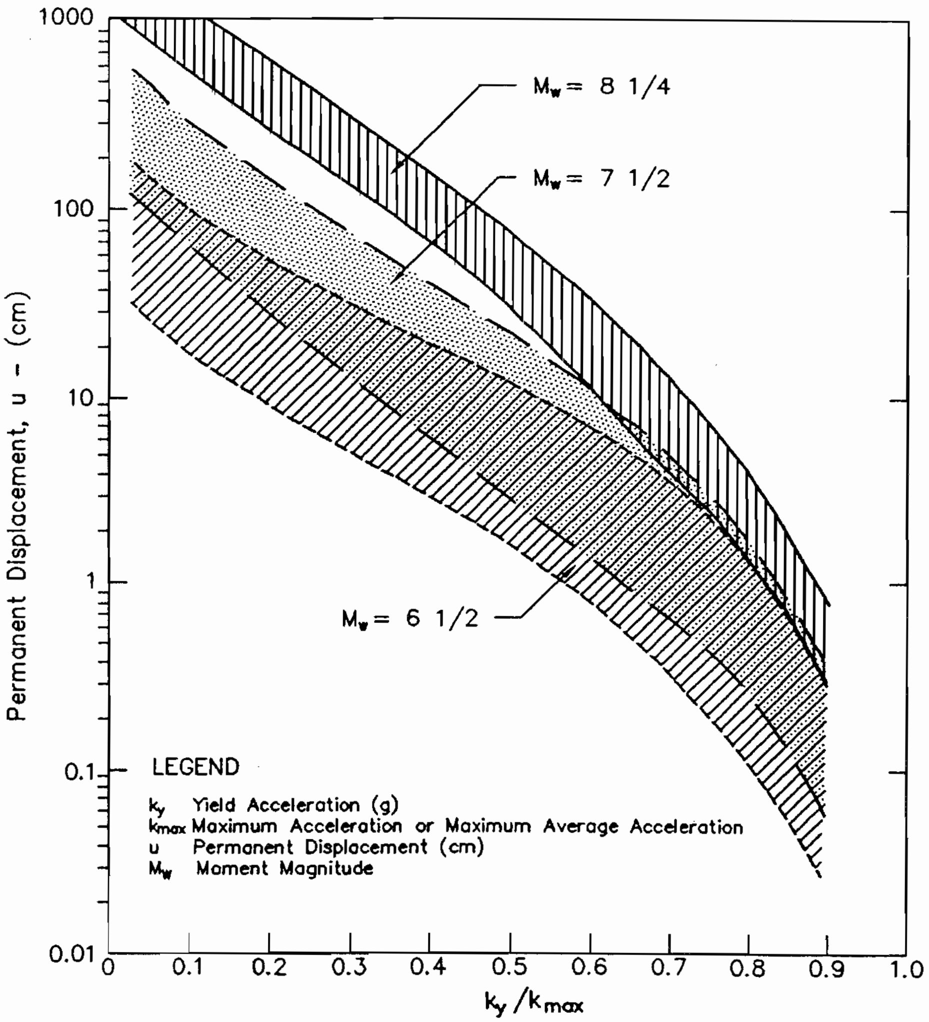


Figure 53. Permanent displacement versus normalized yield acceleration for embankments (after Makdisi and Seed, 1978, reprinted by permission of ASCE).

7.5 ADDITIONAL CONSIDERATIONS

Stability of the underlying foundation soil is an important consideration in evaluating the overall performance of the embankment, particularly if a layer (or layers) in the foundation is susceptible to liquefaction. The potential for a liquefaction-induced flow failure may be analyzed using limit equilibrium analyses by employing residual shear strengths in the potentially liquefiable zones. In this type of post-earthquake stability assessment, the seismic coefficient should be set equal to zero (Marcuson et al., 1990). If the residual shear strength is conservatively assessed using minimum values of SPT blow counts (or CPT tip resistance) within the potentially liquefiable layer(s), a factor of safety of 1.1 may be considered as acceptable. Evaluation of residual shear strength for post-liquefaction stability analyses is discussed in chapter 8.

FILL SLOPE ANALYSES

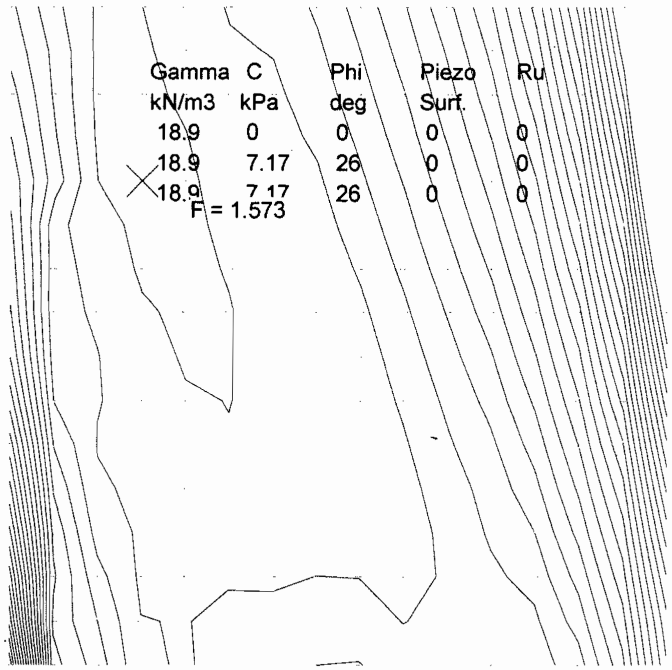
CAL Engineering and Geology, Inc. - Walnut Creek, CA

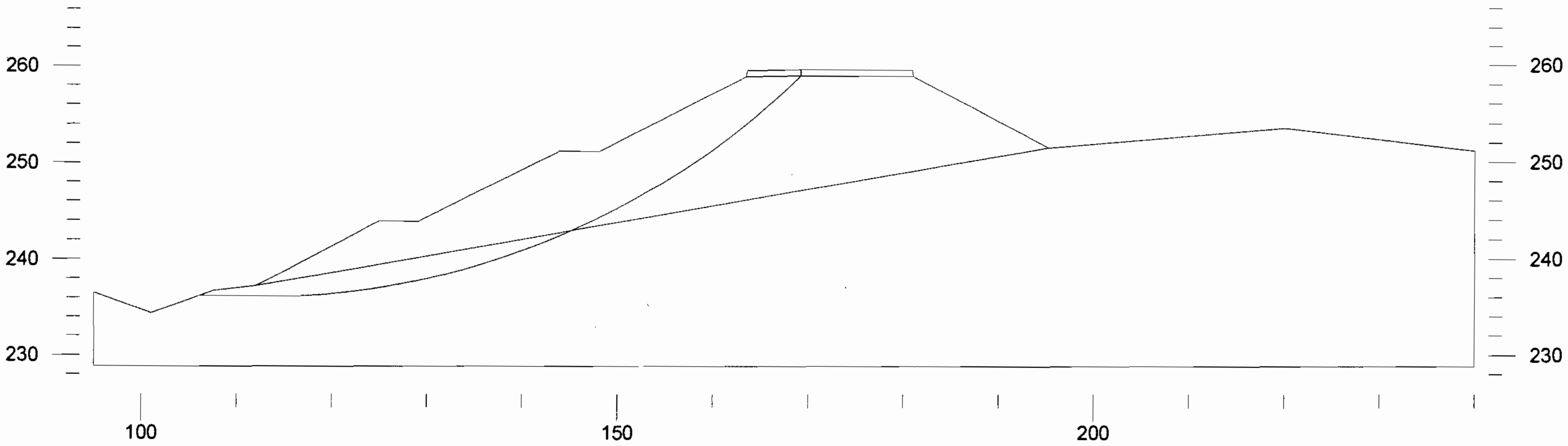
Vasco Road
27 June 2001
Station 0+800
fill slope

STATIC

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	0	0
fill	18.9	7.17	26	0	0
existing	18.9	7.17	26	0	0

F = 1.573





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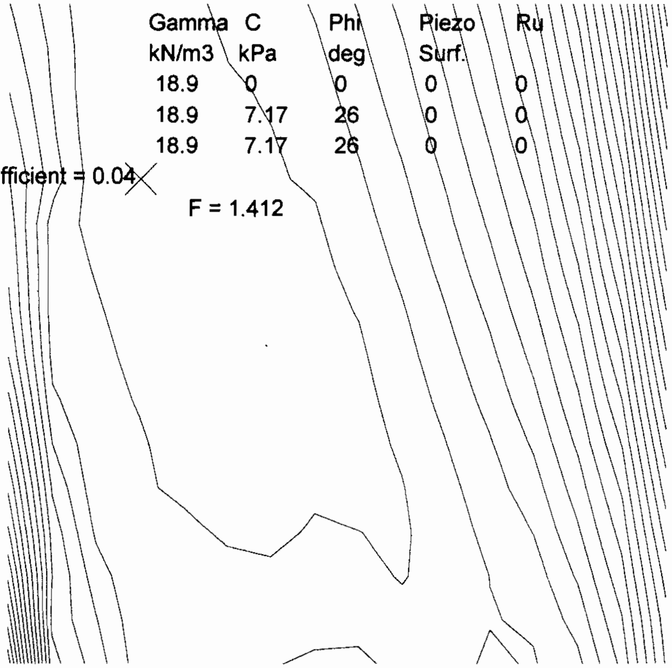
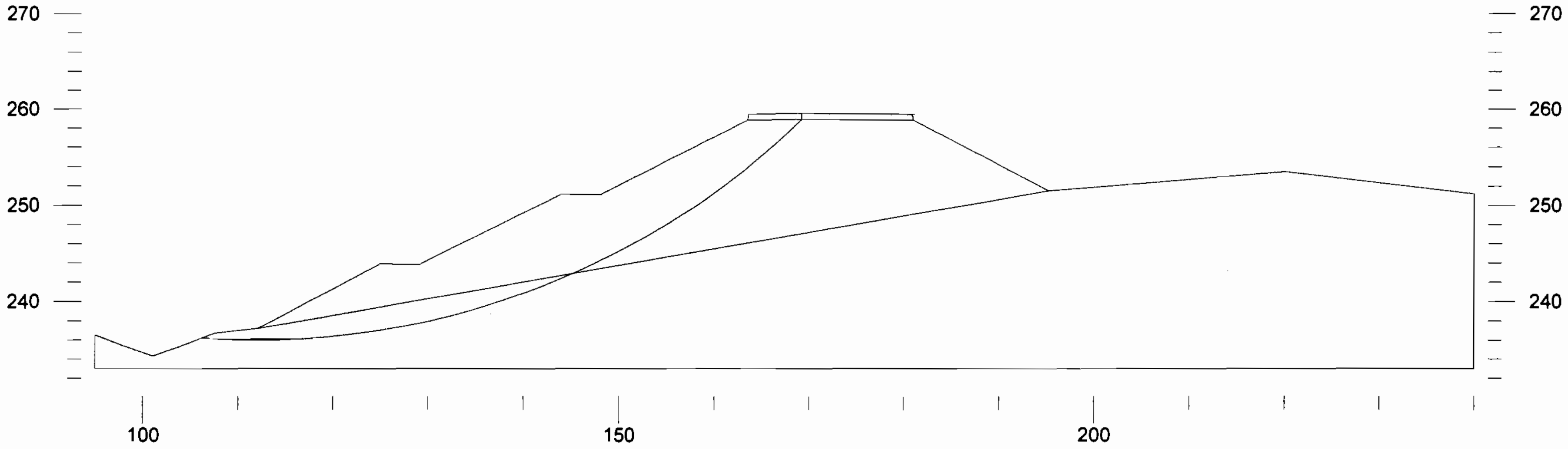
CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-far field
Vasco Road
27 June 2001
Station 0+800
fill slope

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	0	0
fill	18.9	7.17	26	0	0
existing	18.9	7.17	26	0	0

Seismic coefficient = 0.04



F = 1.412



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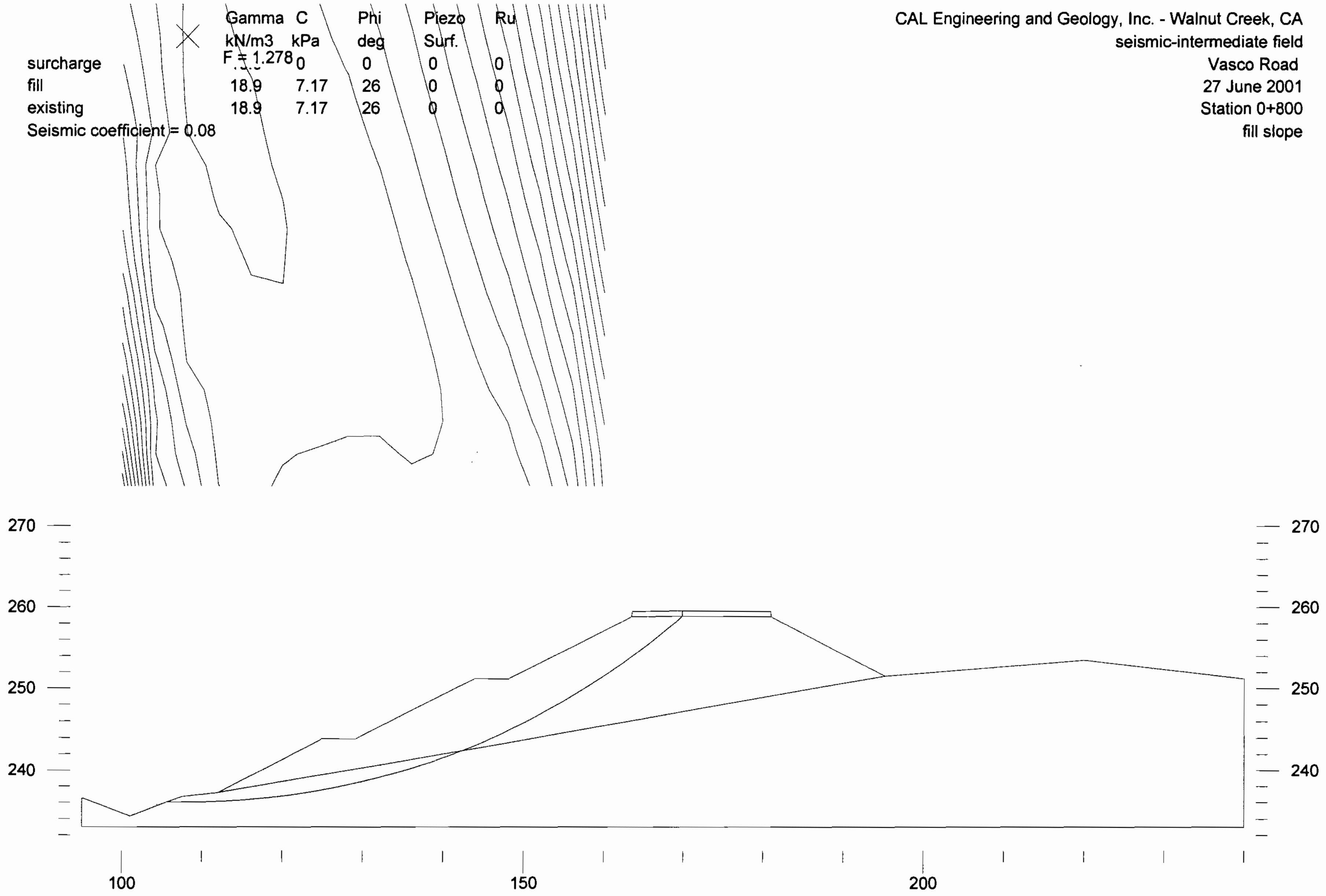
CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-intermediate field
Vasco Road
27 June 2001
Station 0+800
fill slope

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	[illegible]	0	0	0	0
fill	18.9	7.17	26	0	0
existing	18.9	7.17	26	0	0

Seismic coefficient = 0.08



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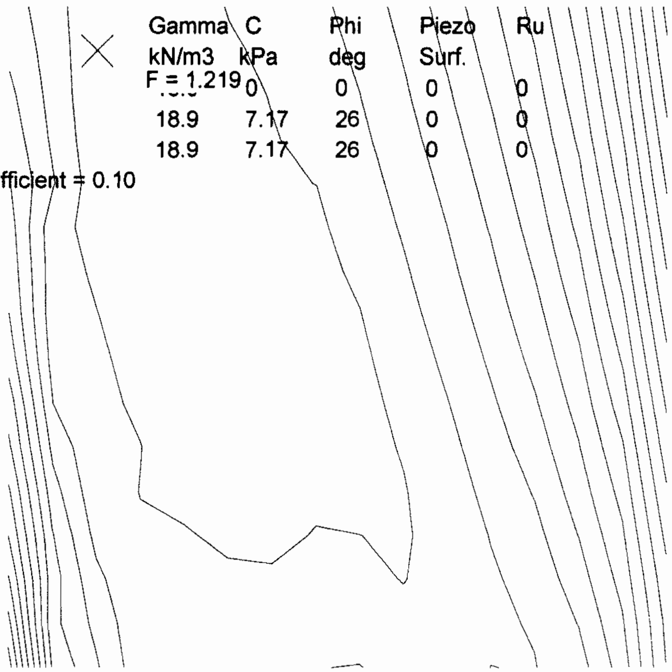
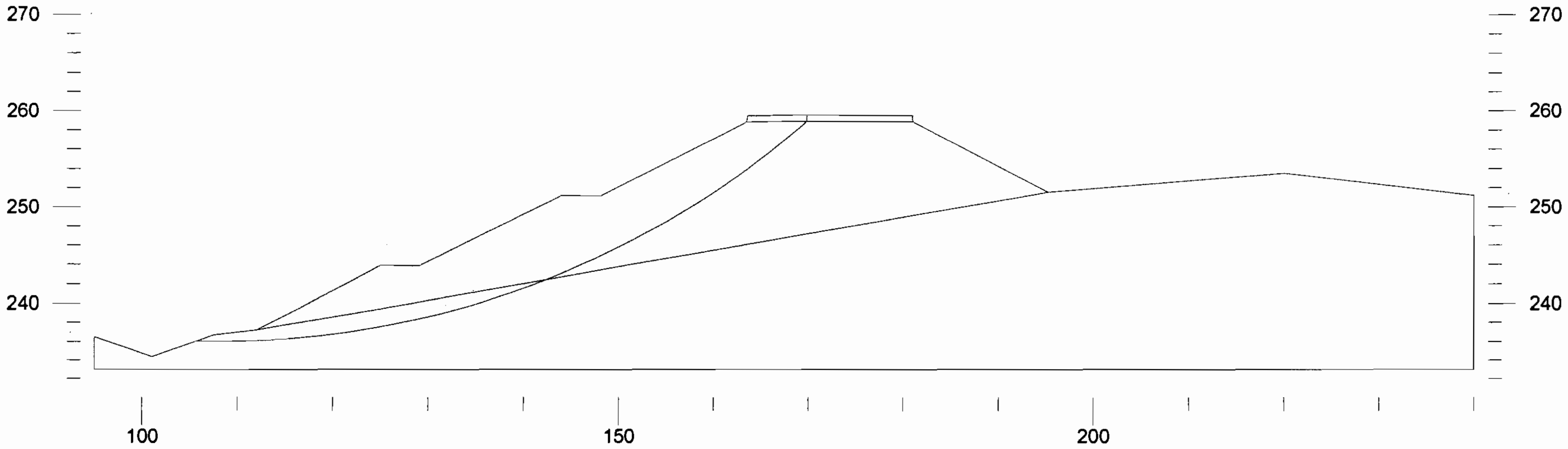
CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-near field
Vasco Road
27 June 2001
Station 0+800
fill slope



	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	[illegible]	0	0	0	0
fill	18.9	7.17	26	0	0
existing	18.9	7.17	26	0	0

Seismic coefficient = 0.10



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	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
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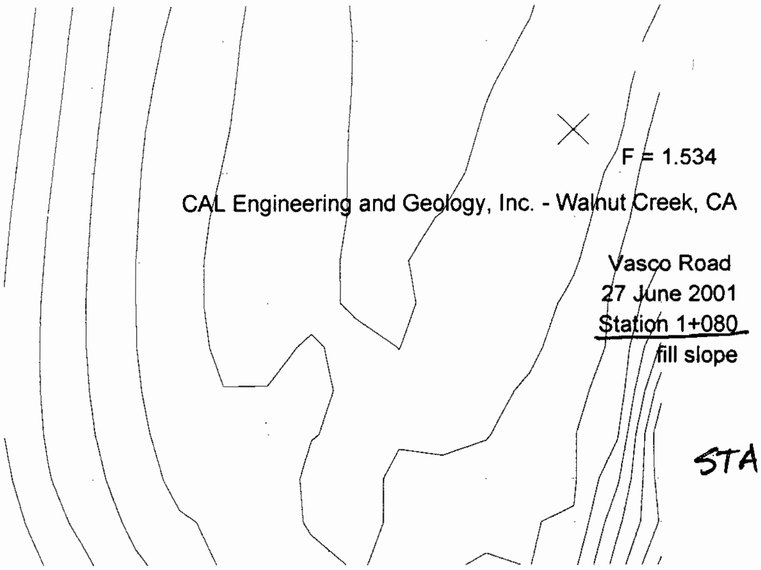
fill	18.9	7.17	26	1	0
native	18.9	7.17	26	1	0

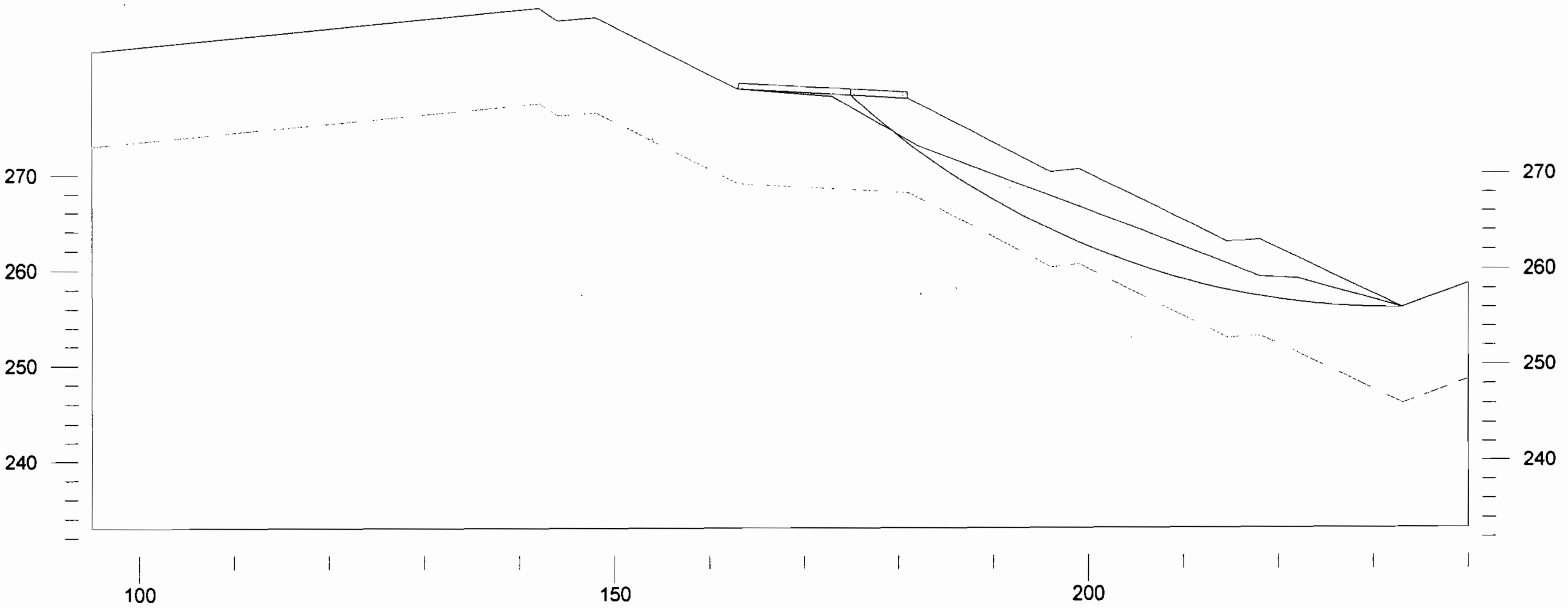


F = 1.534

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
27 June 2001
Station 1+080
fill slope

STATIC



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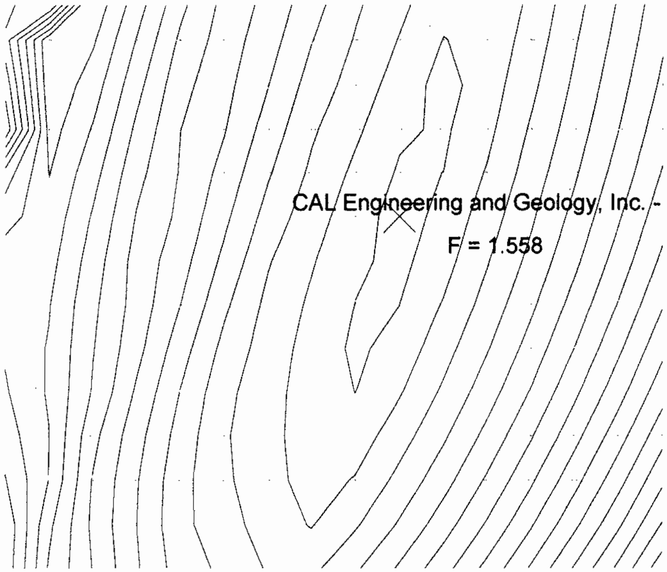
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	26	1	0

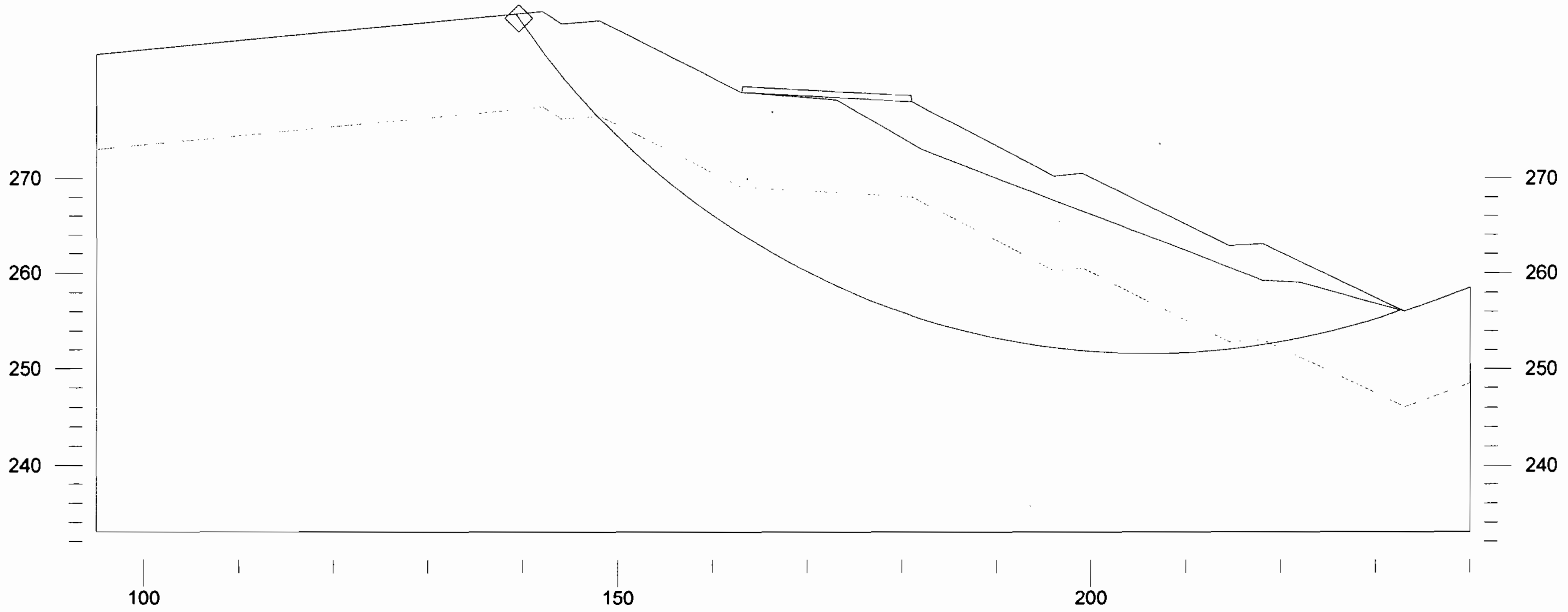


CAL Engineering and Geology, Inc. - Walnut Creek, CA

F = 1.558

Vasco Road
27 June 2001
Station 1+080
fill slope

STATIC



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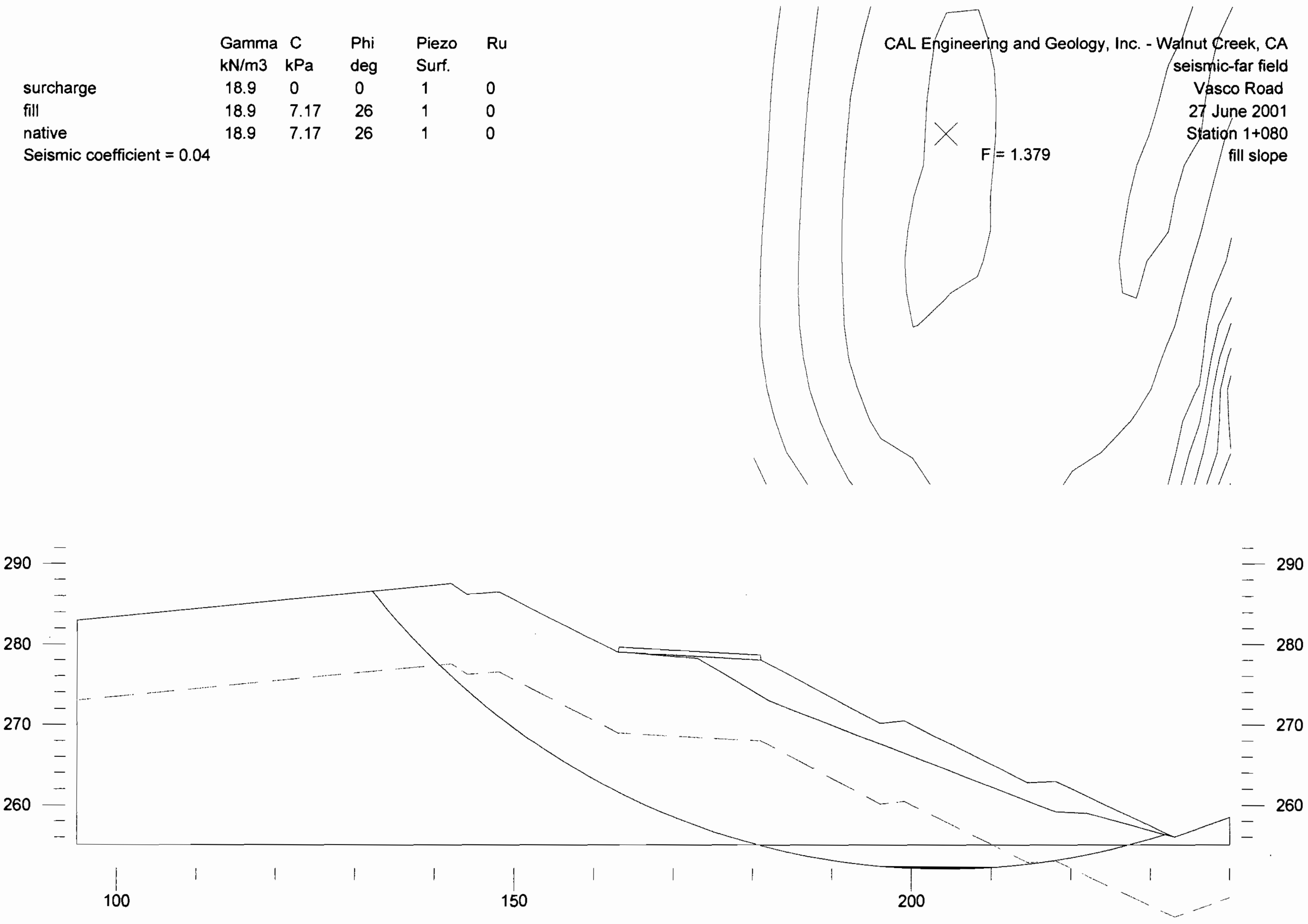
	Gamma	C	Phi	Piezo	Ru
	kN/m3	kPa	deg	Surf.	
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	26	1	0

Seismic coefficient = 0.04

CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-far field
Vasco Road
27 June 2001
Station 1+080
fill slope



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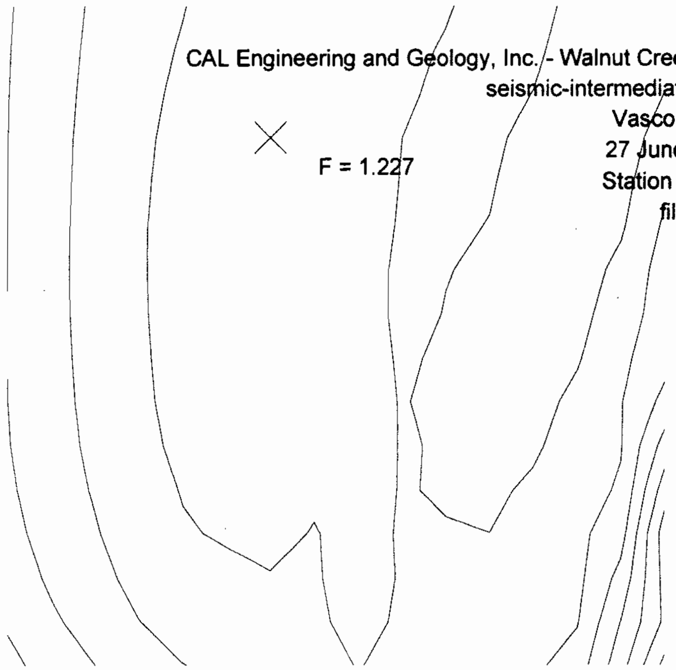
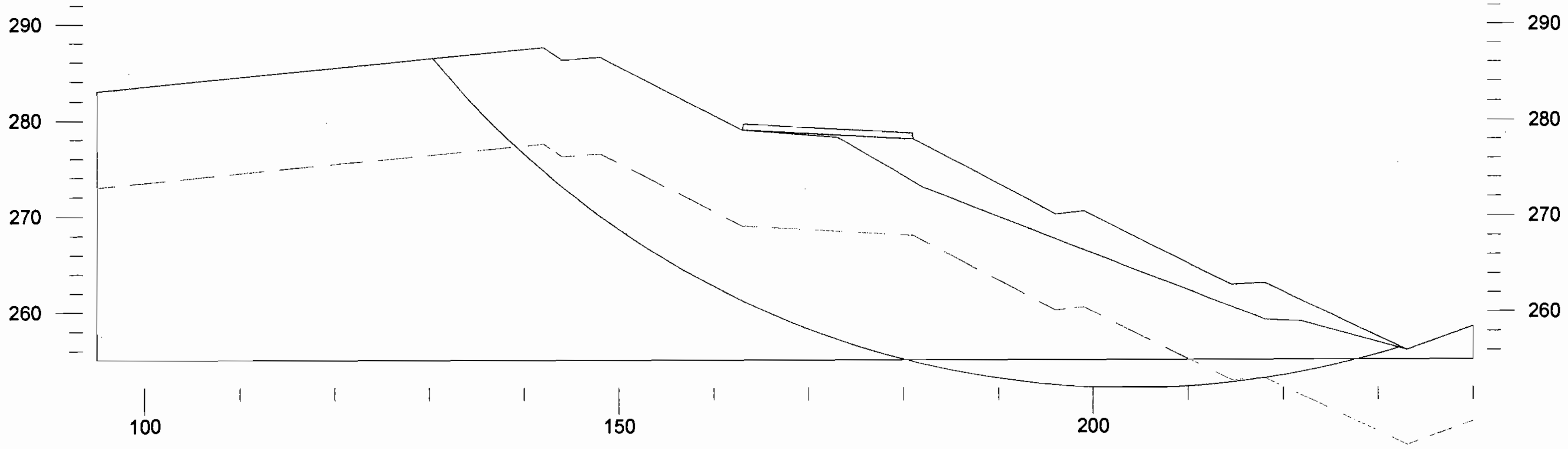
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	26	1	0

Seismic coefficient = 0.08

CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-intermediate field
Vasco Road
27 June 2001
Station 1+080
fill slope





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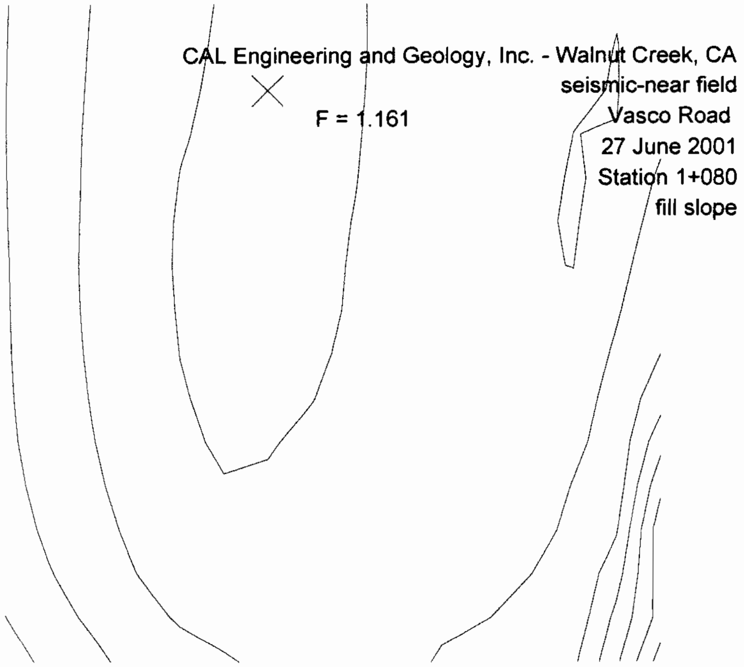
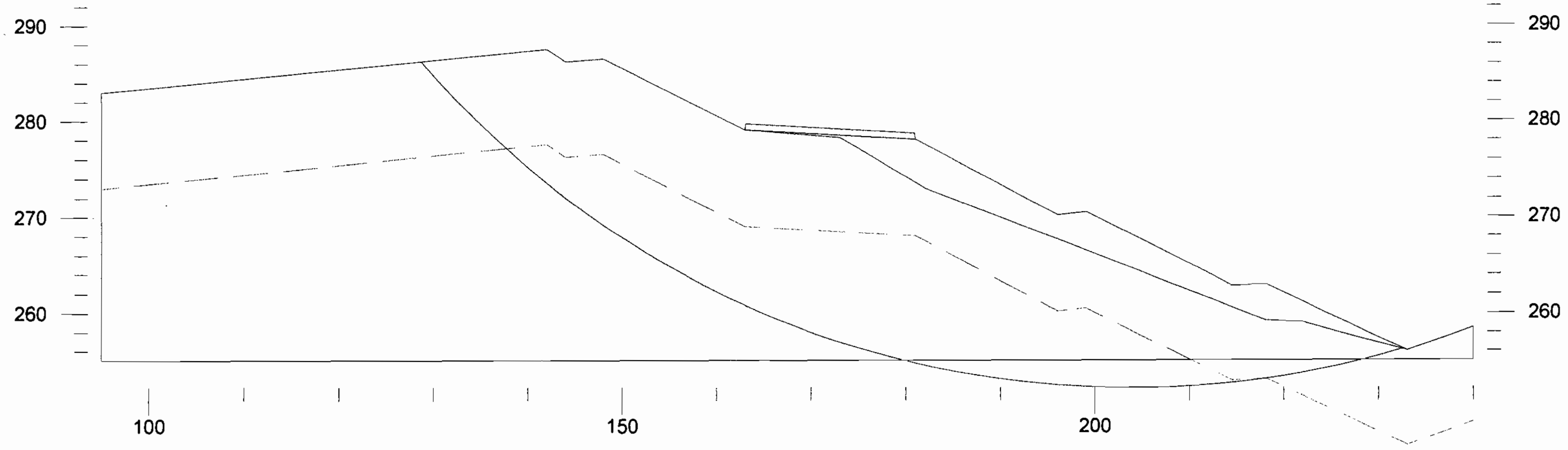
	Gamma	C	Phi	Piezo	Ru
	kN/m3	kPa	deg	Surf.	
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	26	1	0

Seismic coefficient = 0.10



CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-near field
Vasco Road
27 June 2001
Station 1+080
fill slope



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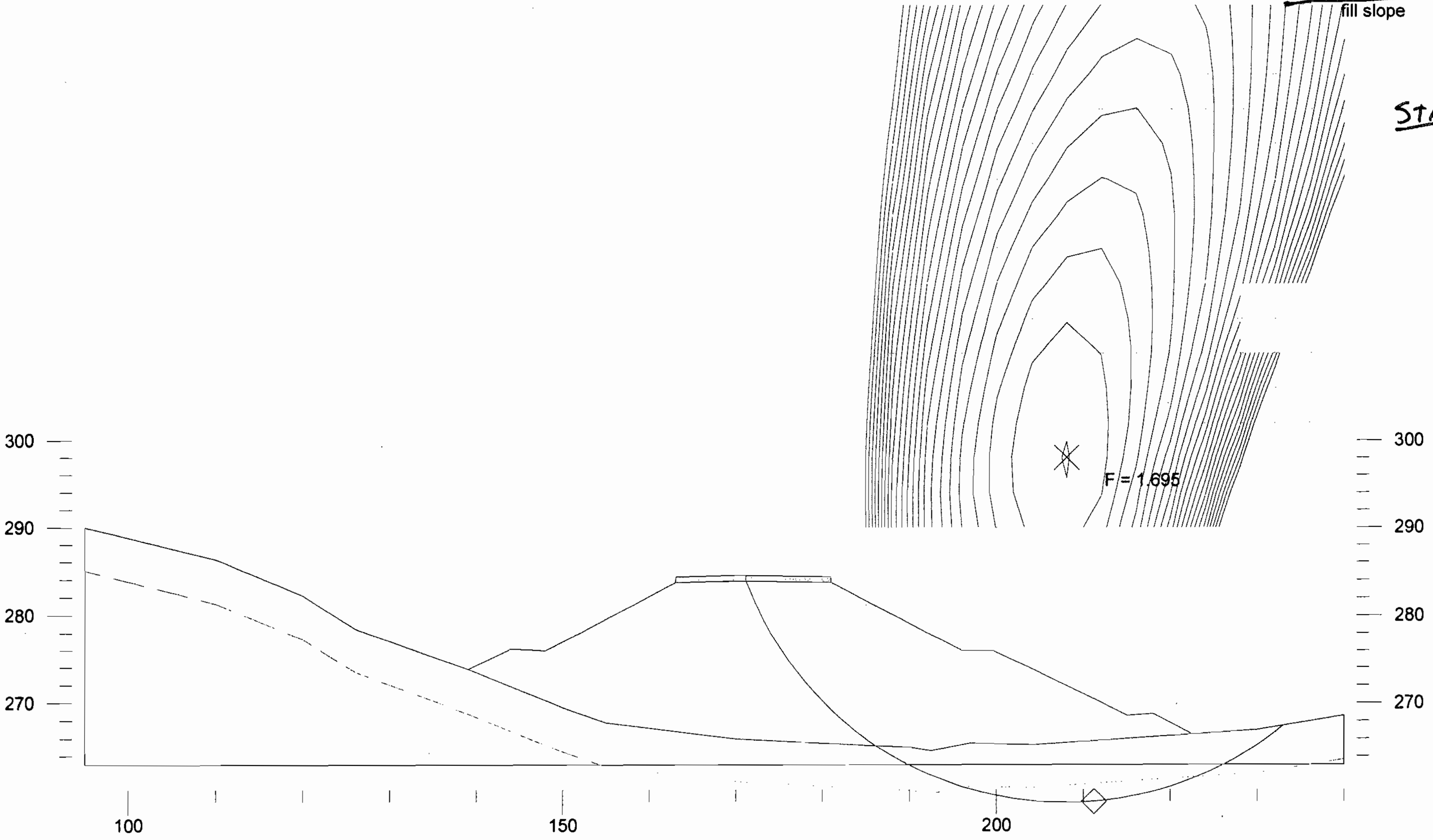
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	20	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
27 June 2001
Station 1+160
fill slope

STATIC



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CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
27 June 2001
Station 1+160
fill slope

STATIC

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
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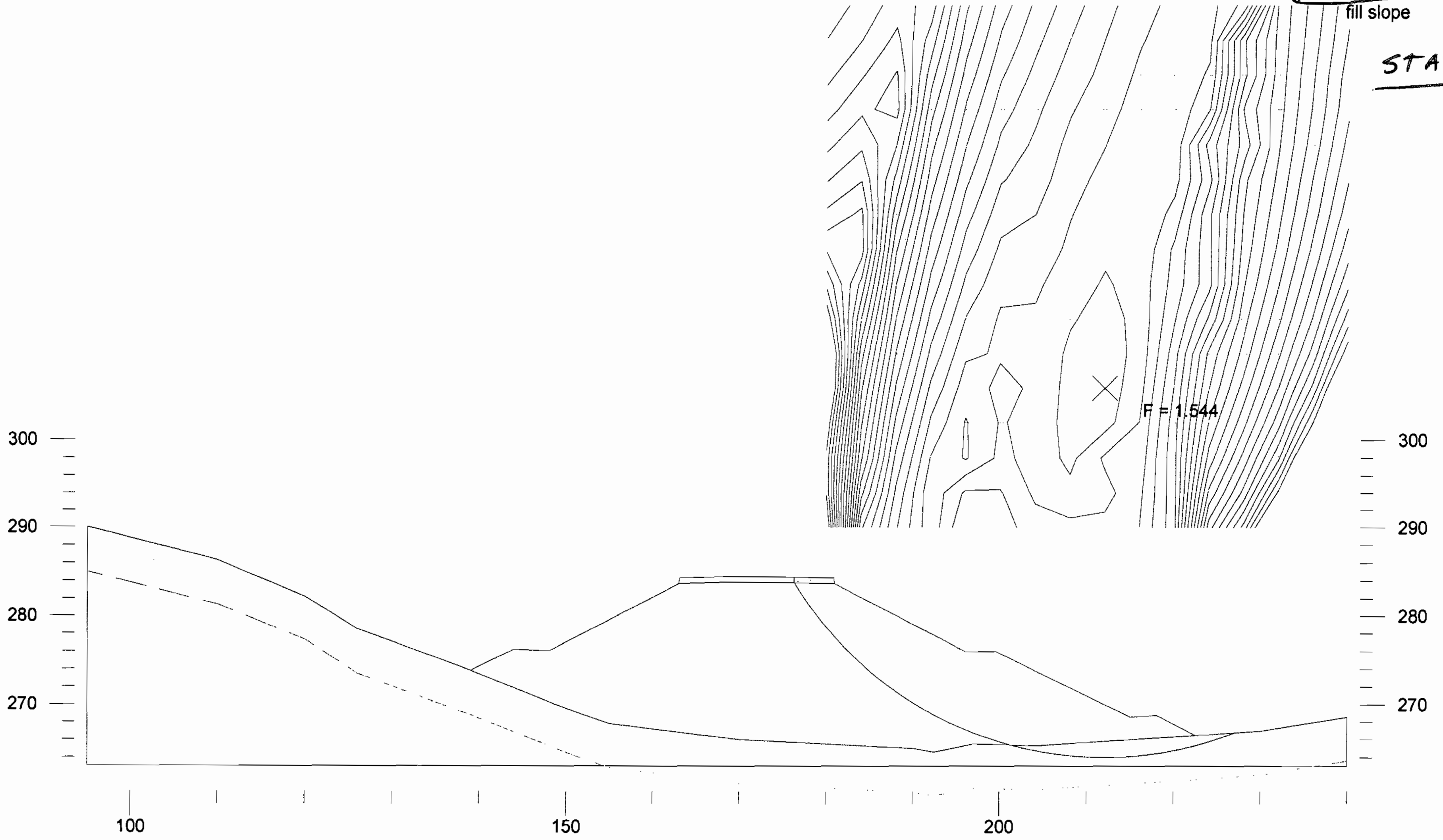
fill	18.9	7.17	26	1	0
native	18.9	7.17	20	1	0



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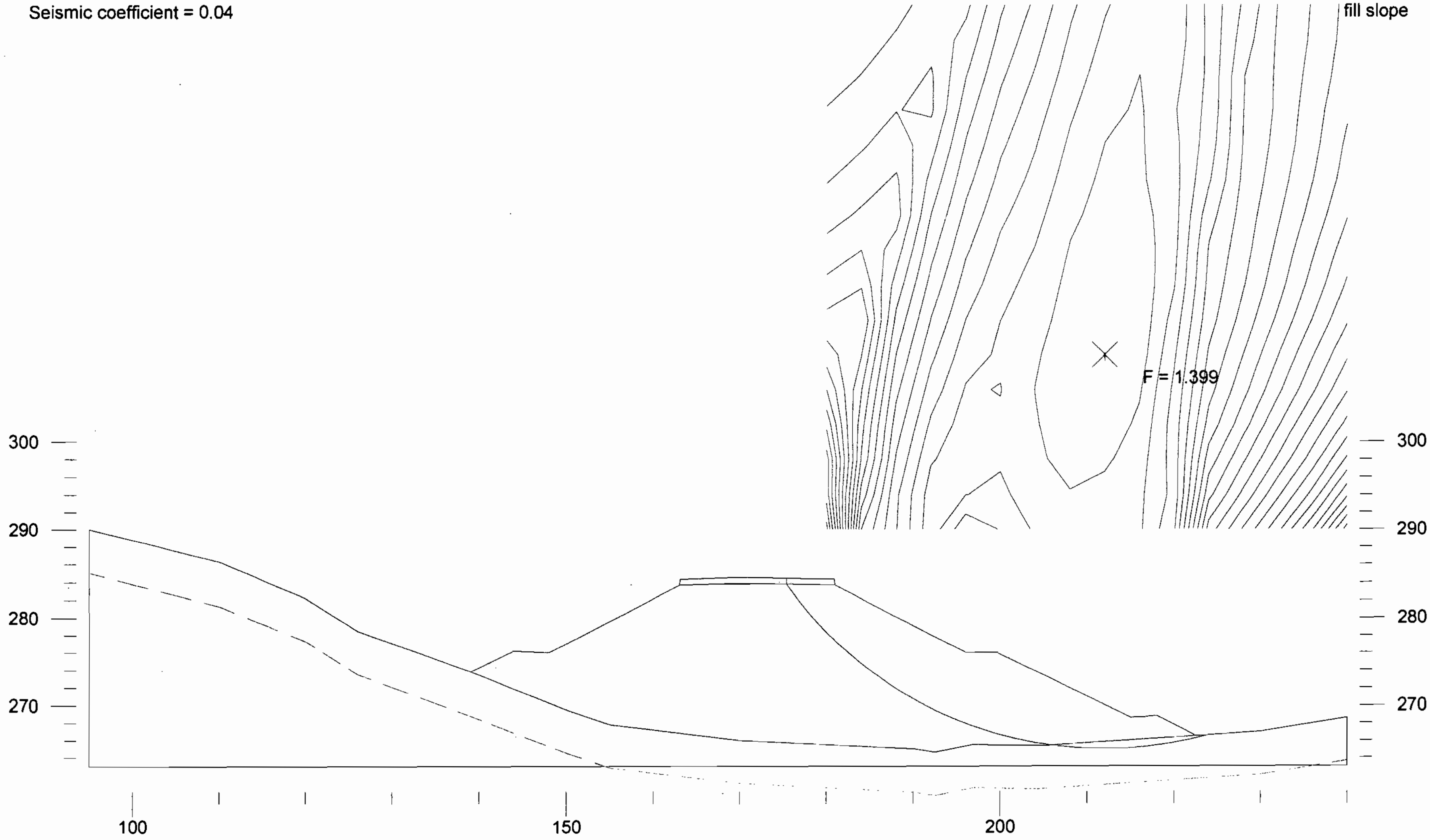
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	20	1	0

Seismic coefficient = 0.04

CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-far field
Vasco Road
27 June 2001
Station 1+160
fill slope



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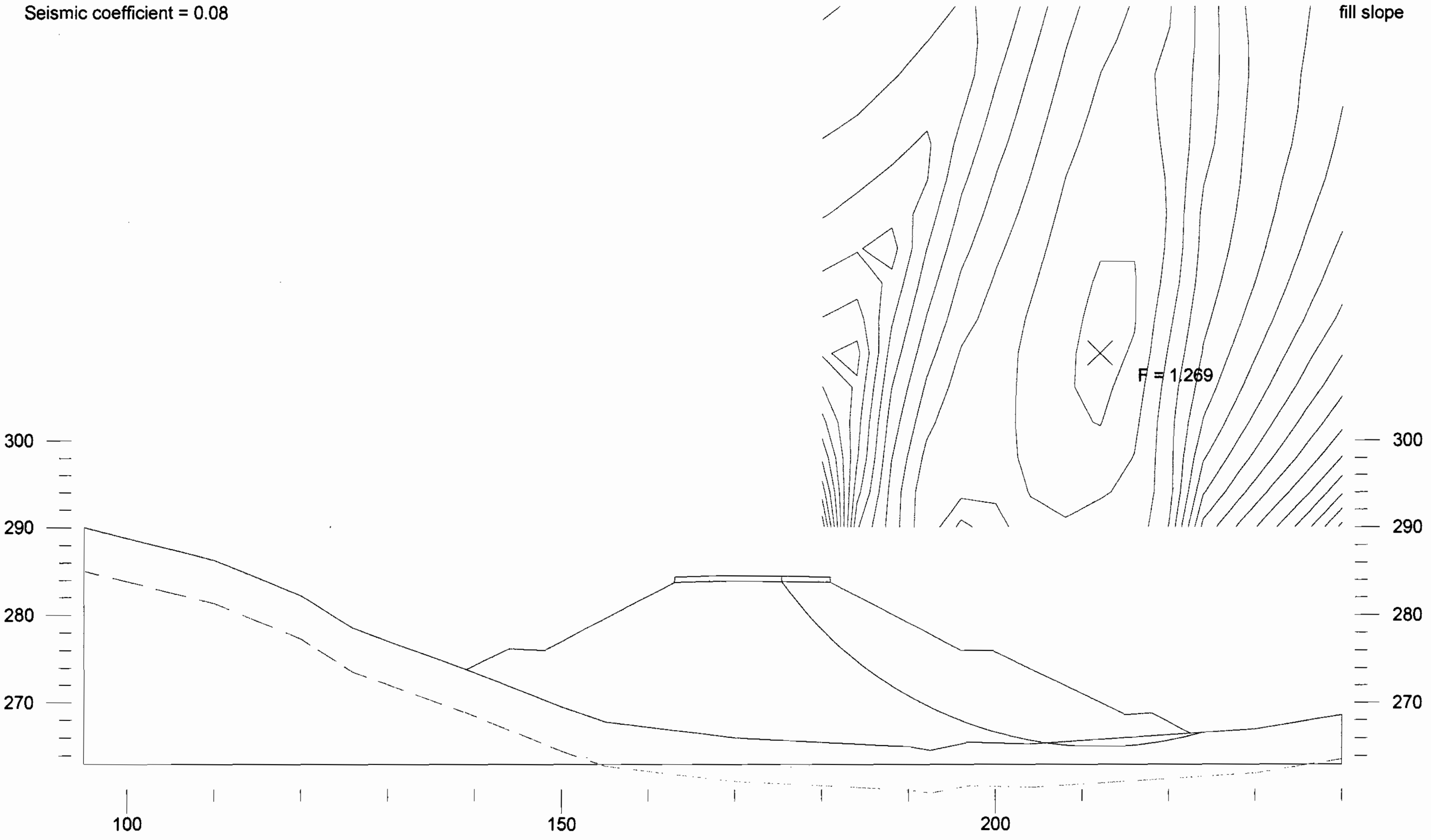
CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-intermediate field
Vasco Road
27 June 2001
Station 1+160
fill slope

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	20	1	0

Seismic coefficient = 0.08



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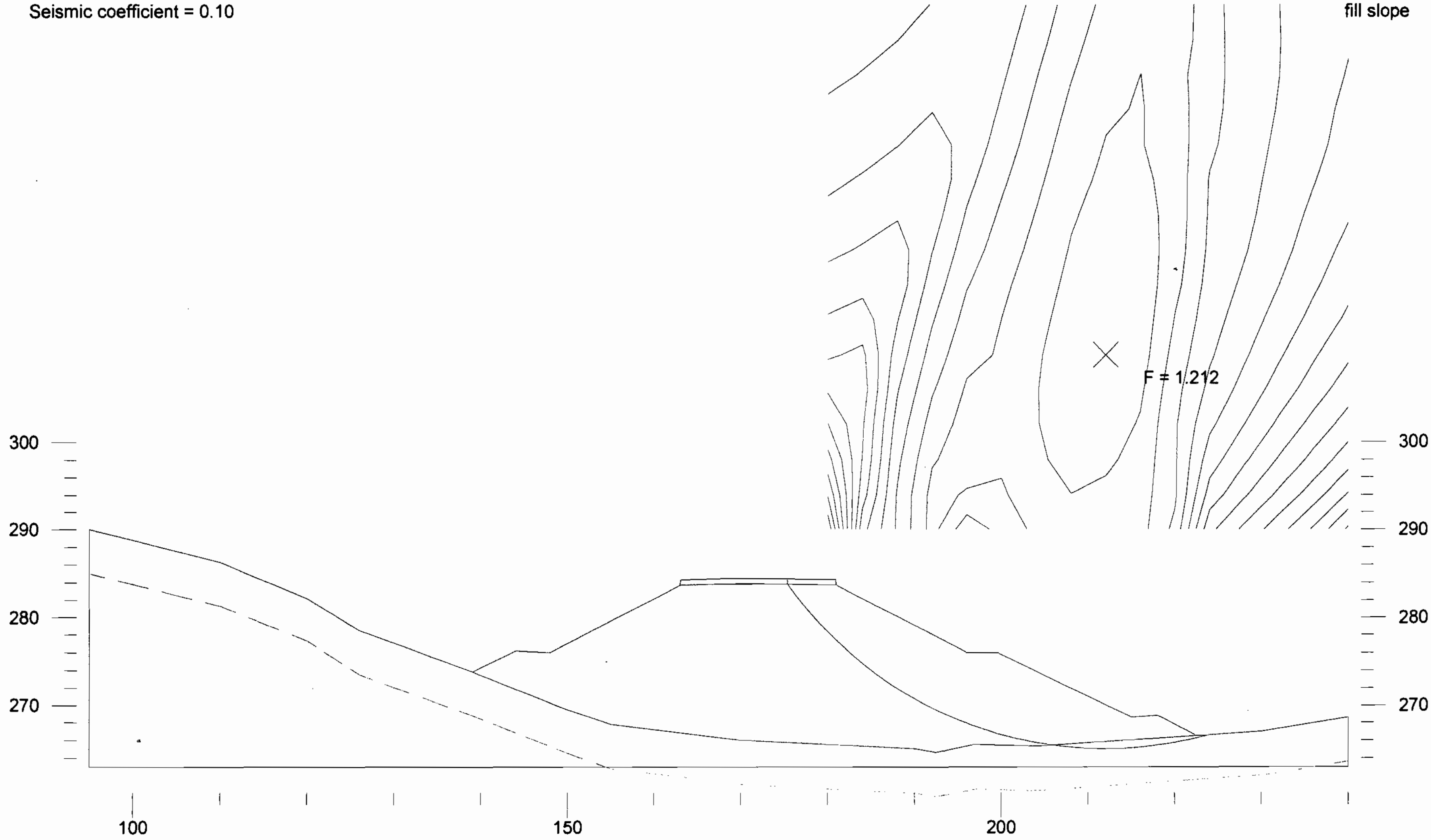
CAL Engineering and Geology, Inc. - Walnut Creek, CA
seismic-near field
Vasco Road
27 June 2001
Station 1+160
fill slope

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
surcharge	18.9	0	0	1	0
fill	18.9	7.17	26	1	0
native	18.9	7.17	20	1	0

Seismic coefficient = 0.10



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Appendix J

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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....B-5 @ 0.15 m

 TEST SAMPLE NO.....VR1

 OPERATOR...........

 TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT ****************
 CSP SITE pH =   6.6 ,   WATER pH =   0.0 ,   SOIL pH =   6.6
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1140 , WATER = 0 , SOIL = 1140
***************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------  ----------------------------------------------------------------
  CSP    | GALV.            GALV.+        GALV.+        GALV.+       GALV.+
 THICK   | 57 g             BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                 (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                               (ABRASION)                  INVERT
18   1.3 |  13               21             28            38          63
16   1.6 |  17               25             32            42          67
14   2.0 |  21               29             36            46          71
12   2.8 |  29               37             44            54          79
10   3.5 |  37               45             52            62          87
 8   4.3 |  45               53             60            70          95
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
------------------------------------------------------------------------

PROJECT LOCATION...

PROJECT ACCOUNT NO.001860

SAMPLE LOCATION....B-5 @ 7.62 m

TEST SAMPLE NO.....VR2

OPERATOR...........

TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  6.5 ,   WATER pH =  0.0 ,   SOIL pH =  6.5
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1520 , WATER = 0 , SOIL = 1520
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
   CSP   | GALV.              GALV.+        GALV.+        GALV.+       GALV.+
  THICK  | 57 g               BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                   (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                                 (ABRASION)                  INVERT
18   1.3 |  14                  22            29            39           64
16   1.6 |  18                  26            33            43           68
14   2.0 |  23                  31            38            48           73
12   2.8 |  31                  39            46            56           81
10   3.5 |  40                  48            55            65           90
 8   4.3 |  49                  57            64            74           99
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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PROJECT LOCATION...

PROJECT ACCOUNT NO.001860

SAMPLE LOCATION....B-5 @ 9.60 m

TEST SAMPLE NO.....VR3

OPERATOR...........

TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  6.8 ,   WATER pH =  0.0 ,   SOIL pH =  6.8
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1280 , WATER = 0 , SOIL = 1280
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
   CSP   | GALV.              GALV.+        GALV.+        GALV.+       GALV.+
  THICK  | 57 g               BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                   (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                                 (ABRASION)                  INVERT
18   1.3 |  15                  23            30            40          65
16   1.6 |  20                  28            35            45          70
14   2.0 |  25                  33            40            50          75
12   2.8 |  34                  42            49            59          84
10   3.5 |  44                  52            59            69          94
 8   4.3 |  54                  62            69            79         104
   FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
   CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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PROJECT LOCATION...

PROJECT ACCOUNT NO.001860

SAMPLE LOCATION....B-5 @ 13.41 m

TEST SAMPLE NO.....VR4

OPERATOR...........

TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  6.7 ,   WATER pH =  0.0 ,   SOIL pH =  6.7
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1520 , WATER = 0 , SOIL = 1520
***************************************************************************
           ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
          |SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
--------- |-----------------------------------------------------------------
   CSP    | GALV.            GALV.+         GALV.+        GALV.+       GALV.+
  THICK   | 57 g             BIT COAT.      BIT COAT &    BIT COAT     POLYMER
Gage & mm |                 (WATER SIDE)    PAVED INV.   (SOIL SIDE)   90 DEG
          |                                (ABRASION)                  INVERT
18   1.3  |  15                23             30            40          65
16   1.6  |  20                28             35            45          70
14   2.0  |  25                33             40            50          75
12   2.8  |  34                42             49            59          84
10   3.5  |  44                52             59            69          94
 8   4.3  |  53                61             68            78         103
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....B-5 @ 21.18 m

 TEST SAMPLE NO.....VR5

 OPERATOR...........

 TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT ****************
 CSP SITE pH =   6.4 ,   WATER pH =   0.0 ,   SOIL pH =   6.4
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1020 , WATER = 0 , SOIL = 1020
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         |SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
  CSP    | GALV.             GALV.+        GALV.+        GALV.+        GALV.+
 THICK   | 57 g              BIT COAT.     BIT COAT &    BIT COAT      POLYMER
Gage & mm|                  (WATER SIDE)   PAVED INV.   (SOIL SIDE)    90 DEG
         |                                (ABRASION)                   INVERT
18   1.3 |  11                 19            26            36            61
16   1.6 |  14                 22            29            39            64
14   2.0 |  18                 26            33            43            68
12   2.8 |  25                 33            40            50            75
10   3.5 |  32                 40            47            57            82
 8   4.3 |  38                 46            53            63            88
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....B-5 @ 24.08

 TEST SAMPLE NO.....VR6

 OPERATOR...........

 TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  5.7 ,   WATER pH =  0.0 ,   SOIL pH =  5.7
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 909 , WATER = 0 , SOIL = 909
 CHLORIDES, PPM... 9 ,    SULFATES, PPM... 1800
****************************************************************************
           ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
          | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
   CSP    | GALV.             GALV.+      GALV.+       GALV.+      GALV.+
  THICK   | 57 g              BIT COAT.   BIT COAT &   BIT COAT    POLYMER
Gage & mm |                  (WATER SIDE) PAVED INV.  (SOIL SIDE)  90 DEG
          |                              (ABRASION)               INVERT
18   1.3  |   7                 15          22           32          57
16   1.6  |   9                 17          24           34          59
14   2.0  |  11                 19          26           36          61
12   2.8  |  15                 23          30           40          65
1    3.5  |  19                 27          34           44          69
 8   4.3  |  24                 32          39           49          74
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 FOR SULFATE RESISTANT CONCRETE AND RCP
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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PROJECT LOCATION...

PROJECT ACCOUNT NO.001860

SAMPLE LOCATION....B-5 @ 24.84 m

TEST SAMPLE NO.....VR7

OPERATOR...........

TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =   6.0 ,   WATER pH =   0.0 ,    SOIL pH =   6.0
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 943 , WATER = 0 , SOIL = 943
 CHLORIDES, PPM... 7 ,     SULFATES, PPM... 1860
****************************************************************************
              ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
             |SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------    |---------------------------------------------------------------
   CSP       | GALV.             GALV.+        GALV.+        GALV.+       GALV.+
  THICK      | 57 g              BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm    |                  (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
             |                                (ABRASION)                  INVERT
18    1.3    |  8                  16            23            33           58
16    1.6    | 10                  18            25            35           60
14    2.0    | 13                  21            28            38           63
12    2.8    | 18                  26            33            43           68
10    3.5    | 23                  31            38            48           73
 8    4.3    | 28                  36            43            53           78
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 FOR SULFATE RESISTANT CONCRETE AND RCP
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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PROJECT LOCATION...

   JECT ACCOUNT NO.001860

SAMPLE LOCATION....B-5 @ 25.76 m

TEST SAMPLE NO.....VR8

OPERATOR...........

TEST DATE..........
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  5.7 ,   WATER pH =  0.0 ,   SOIL pH =  5.7
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 2020 , WATER = 0 , SOIL = 2020
****************************************************************************
           ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
          | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
   CSP   | GALV.            GALV.+        GALV.+        GALV.+        GALV.+
  THICK  | 57 g             BIT COAT.     BIT COAT &    BIT COAT      POLYMER
Gage & mm|                 (WATER SIDE)   PAVED INV.   (SOIL SIDE)    90 DEG
         |                               (ABRASION)                   INVERT
18   1.3 |  11               19            26            36            61
16   1.6 |  15               23            30            40            65
14   2.0 |  18               26            33            43            68
12   2.8 |  26               34            41            51            76
10   3.5 |  33               41            48            58            83
 8   4.3 |  40               48            55            65            90
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...Vasco

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....B-6 @ 6.5'

 TEST SAMPLE NO.....VR9

 OPERATOR...........RRS

 TEST DATE..........03-12-01
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  7.1 ,   WATER pH =  0.0 ,   SOIL pH =  7.1
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 1690 , WATER = 0 , SOIL = 1690
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
  CSP    | GALV.            GALV.+        GALV.+        GALV.+       GALV.+
 THICK   | 57 g             BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                 (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                               (ABRASION)                 INVERT
18   1.3 |  21               29            36            46           71
16   1.6 |  27               35            42            52           77
14   2.0 |  34               42            49            59           84
12   2.8 |  46               54            61            71           96
10   3.5 |  59               67            74            84          109
 8   4.3 |  72               80            87            97          122
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01



 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...Vasco

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....B-6 @ 18.5'

 TEST SAMPLE NO.....VR10

 OPERATOR...........RRS

 TEST DATE..........03-12-01
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  6.3 ,   WATER pH =  0.0 ,   SOIL pH =  6.3
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 3250 , WATER = 0 , SOIL = 3250
****************************************************************************
           ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
          | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
--------- |-----------------------------------------------------------------
   CSP    | GALV.              GALV.+        GALV.+        GALV.+       GALV.+
  THICK   | 57 g               BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm |                   (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
          |                                 (ABRASION)                  INVERT
18   1.3  |  17                 25            32            42           67
16   1.6  |  23                 31            38            48           73
14   2.0  |  28                 36            43            53           78
12   2.8  |  39                 47            54            64           89
10   3.5  |  49                 57            64            74           99
     4.3  |  60                 68            75            85          110
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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PROJECT LOCATION...Vasco

PROJECT ACCOUNT NO.001860

SAMPLE LOCATION....B-13 @ 5'

TEST SAMPLE NO.....VR11

OPERATOR...........RRS

TEST DATE..........03-12-01
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  3.0 ,   WATER pH =  0.0 ,   SOIL pH =  3.0
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 3310 , WATER = 0 , SOIL = 3310
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
   CSP   | GALV.             GALV.+        GALV.+        GALV.+       GALV.+
  THICK  | 57 g              BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                  (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                                (ABRASION)                  INVERT
18   1.3 |   7                 15            22            32           57
16   1.6 |   9                 17            24            34           59
14   2.0 |  11                 19            26            36           61
12   2.8 |  16                 24            31            41           66
10   3.5 |  20                 28            35            45           70
 8   4.3 |  25                 33            40            50           75
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE II MODIFIED CEMENT OR TYPE V CEMENT
    400 kg/m3 WITH 25% MINERAL ADMIXTURE REPLACEMENT (BY WEIGHT)
    AND A MAXIMUM WATER-TO-CEMENTITIOUS RATIO OF 0.40


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
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 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...Vasco

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....TP-1 @ 2-65'

 TEST SAMPLE NO.....VR12

 OPERATOR...........RRS

 TEST DATE..........03-12-01
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  6.5 ,   WATER pH =  0.0 ,   SOIL pH =  6.5
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 2410 , WATER = 0 , SOIL = 2410
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
        | SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
  CSP    | GALV.             GALV.+        GALV.+        GALV.+       GALV.+
 THICK   | 57 g              BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                  (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                                (ABRASION)                  INVERT
18   1.3 |  16                 24            31            41          66
16   1.6 |  22                 30            37            47          72
14   2.0 |  27                 35            42            52          77
12   2.8 |  37                 45            52            62          87
10   3.5 |  47                 55            62            72          97
 8   4.3 |  57                 65            72            82         107
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
    MINIMUM REQUIRED BY CALTRANS STD. SPEC. 90-1.01
    MAXIMUM W/C RATIO OF 0.45


 A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
 IF ABRASIVE CONDITIONS DO NOT EXIST
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
 SITE CONDITIONS MEET CORROSION REQUIREMENTS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
```

```
 MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
 CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)
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 PROJECT LOCATION...Vasco

 PROJECT ACCOUNT NO.001860

 SAMPLE LOCATION....TP-5 @ 0-4'

 TEST SAMPLE NO.....VR13

 OPERATOR...........RRS

 TEST DATE..........03-12-01
************* A DATA VALUE OF ZERO INDICATES NO DATA INPUT *****************
 CSP SITE pH =  3.8 ,   WATER pH =  0.0 ,   SOIL pH =  3.8
 MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 4880 , WATER = 0 , SOIL = 4880
****************************************************************************
          ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
         |SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850
---------|------------------------------------------------------------------
  CSP    |GALV.              GALV.+        GALV.+        GALV.+       GALV.+
 THICK   |57 g               BIT COAT.     BIT COAT &    BIT COAT     POLYMER
Gage & mm|                  (WATER SIDE)   PAVED INV.   (SOIL SIDE)   90 DEG
         |                                (ABRASION)                  INVERT
18    1.3| 11                 19            26            36           61
16    1.6| 14                 22            29            39           64
14    2.0| 18                 26            33            43           68
12    2.8| 25                 33            40            50           75
10    3.5| 32                 40            47            57           82
 8    4.3| 39                 47            54            64           89
  FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
  CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

 STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
 SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

 CONCRETE AND RCP MITIGATION MEASURES FOR pH
    TYPE II MODIFIED CEMENT OR TYPE V CEMENT
    400 kg/m3 WITH 25% MINERAL ADMIXTURE REPLACEMENT (BY WEIGHT)
    AND A MAXIMUM WATER-TO-CEMENTITIOUS RATIO OF 0.40


 A CORRUGATED ALUMINUM PIPE, CAP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 A CORRUGATED ALUMINIZED STEEL PIPE, CASP, SHOULD NOT BE USED
 DUE TO CORROSIVE CONDITIONS

 PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
 CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
 CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
 TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.
```

Appendix K

PAVEMENT STRUCTURAL SECTION DESIGN

Basement Soil R-Value Testing and Results

Selected samples of soil and bedrock materials recovered during our subsurface exploration operations were tested to determine their Resistance Value (R-value). A total of three (3) samples were tested by Cooper Testing Laboratories in Mountain View, California. The approximate locations of the samples and the results of the R-value determinations are presented in the table below. The laboratory R-value test sheets are included at the end of this appendix. A description of the samples tested and a summary of the test results are presented in Table K-1 below. The samples were tested in accordance with the procedures presented in the California Test 301, March 2000.

TABLE K-1
SUMMARY OF R–VALUE TEST RESULTS

SAMPLE LOCATION	SAMPLE DESCRIPTION	R-VALUE	EXPANSION PRESSURE (MPa)
TP-2 0.0 - 0.6m	Brown clayey sand	25	0.86
TP-4 0.0 - 0.6m	Brown silty sand, slightly clayey (weathered sandstone)	55	0.14
TP-5 0.0 - 0.6m	Brown clayey sand with gravel	23	0.00

The samples selected for R-value determination from the middle and southern portions of the alignment consisted of Tertiary marine arkosic sandstone with pebble conglomerate (Tmss). The R-values of the two samples taken from this area are 23 and 55. Additional R-value tests should be performed during construction do determine the representative R-value of the as-built basement soil along the alignment and the pavement sections designed accordingly.

The sample from the northern portion of the alignment consisted of arkosic sandstone with interbedded shale and claystone belonging to the Panoche Formation (Kps). The R-value of this sample was 25. It should be noted that R-values of materials generated from the shale and claystone bedrock can be significantly lower than materials generated from the sandstone bedrock. Additional R-value tests should be performed during construction do determine the representative R-value of the as-built basement soil along the alignment and the pavement sections designed accordingly.

Discussion

Section 606.2(3) of the HDM recommends that as part of a subsurface drainage system, an asphalt treated permeable base (ATPB) layer should be placed immediately below the ACP to intercept surface water seeping through the structural section. The drainage layer can be eliminated from the structural section if the mean annual rainfall is less than 125 mm or the permeability of the basement soil is $\geq 3.53 \times 10^{-4}$ m/s. The mean annual rainfall in the area typically ranges from approximately 200 mm to 450 mm. Based upon our analysis of samples recovered from our subsurface exploration operations, we estimate that the Tmss material (sandstone and pebble conglomerate) has a relatively high permeability on the order of 5 x 10^{-4} m/s, and the Kps material (sandstone with intebedded claystone and shale) has a relatively lower permeability on the order of 1 x 10^{-7} m/s. We anticipate that compacted fill consisting of the Tmss material (provided it has not been mixed with other materials) will have a permeability $\geq$ 3.53 x10^{-4} m/s. In general, we recommend that all pavement structural sections should include a drainage layer consisting of at least 75 mm of ATPB placed immediately below the ACP and connect to a subsurface drainage system, as specified in Section 606.2 of the HDM. However, pavement structural sections constructed on basement soil derived from the Tmss material may consist of a section which does not include a drainage layer of ATPB, provided the permeability is $\geq$ 3.53 x10^{-4} m/s.

Analysis

It is anticipated that basement soil consisting of import material will have an R-value between 5 and 50. Although there is no specified minimum R-value for Selected Material, it would be prudent to evaluate the impact of using a low R-value basement soil on the cost of the pavement structural section prior to use.

The design Traffic Index for the project, supplied to us by Alameda County, is 10.5. This index is based on traffic studies performed on the existing Vasco Road.

The software program NEWCOM90 was used to calculate the various pavement section combinations. The structural section materials assumed in the analysis were plant-mixed Type A asphalt concrete (AC), Class 2 aggregate base (AB), and Class 2 aggregate subbase (AS). Layer thicknesses were converted from values in feet produced by the program and rounded in accordance with section 608.4(3)(g) of the HDM. The estimated pavement section cost in \$/m^2 shown in the tables below are for relative cost comparisons only. The values were converted from values in \$/yd^2 produced by the program given assumed costs of \$95.00/yd^3 (\$124.26/m^3) for AC, \$80/yd^3 (\$104.64/m^3) for TPB, \$30/yd^3 (\$39.24/m^3) for AB, and \$25/yd^3 (\$32.70/m^3) for AS. The actual cost of pavement section layers could vary substantially from the values indicated and should be determined with current local costs and factors.

The following four alternatives present our the range of pavement sections for the anticipated range of R-values, site drainage conditions, and a Traffic Index of 10.5. As stated in section 608.4(3)(g) of the HDM, the minimum allowable thickness of AC "may be increased when appropriate to minimize construction costs, reduce construction time, match layer placement with existing ... [sections], reduce the number of layers, etc., provided minimum GE and construction requirements are satisfied." Therefore, we have included several structural section designs for combinations of R-values and each alternative. Additional section configurations for intermediate R-values may be determined by interpolation.

TABLE K-2
PAVEMENT STRUCTURAL SECTIONS, ALTERNATIVE 1

For Areas Where Basement Soil is Not Free Draining

R-VALUE	$AC_{\text{Type A}}$ (mm)	ATPB (mm)	$AB_{\text{Class 2}}$ (mm)	Residual GE[†] (mm)	Relative Cost ($/$m^2$)
5	165[††]	75	525	0	49.13
5	195	75	450	6	50.53
5	225	75	375	3	51.33
5	300	75	180	-6	53.02
5	345	75	105	46	55.71
10	165[††]	75	465	0	47.34
10	195	75	405	9	48.74
10	225	75	330	3	49.54
10	300	75	135	-6	51.22
10	330	75	105	49	53.82
20	165[††]	75	375	3	43.75
20	195	75	300	-6	44.55
20	225	75	240	3	45.95
20	300	75	105	64	50.03
30	165[††]	75	285	6	40.16
30	195	75	210	-6	40.96
30	225	75	150	6	42.36
30	255	75	105	37	44.35
40	165[††]	75	195	6	36.57
40	195	75	120	-3	37.37
40	225	75	105	58	40.57
50	165[††]	75	105	9	32.99
50	195	75	105	82	36.78
60	165[††]	75	105	110	32.99

Notes: [†] A positive Residual GE value indicates over design. Use of a section with a Residual GE value >30 mm must be justified and approved prior to use.

[††] Section having the lowest cost per m^2.

TABLE K-3
PAVEMENT STRUCTURAL SECTIONS, ALTERNATIVE 2

For Areas Where Basement Soil is Not Free Draining

R-value	$AC_{Type\ A}$ (mm)	ATPB (mm)	$AB_{Class\ 2}$ (mm)	$AS_{Class\ 2}$ (mm)	Residual GE[†] (mm)	Relative Cost ($/m²)
5	165[††]	75	150	390	-6	47.74
5	195	75	105	375	-3	49.24
5	225	75	105	300	6	50.53
5	300	75	105	105	15	53.52
10	165[††]	75	150	345	0	46.25
10	195	75	105	315	-6	47.24
10	225	75	105	255	-6	48.53
10	300	75	105	105	67	53.52
20	165[††]	75	150	240	-3	42.76
20	195	75	105	225	3	44.25
20	225	75	105	150	6	45.54
20	255	75	105	105	43	47.84
30	165[††]	75	150	150	6	39.77
30	195	75	105	120	0	40.76
30	225	75	105	105	64	44.05
40	165[††]	75	150	105	64	38.27

Notes: [†] A positive Residual GE value indicates over design. Use of a section with a Residual GE value >30 mm must be justified and approved prior to use.

[††] Section having the lowest cost per m².

TABLE K-4 – PAVEMENT STRUCTURAL SECTIONS, ALTERNATIVE 3

For Areas Where Basement Soil (BS) is Free Draining (Permeability ≥ 3.53 x 10^{-4} m/s)

R-VALUE	AC$_{\text{Type A}}$ (mm)	AB$_{\text{Class 2}}$ (mm)	Residual GE[†] (mm)	Relative Cost (\$/m^{2})
5	165[††]	615	-6	44.75
5	195	555	0	46.14
5	225	465	-3	46.94
5	300	285	4	49.24
5	375	105	30	51.52
10	165[††]	570	-6	42.96
10	195	510	3	44.35
10	225	420	-3	45.15
10	300	240	6	47.44
10	360	105	37	49.63
20	165[††]	465	-3	39.37
20	195	405	3	40.76
20	225	330	-3	41.56
20	300	150	6	43.86
20	330	105	46	45.84
30	165[††]	375	0	35.78
30	195	315	6	37.17
30	225	240	0	37.97
30	285	105	15	40.16
40	165[††]	285	0	32.20
40	195	225	9	33.58
40	225	165	3	34.39
40	255	105	34	36.38
50	165[††]	195	3	28.61
50	195	120	-6	29.40
50	225	105	55	32.59
60	165[††]	105	3	25.02
60	195	105	79	28.08

Notes:

[†] A positive Residual GE value indicates over design. Use of a section with a Residual GE value >30 mm must be justified and approved prior to use.

[††] Section having the lowest cost per m^{2}.

TABLE K-5
PAVEMENT STRUCTURAL SECTIONS, ALTERNATIVE 4

For Areas Where Basement Soil (BS) is Free Draining (Permeability ≥ 3.53 x 10^{-4} m/s)

R-value	$AC_{Type A}$ (mm)	$AB_{Class 2}$ (mm)	$AS_{Class 2}$ (mm)	Residual GE[†] (mm)	Relative Cost ($/m²)
5	165[††]	240	405	3	43.86
5	195	180	390	-6	44.75
5	225	105	405	6	46.05
5	300	105	195	0	48.53
5	345	105	105	46	51.22
10	165[††]	240	345	-6	41.86
10	195	180	345	0	43.26
10	225	105	345	-6	44.05
10	300	105	150	-6	47.04
10	300	105	105	49	49.33
20	165[††]	240	255	6	38.87
20	195	180	240	-3	39.77
20	225	105	255	6	41.06
20	285	105	105	18	43.65
30	165[††]	240	150	0	35.38
30	195	180	150	6	36.78
30	225	105	150	3	37.58
30	255	105	105	37	39.86
40	165[††]	240	105	58	33.88

Notes: [†] A positive Residual GE value indicates over design. Use of a section with a Residual GE value >30 mm must be justified and approved prior to use.

[††] Section having the lowest cost per m².

Appendix L

DCM/Joyal Engineering

David C. Mathy
Norman A. Joyal
Robert A. Kahl
Dru R. Nielson
Brian R. Dodge
Mark D. Sinclair
Marc M. Gelinas

June 28, 2002
File: J-4286-13

Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, CA 94544-1395

Subject: **Geotechnical Engineering Peer Review of Reference A**
Vasco Road Safety Improvement Project (Phase 1)
Between Mile Posts 3.4 and 4.3
Alameda County, California

Reference A: **Responses to Peer Review Comments – Vasco Road Safety Improvement Project**
By: Cal Engineering & Geology
Dated: June 25, 2002

Reference B: **Geotechnical Engineering Peer Review**
Vasco Road Safety Improvement Project (Phase 1)
Between Mile Posts 3.4 and 4.3
Alameda County, California
By: DCM/Joyal Engineering
Dated: May 16, 2002

Dear Moses,

This geotechnical peer review wrap-up report contains our comments to written response by Cal Engineering & Geology (Reference A) to our earlier peer review (Reference B) of Cal Engineering documents for the proposed Vasco Road Safety Improvement Project in Alameda County, California. Bibliographic references of these documents were provided in Reference B.

Our services for this geotechnical peer review wrap-up report were provided in accordance with the Alameda County Public Works Agency's Engineering and Road Construction Department's request for Geological and Geotechnical Review, dated April 11, 2002, and are based on the scope of work outlined by DCM/Joyal Engineering in a proposal letter dated April 8, 2002. Our scope of work for this peer review wrap-up report did not include independent research, data gathering, testing or geotechnical analysis.

PEER REVIEW WRAP-UP COMMENTS

Most of Cal Engineering's responses (Reference A) to our original peer review comments (Reference B) are favorable acknowledgements to our comments with a commitment to appropriately revise, incorporate, modify, or reconcile the Final Geotechnical Design and Materials Report (e.g., following additional testing for rebound of claystone cuts). There were, however, several Cal Engineering responses that require the following additional peer review wrap-up comments.

1. As we indicated in our original peer review comments (page 3, and paragraph 1 of page 4, Reference B), a large part of this project will consist of making significant excavation cuts and placing significant embankment fills. These cuts will be made in a structurally complex geologic setting that includes an active fault zone cutting through regionally mapped, southwest down dipping sedimentary bedrock that is described as pervasively fractured/sheared/shattered. Consequently, geologic instabilities are bound to be exposed in the proposed slope cuts. The performance of portions of Vasco Road recently improved as part of the Los Vaqueros Reservoir project could serve as a benchmark for performance of proposed cut and fill slopes for this project. As such, it is important that Cal Engineering review/discuss the earthwork "construction failures" that occurred as part of that road realignment improvement project. In each case, the controlling mechanism of failure should be reviewed (presuming investigations were undertaken to evaluate the causation and repair of earthwork failures), and any back-calculated slope strength data should be compared with the rock strengths used by Cal Engineering in their stability analyses. The intent should be to have this project learn from past history and not repeat it. As such, final cut slope recommendations should be predicated upon a review of slope failures (i.e., construction precedence) which occurred during construction of other nearby areas of Vasco Road (e.g., in Contra Costa County).

   Cal Engineering indicated that they "*will review and summarize information regarding these failures that may be available*" (page 2, paragraph 1, Reference A). We recommend that the County of Alameda Public Works Agency obtain these related documents from the appropriate departments of Contra Costa County and provide them to Cal Engineering for use as we have recommended.

2. Page 3, paragraph 2, Reference A indicates, "*Specific locations for access roads and ingress and egress points will be determined during final design and will not be shown or called-out in the Final Report*". We concur that the Final Report is not the appropriate stage to call out the specific locations of ingress and egress access roads for slope maintenance. However, as a reminder to the project designers, the Final Report is the appropriate stage of design to recommend that ingress and egress access roads for slope maintenance be incorporated in the final project design.

3. In our original peer review (page 8, last paragraph, and page 9 paragraph 1 and 2, Reference B) we inquired as to the basis for the Maximum Probable Magnitudes used in Cal Engineering's

design, indicating that the Maximum Probable Magnitude of the Greenville fault should be at least as large as known historic earthquakes (e.g., the Maximum Probable Magnitude of the Greenville Fault should intuitively at least reflect the January 24, 1980, Magnitude 5.8 earthquake cited by Cal Engineering from Bonilla, et al., 1980). Cal Engineering's recommendation in Section 7.4.1 of their draft report stated that design should anticipate future surface rupture of a similar magnitude to that which occurred in 1980 [right-lateral and dip slips on the order of 2 to 4 cm] during the operational life of the roadway.

Cal Engineering's response was that, "*The data in Table 4-1 were based on data included in California Division of Mines and Geology (1996) and were checked against California Division of Mines and Geology (1998)*" (page 8, last paragraph, Reference A). Furthermore, Cal Engineering indicated that "*The maximum probable earthquake (MPE) for the Greenville fault that was reported on Table 4-1 was based on the earthquake magnitude associated with an approximate 100-year return period*" (page 9, paragraph 3, Reference A). We find no reference to an MPE of 5.2 for the Greenville fault in any of these references or in any other reference that we are aware of. We recommend that Cal Engineering discuss the rational behind their recommended MPE of 5.2 on the Greenville fault (e.g., reference sources and/or statistical calculations).

Note: The U.S. Geological Survey reports that the overall probability of an earthquake of magnitude equal to or greater than 6.7 happening before the year 2030 somewhere on the Greenville fault is 6 percent (U.S. Geological Survey OFR 99-517). Also note that in addition to the magnitude 5.8 earthquake on the Greenville fault mentioned above, a magnitude 6.25 earthquake was believed to have occurred near the north end of the Greenville fault in 1889 (113 years ago) and a magnitude 6.0 earthquake was believed to have occurred near the south end of the Greenville fault in 1881 (121 years ago; U.S. Geological Survey OFR 96-705).

4. We indicated in our original peer review that regional structural data should be used in cross-section and stability analysis where not superseded by site specific data from Cal Engineering fieldwork (page 9, Part F, Item 1, Reference B).

   In response Cal Engineering stated that, "*Most of the regional structural data cited by DCM/J is shown for areas on either side of the Greenville fault and little to no published structural data are available for the areas between the main and eastern strands of the Greenville fault as shown in Figure 4-4. Because of the sheared and generally chaotic nature of the bedrock (as evidenced by the rock exposed in the test trenches) in this area, it is our opinion that applying data from outlying areas may not be representative of actual site conditions in the area of maximum cut*" (page 10, Part F, Item 1 Response, Reference A).

   We agree that this is possible, but we also point out that (1) since the Greenville faults are reportedly nearly vertical, and (2) since they are reportedly associated with right-lateral strike-slip movement, they will not tend to cause major inter-fault block rotations and hence will tend to generally preserve regional structural trends. Hence, slope stability analyses that include a scenario based on an assumption that regional bedding of applicable fractured and sheared bedrock (e.g., Panoche, Cierbo, etc.) is preserved, would be appropriate.

5. We indicated in our original peer review (page 16, paragraph 3, Reference B) that in Subsection 11.1.2 of the draft report, Cal Engineering warns that *"the complex geology and presence of the Greenville fault traces create the potential for localized adverse geologic conditions within the design excavations.*" They go on to note that *"A moderately inclined (1V:2H) excavation made at the nearby landfill reportedly failed several days after originally being cut."* In the context of the discussion in this section of the report, Cal Engineering cautions about the short-term stability of 1V:2H excavations cuts, and the need to plan excavation cuts so that there is no inadvertent oversteepening of cut slopes. As such, in one section of the report, Cal Engineering discusses the vulnerability of 1V:2H slopes, yet 1V:2H slopes are included as part of the recommendations (see Table 12-1 of the draft report). This transition from warning to recommendation occurs without any supporting documentation that indicates 1V:2H slopes will be more stable on this project than they were on the adjacent landfill site. Therefore, slope stability evaluations should be completed for the recommended 1V:2H cut slopes utilizing material strength properties and groundwater conditions that model the cut slopes.

   Cal Engineering's reply to our foregoing review comments was that "*The 1V:2H cut slope recommendations included in Table 12-1 were for cuts in Cierbo Formation sandstone and conglomerate that are above the water table*" (page 19, paragraph 4, Reference A). Does this imply, as described above by Cal Engineering, that both (1) the localized adverse geologic conditions within the design excavations, and (2) the moderately inclined (1V:2H) excavation made at the nearby landfill which reportedly failed several days after originally being cut, do not apply to the Cierbo Formation? The presumption is that the landfill failure did not occur in the Cierbo Formation but in some other formation. Perhaps Cal Engineering, in support of their recommendations for IV:2H cut slopes, could augment their discussion of the landfill failure by identifying the formation and the circumstances under which the failure occurred. Again, the "lessons learned" from past construction precedence, whether favorable or adverse to this project, should be discussed in detail, if possible, and used in support of the design recommendations presented in the Final Report.

CLOSURE

We appreciate the opportunity to be of service to the Alameda County Public Works Agency's Engineering and Road Construction Department on this project and trust that this geotechnical peer review wrap-up report provides the information you need at this time. Please call us if you have any questions regarding this letter or the comments presented herein.

Very truly yours,

DCM/JOYAL ENGINEERING

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25 June 2002

Mr. Moses Tsang
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399 Elmhurst Street
Hayward, California 94544-1395

RE: Responses to Peer Review Comments - Vasco Road Safety Improvement Project

Dear Mr. Tsang:

This letter summarizes Cal Engineering and Geology's (CEG) response to the peer review comments that were provided in the May 16, 2002 DCM/Joyal Engineering (DCM/J) letter to the County of Alameda Public Works Agency.[1] The DCM/J letter included geologic and geotechnical review comments regarding the Draft Geotechnical Design and Materials Report that was completed to support design and construction of the proposed Vasco Road Safety Improvement Project in Alameda County, California. This project includes the realignment and straightening of approximately 1.6 km of Vasco Road north of State Highway 580 in Alameda County, California. The improvement project will require cut and fill earthwork, retaining structures, and surface and subsurface drainage provisions. Responses to specific DCM/J comments are summarized below. As applicable, the DCM/J comments are referenced by page and paragraph number or item number and are summarized in *italics* type for clarity.

A. <u>General Geologic Review Comments</u>

Page 4, Paragraph 1

> *.....final cut slope recommendations should be predicated upon a review of slope failures (i.e., construction precedence) which occurred during construction of other nearby areas of Vasco Road (e.g., in Contra Costa County).*

CEG is aware of several failures that occurred during the Vasco Road realignment work that was completed as part of the Los Vaqueros Reservoir project. In preparation of the Draft report for Alameda County's current realignment project, we reviewed the Materials Report prepared by

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[1] DCM/Joyal Engineering, 2002, *Geotechnical Engineering Peer Review, Vasco Road Safety Improvement Project (Phase I), Between Mile Posts 3.4 and 4.3, Alameda County, California*; letter to Mr. Moses Tsang, County of Alameda Public Works Agency, May 16.

Woodward-Clyde Consultants for the Los Vaqueros project. However, we did not obtain nor review information specifically related to the landslides which occurred during construction. Accordingly, we will review and summarize information regarding these failures that may be available. Particular data that will be reviewed will include the Project Plan Record Drawings for the Relocation of Vasco Road (Segment B) that was prepared by Woodward-Clyde Consultants. Applicable information from the review will be summarized, included in the Final Geotechnical Design and Materials Report, and applied as one of the bases for determination of final cut slope recommendations.

Page 4, Paragraph 2

> *Even through no bedrock structure (strike and dip) could be measured during field work along the alignment by Cal Engineering, there is sufficient information in the geologic literature with respect to regionally mapped strike and dip. Based on regional geology, west-facing excavations into bedrock will tend to be more unstable (due to bedrock bedding) than east-facing excavations. This aspect of the regional geology could potentially control slope stability and this should be addressed in more detail in the final or update reports.*

DCM/J correctly notes that only limited bedrock structure could be measured in the field. However, we note that regionally mapped strike and dip may not be representative of conditions between the eastern and main strands of the Greenville fault (test pits indicated sheared and variably discontinuity orientations in this area). It is likely that localized discontinuities which do not reflect regional trends and bedding are present. Nonetheless, aspects of regional geology that potentially could influence or control slope stability will be further evaluated and addressed in the Final Geotechnical Design and Materials Report.

In addition to further evaluating the possible influence of regional bedding on the cut slope stability, the final report will also include more specific recommendations regarding the use of geologic mapping of excavations made during construction to identify any localized discontinuities or other anomalies which might adversely affect stability of the cut slopes.

B. General Geotechnical Review Comments

Page 5, Paragraph 1

> *....the use of hydraugers for slope dewatering do require periodic maintenance, such as high pressure hydroflushing to maintain their effectiveness. As such, the design should contemplate provisions (i.e., access road, and ingress and egress points) for equipment access to the hydraugers for the periodic maintenance, especially those installed on slope benches above the road bed. Hydrauger maintenance should be included in a routine maintenance program for this segment of the roadway. In*

> *addition, because weathering of the cut slopes is anticipated (Subsection 8.2.5), the maintenance program should include yearly inspections of the slopes and drainage improvements.*

We strongly agree with this comment regarding the need for regular maintenance of the hydraugers and for inspections of the cut slopes and drainage improvements. Maintenance and inspection of the slopes will be addressed as a specific section in the Final Geotechnical Design and Materials Report. The minimum cut slope bench widths recommended in the Draft Report are intended to reflect the need to access the cut slopes for future maintenance. Specific locations for access roads and ingress and egress points will be determined during final design and will not be shown or called-out in the Final Report. It is also planned that during development of the grading plans for cut slopes, we will review the plans and provide input regarding cut slope configurations as they pertain to maintenance requirements.

C. Specific Review Comments

Item 1

> *In Section 6.0, Geotechnical Testing, Figure 6-2 (1 of 2 and 2 of 2), the depth of the test is referenced in feet which is not consistent with the metric report format.*

The units will be converted to metric in the Final Geotechnical Design and Materials Report.

Item 2

> *In Section 7.0, Subsection 7.1.3 Landslides, reference is made to two landslides within the project area not shown on a landslide map (Figure 7-1) and those two landslides are referenced as landslides LS-1 and LS-2. However, on the Map of Geologic Features, Figure 4-3, there are four landslides and their identification nomenclature is either QLS 1, QLS-2, or QLS.*

Figure 7-1 is a reproduction of a published regional landslide map and provides indication of local large-scale regional landslides mapped by others.[2] As a result, this map is not intended to illustrate site-specific landslides mapped as part of this project. The text of Subsection 7.1.3 will be revised to address this distinction. The site-specific landslide nomenclature in the report text and in the report figures will be reconciled in the Final Geotechnical Design and Materials Report.

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[2] Nilsen, T.H., 1975, *Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of the Byron Hot Springs 7-1/2' Quadrangle, Contra Costa and Alameda Counties, California*; U.S. Geological Survey Open File Map 75-277-9, scale 1:24,000.

> *In the Landslide discussion of this subsection, reference is made to Boring B-7 being located within LS-1; however, in Figure 4-3, Boring B-7 is located within an un-numbered landslide identified only as QLS. Near the end of the discussions in this subsection, reference is made to* "two landslides (LS-3 and LS-4)" *as being located within the main and eastern strand of the Greenville Fault. However, on Plate 4-3, these two landslides are identified as QLS-1 and QLS-2. Although the landslide discussion appears to be correct, the landslide numbering and report text references are in conflict.*

Landslide numbering and report test references will be reconciled in the Final Geotechnical Design and Materials Report.

Item 3

> *In Section 7.3, Subsection 7.3.2 Groundwater, reference is made to the highest groundwater level shown on Figure 4-3. This appears to be an inaccurate reference and the correct reference should be to Figure 4-4.*

The correct reference should be Figure 4-4 and the text will be modified accordingly in the Final Geotechnical Design and Materials Report.

Item 4

> *The geotechnical issues of importance for the relocation are the location of the new line and the type of backfill used for the pipe embedment material. Where granular embedment material is used, the material can and often acts as a collector and/or conduit for subsurface water, and this can potentially result in unstable conditions. As such, if the gas pipe line relocation consists of an overland route that is within or skirts the project cuts and fills, the physical location and the type of backfill material used needs to be given special consideration to avoid having the pipeline, in its relocated environment, from possibly contributing to an unstable condition.*

The location of the pipeline in its new position relative to the proposed realignment cuts and fills is not known at this time, nor are PG&E's design parameters for the type of backfill. However, the DCM point is well-taken and the text of Subsection 11.2.3 of the Final Geotechnical Design and Materials Report will be revised to highlight the need for attention given to the physical location of the pipeline and the type of backfill material used to avoid contributing to an unstable condition.

Item 5

> *In Appendix C, Log of Test Borings, on Sheet C7, there is a misidentification of the boring elevations for Boring B-5. For example, the boring is reported to have been terminated at Elevation 285.6 m, yet the elevation scale on the right side noted near the bottom of the boring is Elevation 275 m. The elevation scale on the left side of Boring B-3 appears to be the correct scale.*

Elevation scales on the Logs of Test Borings included in Appendix C will be checked and revised as necessary in the Final Geotechnical Design and Materials Report.

Item 6

> *In Appendix D, Trench Logs, the format for the trench log scales is feet. For report consistency, the trench log scales should reflect the metric format.*

The trench logs will be revised to show metric units in the Final Geotechnical Design and Materials Report.

D. Section 4 - Physical Setting Review Comments

Item 1

> *In Section 4.0, Physical Setting, Figure 4-3 could be enhanced by showing the location of the seismic refraction lines completed for the project. This would visually delineate the location of the seismic refraction lines with respect to the geologic sections without having to reference the geophysical data in Appendix E for the location of the seismic refraction lines.*

Figure 4-3 will be modified in the Final Geotechnical Design and Materials Report to show the seismic refraction lines.

Item 2

> *In Section 4.0, Physical Setting, Figure 4-4, the P-wave velocity identified in the figure is presented in terms of feet per second, which contrasts the metric report format and Section 8.2.2, Rippability, which discusses the P-wave velocity data in a metric format.*
>
> *Also on Figure 4-4, the data presented for* "Layer 2 (V_p = 6900-9100 fps)" *should be corrected to identify this as Layer 3.*

Figure 4-4 will be modified in the Final Geotechnical Design and Materials report to present P-wave velocities in metric format and to re-label the lowest seismic layer (V_p = 6900-9100 fps) as "Layer 3."

Item 3

> *In Section 4.4.1, no reference is made to geologic maps of Contra Costa County (e.g., Crane, 1995, and Graymer and others, 1996) that post-date maps cited by Cal Engineering (i.e., Majmundar, 1991).*

The Crane (1995) and Graymer and others (1996) have now been reviewed and compared with the Majmundar (1991) information included in the Draft Report. The text of the report will be revised and the more recent information will be referenced in the Final Geotechnical Design and Materials Report as applicable.

Figure 4-2

> *A legend, scale, north arrow, and box indicating the mapped area shown on Figure 4-3 should be added. Part of the legend can be handled by indicating that mapped units are as described in Section 4.4.1 of the report.*

Figure 4-3 will be revised as recommended and included in the Final Geotechnical Design and Materials Report.

Figure 4-3

> *Approx. Stationing 22+00 to 24+00 is shown on Figure 4-2 to be Kps but shown on Figure 4-3 to be Tmss*

Figure 4-3 will be revised as necessary and included in the Final Geotechnical Design and Materials Report.

> *Dots indicative of concealed faulting should be differentiated from those indicative of resistant pebble conglomerate and sandstone outcrops.*

Figure 4-3 is a color figure that shows concealed faulting dots in red and the resistant pebble conglomerate dots in light brown (these colors are shown in the legend to the figure). To avoid confusion when the report is reproduced in black and white, we will modify the symbols in the Final Geotechnical Design and Materials Report.

> *Orientation of fault movement (inferred if not know) should be shown (e.g. per Section 7.4.1).*

Arrows showing relative fault movement will be added to Figure 4-3.

> *Slide motion vectors indicated for Qls-2 near Station 22+00 are consistent with a cross-fault extrapolation of a down-dip direction of movement (parallel to the dip of nearby bedrock bedding). Direct downslope movement slide vectors would be perpendicular to topographic contours (i.e., a southwest direction for slide Qls-2). Are the directions of the slide motion vectors accurately shown? If so, this observation of discontinuity controlled sliding (e.g., bedding plane slip) should be addressed in slope stability analysis for the project.*

As discussed in the Draft Report text and in the legend of Figure 4-3, evidence for landslide Qls-2 was based on interpretation of aerial photographs and is very indistinct. However, the topographic evidence inferred from the photographs suggests movement towards the northwest-southeast trending drainage channel approximately as shown in Figure 4-3. Although regional bedding suggests the potential for down dip movement along bedding, our field investigation indicated bedding between the two strands of the Greenville fault did not follow a consistent pattern in any particular direction. Accordingly, it is our opinion that there is no compelling evidence the landslide Qls-2 (if present) was controlled by sliding along discontinuities. Nonetheless, and as discussed in more detail in our response to Comment 4 on Page 14 of the DCM letter, additional stability analyses have been performed to assess the stability of a landslide (should one occur) in this area. These analyses indicated the landslide material or potential failure surface would have to have very low strength (a friction angle on the order of six degrees) to result in failure. Moreover, these analyses also indicated the proposed roadway re-alignment embankment in this area will buttress landslide Qls-2.

> *Landslides indicated by Majmundar (1991) should be shown (see comments for Section 7.1.3.*

The regional landslides indicated by Majmundar are outside of the mapped area shown in Figure 4-3. The landslides indicated by Majmundar are shown in Figure 4-2.

Figure 4-4

> *Sections lines shown on Figure 4-3 should be equivalent to the limits of the cross-sections shown on Figure 4-4.*

The lengths of the section lines in Figure 4-3 will revised to be consistent with the length of cross-section shown in Figure 4-4.

> *Structural data provided on Figure 4-3 should be expressed in the cross-sections of Figure 4-4 (i.e., apparent dips). We anticipate that this would show that cut slopes would expose soutwestwardly down-dipping bedrock (adversely oriented for cut slopes east of the centerline of the proposed alignment - i.e., westward-facing cut slopes).*

The bedding orientation measured in the road cut immediately north of Section A-A' will be added to the section.

> *What is the basis for the orientation of the Greenville fault shown at depth? Relative fault displacement directions should be shown per Section 7.4.1*

The near-surface orientation of the Greenville fault shown in Figure 4-3 is an approximation based on information that the fault is a near-vertical feature. Accordingly, the actual orientation of the fault in section may vary from that shown in the figure. Relative fault direction vectors will be added to Section A-A' and Section B-B' based on this information presented in Bonilla et al. (1980).[3]

Table 4-1

> *What is the basis for the given Maximum Credible and Maximum Probable Magnitudes? Maximum Magnitudes on faults to be used with the 1997 UBC, and justifications for their use are provide in the 1998 publication by the California Division of Mines and Geology. Maximum Credible Magnitudes suggested by Caltrans for use in deterministic designs are provided by Mualchin (1996). A database of potential sources for earthquakes larger than Magnitude 6 in Northern California is provided with estimated magnitudes by the Working Group on Northern California Earthquake Potential (1999). These reputable sources post-date sources cited by Cal Engineering.*

The data in Table 4-1 were based on data included in California Division of Mines and Geology (1996)[4] and were checked against California Division of Mines and Geology (1998). Following the DCM/J comment, we will check this information against information included in the Working Group

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[3] Bonilla, M.G., Lienkaemper, J.J. and J.C. Tinsley, 1980, *Surface Faulting Near Livermore, California Associated with the January 1980 Earthquakes*; U.S. Geological Survey Open File Report 80-523.

[4] California Division of Mines and Geology, 1996, *Probabilistic Seismic Hazard Assessment for the State of California;* California Division of Mines and Geology, DMG Open File Report 96-08, Sacramento, California, April.

on Northern California Earthquake Potential (1999) and Table 4-1 will be revised and/or annotated as appropriate.

> *Maximum Probable Magnitudes should be at least as large as known historic earthquakes (e.g., the Maximum Probable Magnitude of the Greenville Fault should at least reflect the January 24, 1980, Magnitude 5.8 earthquake city by Cal Engineering from Bonilla et al., 1980). This is consistent with Cal Engineering's recommendation in Section 7.4.2 stating the design should anticipate future surface rupture of a similar magnitude to that which occurred in 1980 [right-lateral and dip slips on the order of 2 to 4 cm] during the operational life of the roadway. Such an occurrence should be considered during design of the roadway and during development of maintenance and operation plans (Cal Engineering's Maximum Probable Magnitude for the Greenville Fault is indicated as 5.2 in Reference A).*

The maximum probable earthquake (MPE) for the Greenville fault that was reported in Table 4-1 was based on the earthquake magnitude associated with an approximate 100-year return period. In our opinion, use of a published and generally accepted definition of the MPE is more appropriate than applying a subjective interpretation of the MPE as "at least as large as known historic earthquakes." Nonetheless, a note can be added to Table 4-1 indicating that an earthquake of magnitude 5.8 occurred on the Greenville fault in 1980. The Draft Report notes that design and maintenance of the roadway should anticipate fault rupture during the operational life of the roadway.

E. Section 5 - Field Explorations

Item 1

> *In Section 5.2, the source and date of the aerial photographs reviewed should be referenced.*

References to sources and dates or the aerial photographs are provided in the Draft Report in Section 3 on page 3-1.[5]

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[5] Pacific Aerial Surveys photographs AV-253-33-29, AV-253-33-30, and AV-253-33-31 dated May 22, 1957 at a scale of 1:12,000 and photographs AV-6100-135-26, AV-6100-135-27, and AV-6100-135-28 dated August 17, 1998 at a scale of 1:12,000.

Item 2

> *In Section 5.3, the text refers to two seismic refraction lines that were 800 feet long. For report consistency, this reference should be in metric.*
>
> *Cal Engineering should discuss their extrapolation of results from the seismic refraction lines to cross-sections as shown on Figure 4-4 in consideration of the fact that the seismic refraction lines run perpendicular to the cross-section.*

Section 5.3 of the Final Geotechnical Design and Materials Report will be revised to include metric distances for the seismic refraction lines. Section 5.3 will also be revised to reference Figure 4-4 and to note that the seismic refraction data shown in this figure is extrapolated from refraction lines that were laid out normal to the cross section locations.

F. **Section 7 - Geotechnical Conditions**

Item 1

> *Regional structural data (e.g. provided by Dibblee, 1980, Crane 1995, Majmundar, 1991, and Graymer and others, 1996) should be used in cross-section (Figure 4-4) and stability analysis where not superceded by site specific data from Cal Engineering fieldwork.*

Most of the regional structural data cited by DCM/J is shown for areas on either side of the Greenville fault and little to no published structural data are available for the areas between the main and eastern strands of the Greenville fault as shown in Figure 4-4. Because of the sheared and generally chaotic nature of the bedrock (as evidenced by the rock exposed in the test trenches) in this area, it is our opinion that applying data from outlying areas may not be representative of actual site conditions in the area of maximum cut. As discussed in the Draft Report, stability analyses were based on lower-bound interpretation of laboratory test data for samples that were biased towards the weakest materials recovered from the borings and on an assessment of overall strength of the rock mass as a whole.

Item 2

> *In Section 7.1.3, The Nilsen (1975) base map for Figure 7-1 should be replaced with more recent maps by Majmundar (1991; particularly Maps 27A and 27B) which show landslides along the alignment not indicated by Nilsen. Majmundar (1991) indicates on Map 27A that most of the slopes along the alignment are* "naturally unstable and subject to failure even in the absence of the activities of man." *A legend, scale, north arrow, and box indicating mapped area shown on Figure 4-3*

> *should be added. Landslides identified along or near the alignment by Majmundar (1991) should also be shown on Figure 4-3.*

The Majmundar (1991) maps will be reviewed and the figures included in the Final Geotechnical Design and Materials Report will be revised accordingly. The final landslide figure will include a legend, scale, and north arrow, and will box the area mapped for the re-alignment investigation.

Item 3

> *In Section 7.1.4, uniaxial compressive strengths are discussed for the Panoche formation materials, but not for Tmss (Cierbo) materials.*

Laboratory tests were performed on samples collected from borings located within the proposed area of maximum excavation. As a results laboratory tests were not performed on samples from the Cierbo Formation.

> *Given the number of possible kinematically unfavorable orientations, the discontinuity orientation factor assumed for the evaluation could easily be assumed to be unfavorable (-50) to very unfavorable (-60), with the rock mass underlying the proposed expansion area (including in Borings B-2, B-3, B-4, and B-5 on Table 7-2) being classified as very poor rock (Class V).*

Assigning a discontinuity spacing, condition, and orientation factors to the rock mass was somewhat subjective and was based on conditions observed in the test trenches, information inferred from samples recovered from the borings, and on the preliminary orientations of the cuts planned for this project. In our opinion, classifying the rock in the area of the proposed cut slopes as poor to very poor is consistent with the observed conditions.

Item 4

> *Governing shear strength properties for the project cut slopes will most likely be along discontinuities (e.g. bedding planes and fractures). Precedent failure/repair studies by others pertaining to prior instabilities along nearby reaches of Vasco Road would be useful to establish shear strength properties along geologic discontinuities typical of the area.*

As summarized previously, we are aware of several failures that occurred during Vasco Road realignment work that was completed as part of the Los Vaqueros Reservoir project and we will review and summarize information regarding these failures that may be available. Strength values used for analysis will also be checked against relevant information obtained from this review. Additionally, to better assess the potential for failure along bedrock discontinuity surfaces, we will perform additional stability analyses that assume multiple block or wedge surfaces. The results of these analyses will be included in Appendix I of the Final Geotechnical Design and Materials Report. Modifications for cut slope recommendations will be revised in the Final Report, as appropriate.

Figure 7-2

> *A legend describing the numbered geomorphic features would be helpful.*

Figure 7-2 will be revised to include a legend describing the geomorphic features that are called out in the figure.

G. Section 8 - Geotechnical Analysis and Design

1. General Editorial Comments

Item 1

> *In Section 8.0, Subsection 8.1.1 Seismic Parameters Used in Analysis, reference is made to a U.S. Department of Transportation design guidance which allows the seismic coefficient for use in pseudo static analyses to be one-half (½) of the peak horizontal ground acceleration of the applicable fault source. As an example, for the near-field source seismic event (Greenville Fault) Cal Engineering states that for* "....a design PHGA of 0.27g, a seismic coefficient of 0.14 was assumed....." *However, in the tables summarizing the slope stability data (Appendix I, Slope Stability Analyses), the seismic coefficient (k_y) used in analysis for the near-field source is 0.10 with a footnote in regards to its reduction from 0.14 to 0.10. This reduction in seismic coefficient should also be made a part of the text discussion in Subsection 8.1.1 Seismic Parameters Used in Analysis.*

The seismic coefficient reduction was based on recommendations included in Seed (1979) for earthquakes with $M_w < 6.5$. The information included in Appendix I (Slope Stability Analyses) and the text of the Draft Report will be reviewed and revised as necessary.

> *The discussions in this section need to reflect comments in Section 4 (particularly with regard to selecting the Maximum Probable Earthquakes). The selection of appropriate MPE's will affect PHGA and seismic coefficients pursuant to reported U.S. Department of Transportation guidance (1997). Seismic coefficients are generally linked to recommended pseudo-static factors of safety. Many state and local agencies in California require the use of a seismic coefficient of 0.15, and a*

> *minimum computed psuedo-static factor of safety of 1.0 to 1.2 for analysis of natural, cut, and fill slopes (CDMG 1997).*

As discussed previously, the MPE and associated PHGA for the Greenville fault were based on the earthquake magnitude associated with an approximate 100-year return period. We do not disagree that more generalized pseudo-static coefficients are often used to evaluate seismic slope stability. Accordingly, we will complete additional analyses using a pseudo-static coefficient of 0.15 and include the results in the Final Report. If required, we will also complete additional seismic displacement analyses. The results of the analyses and modifications to our recommendations will be included in the Final Report, as appropriate.

> *Regional structural data (e.g., provided by Dibblee, 1980; Crane, 1995; Majmundar, 1991; and Graymer and others, 1996) should be used in stability analyses where not superceded by site specific data from Cal Engineering fieldwork.*

As described previously, most of the regional structural data cited by DCM/J is shown for areas on either side of the Greenville fault and little to no published structural data are available for the areas between the main and eastern strands of the Greenville fault as shown in Figure 4-4. Because of the sheared and generally chaotic nature of the bedrock (as evidenced by the rock exposed in the test trenches) in this area, it is our opinion that applying data from outlying areas may not be representative of actual site conditions in the area of maximum cut. As discussed in the Draft Report, stability analyses were based on lower-bound interpretation of laboratory test data for samples that were biased towards the weakest materials recovered from the borings and on an assessment of overall strength of the rock mass as a whole.

Item 2

> *In Section 8.0, Subsection 8.2.1.7 Results of Analyses, the report states that* "Pseudo static safety factors were less than 1 for all conditions analyzed." *However, this contradicts Table 8-1 in which all of the reported pseudo static safety factors are greater than 1.0. In the same subsection, the* "potential seismic displacements" *are reported to be less than 30 cm for the slope conditions analyzed. This is inconsistent with Table 8-1 in which the maximum displacements are reported to be less than 1 cm.*

Subsection 8.2.1.7, Table 8-1, and Appendix I (Slope Stability Analyses) will be reviewed and reconciled prior to completing the Final Geotechnical Design and Materials report.

Item 3

> *In Section 8.0, Subsection 8.3.1.4 Shear Strength Assumed for Stability Analyses, there is a discrepancy between what was reportedly used for analyses* ("....cohesion intercept of 7.7 kPa and a friction angle of 26 degrees") *as discussed in Section 8.3.1.4, and what was actually used in analyses (cross sections used in the embankment slope analyses reports the fill strength used to be 7.17 kPa with a friction angle of 26 degrees).*

The values described in Section 8.1.3.4 will be compared with the values shown in the stability analysis cross sections and reconciled before completing the Final Geotechnical Design and Materials Report.

Item 4

> *In Section 8.0, Subsection 8.3.1.6 Results of Stability Analyses, the report states that in Table 8-2 the* "...static safety factors that range from about 1.5 to 1.7 for the different conditions that were analyzed." *However, in Table 8-2, the static safety factors reported are between 1.53 and 1.57. As such, there is a discrepancy between the text discussion and the tabulated data.*
>
> *In this same subsection, the report states that* "Pseudo static safety factors were less than 1 for all conditions analyzed." *However, in Table 8-2, the tabulated data for the pseudo static safety factors are all greater than 1.16, thus the report text is not consistent with the tabulated data.*

Static and seismic analysis results summarized in the text and shown in the tables of the report will be reviewed and reconciled before completing the Final Geotechnical Design and Materials Report.

Item 5

> *In Section 8.0, Subsection 8.3.2 Post-Construction Embankment Movements, recommendations are provided for* "zoning and fill control measures." *The issue of concern is that there is no upper bound limit on moisture content (i.e.,* "+4% or +2% of optimum or greater," *respectively) for the* "uppermost 5m" *and the* "mid-embankment" *fill material. The* "or greater" *qualification potentially allows the contractor to incorporate very high moisture contents in the fill material while still meeting the report recommendations. Compacting material with very high moisture contents could result in an unstable subgrade (i.e., pumping subgrade) which is not desirable for an embankment fill.*

We agree with this comment. The Final Geotechnical Design and Materials Report will be revised to include an upper bound limit on moisture content.

Item 6

> *Section 8.5 Culverts, discusses the corrosion potential of the soils and bedrock for steel and concrete structures. This section could be augmented by a discussion of the corrosion problems Contra Costa County encountered in some of their culvert crossings during construction of the Vasco Road realignment as part of the Los Vaqueros project. During construction, at least one local newspaper reported that accelerated failure occurred in some of the culvert crossings because backfill materials used around the culvert crossings were highly corrosive. The "lessons learned" from these prior culvert failures should be applied to this project to prevent a repetition.*

We are aware of the problems experienced by Contra Costa County with highly corrosive backfill for the steel culverts utilized on their project. It is our understanding that the problems encountered on that project were due to highly corrosive imported backfill sand and not from local sources. Section 8.5 of the Final Geotechnical Design and Materials Report will be revised to note to failures that occurred in some of the culvert crossings because of the corrosive backfill that was used during construction. The culvert recommendations will be revised to include recommendations for specifying backfill materials to avoid the use of corrosive soils. We will also highlight the corrosion testing that was performed as part of our investigation and that is included in Appendix G of the report.

2. Comments Pertaining to Geotechnical Analysis and Design

Comment 1

> *In Subsection 8.3.1.4 Shear Strength Assumed for Stability Analyses, the report states that* "...where the embankment will be underlain by the weaker Panoche formation materials, the strength parameters discussed in Section 8.2.1.5 were assumed for those materials." *The strength reported in Section 8.2.1.5 for the Panoche Formation includes a cohesion intercept of 2.39 kPa and a friction angle of 20 degrees. However, on the slope stability embankment cross sections at Station 1+160 where the material is identified as "native" (which we presume is the native Panoche formation material), the reported strength used in analyses includes a cohesion intercept of 7.17 kPa and a friction angle of 20 degrees. The strength parameters associate a cohesion intercept of 2.39 kPa with a friction angle of 20 degrees for the Panoche Formation (Subsection 8.2.1.5), and a cohesion intercept of 7.7 [7.17?] with a friction angle of 26 degrees for the Cierbo Formation*

> *(Subsection 8.3.1.4). As such, there is an apparent commingling of the reported strength properties for the slope stability analyses that involves the Panoche formation. The slope cross section that involves the Panoche formation should be analyzed with the appropriate material strengths discussed in the report.*

As summarized above, strength properties summarized in the text of the report, shown in the report tables, and shown in the stability analysis cross sections will be reviewed and reconciled prior to finalizing the report. The results of analyses which are affected by the reconciliation will be reported in the Final Report and recommendations presented therein will be modified to reflect the results of the stability analyses.

Comment 2

> *...we question the use of a free swell test on a core sample of claystone bedrock to model elastic rebound. Performing a free swell test is one way of modeling the behavior of claystone when subjected to free water and to assess the magnitude of swelling that could be anticipated. Therefore, performing a free swell test on a claystone sample is more a measure of the swelling magnitude than it is elastic rebound. That being the case, the reported magnitudes of rebound/heave (100 mm to 400 mm) could be significant if most of the measure is associated with swelling heave and the fact that swelling heave is a time-dependent behavior. Therefore, the roadbed could become significantly distorted over time resulting in an adverse impact on the roadway improvements (i.e., pavement section, drainage gradients, etc.). The impacts could be significantly magnified in the case where the claystone is interbedded with low or non-expansive bedrock materials resulting in abrupt changes in the roadbed profile.*

We concur with the DCM/J comment. Our testing completed to date primarily addresses the possible moisture induced expansion of the claystone bedrock. Determination of the magnitude and time-dependence of bedrock rebound (as compared to moisture controlled expansion) should also be completed. Modeling of this heave mechanism is very difficult. At this time, we intend to model this condition as closely as possible by taking one or more core samples from the approximate elevation of the base of the cut, re-confining the samples to pressures equivalent to a pre-cut condition, and them allowing the samples to elastically rebound at a constant moisture. The amount of rebound will be measured periodically. The rebound will be plotted against time to determine the time-dependency of the rebound. Depending on the results of the tests, we will provide recommendations regarding mitigation of the affects of elastic rebound which may occur following excavation into the claystone. We expect that our testing will indicate that the great majority of elastic rebound will occur immediately following excavation as the unloading of the rock occurs. However, should our testing show otherwise, we will develop and present remedial

recommendations for addressing the potential hazards resulting from long-term rebound of the claystone bedrock.

We also agree with DCM/J that interbedding of the claystone could result in variations in the both elastic rebound and moisture induced expansion along the base of the excavations. Because of the sheared nature of the materials within the strands of the Greenville Fault, identification of the expansive and non-expansive beds will not be possible until the excavations are made. Therefore, as discussed above, in the Final Report we will include additional recommendations regarding the need to map all excavations during construction so that modifications and/or additions to the remedial measures recommended can be developed and implemented, as necessary.

Comment 3

> *With respect to the major cut slope on this project, Cal Engineering modeled the major cut slope as a uniform rock mass slope for the full depth of the cut and beyond, and reasonable strength parameters were assigned for the rock mass. However, the engineering data (shear strength data and shear wave velocity) summarized on the geologic cross section on Figure 4-4 indicates a marked difference in the bedrock between Elevations 295 m and 300 m at Cross Section B-B'. According to the data summarized on Cross Section B-B', the shear strength data and the shear wave velocities are several orders of magnitude greater than the bedrock materials above it resulting in a "resistant bedrock layer." This marked change in the bedrock daylights in the cut slope a few meters above the roadbed at the report stationing of about 23+50 (Figure 4-3). Because bedrock strength and shear wave velocity data suggests this geologic condition could control slope stability, this geologic condition should be modeled in a slope stability cross section to evaluate the impact a "resistant bedrock layer" might have on slope stability and the resulting safety factor.*

Following the DCM/J comment, we have run additional stability analyses (included in Attachment 1) assuming that the resistant bedrock layer may be represented by a friction angle of 25 degrees and a cohesion intercept of 7.5 kPa. Using these higher rock strength values increases the static safety factor of deep failure surfaces by about 24 percent to 34 percent. The increased strength does not affect the safety factor for shallow failure surfaces above the resistant layer.

Comment 4

> *From a geotechnical engineering point of view, placing an embankment fill on the toe of a* "questionable" *landslide or* "zones of relatively weaker bedrock" *is a condition that can result in hillside instability and warrants further evaluations. As such, the existence or non-existence of a* "questionable" *landslide or* "zones of

> relatively weaker bedrock" *identified as QLS-2 needs further evaluations and/or assessment to ascertain where or not it exists. If it does exist, the impact of placing a roadway embankment fill at the toe of the instability feature needs to be evaluated through slope stability analyses. Depending on the results of such evaluations and assessments, recommendations may be necessary to address this geologic and embankment slope condition in order to accommodate the roadway embankment fill. For example, significant project grading costs could be incurred if the landslide toe has to be removed and replaced as engineered fill to accommodate the roadway embankment fill. In any case, this geologic condition warrants further review and evaluations to accommodate the roadway embankment fill.*

In response to this comment, we have conservatively assumed that the landslide exists and performed additional analysis to assess the relative impacts placing embankment fill in this area could have on overall stability of the landslide (and the fill). This analysis is included in Attachment 2 and included: (1) back-calculating the strength required for a safety factor of 1.0 against sliding of the landslide mass; (2) adding the embankment fill to the cross-section; and (3) evaluating the resultant safety factor using the back-calculated shear strength for the landslide materials. The results of this analysis indicated a friction angle on the order of 6 degrees would result in a safety factor on the order of 1.0 for the landslide mass. Using this strength value and adding the embankment fill increases the safety factor from 1.0 to 2.4 because the embankment buttresses the area of the landslide.

H. <u>Section 12 - Recommendations and Specifications</u>

1. <u>General Report Discussion Comments</u>

Item 1

> *It is unclear if the* "very weak rock" *discussed in this section is any weaker or has substantially less strength than that anticipated for the very poor to poor rock discussed in Subsection 7.1.4. Because constructing buttress fills could be a substantial project expense, guidelines should be presented or discussed on how* "very weak rock" *can be distinguished or identified from the other very poor to poor rock anticipated in the project excavations. The need for buttress fills should be based on measurable and identifiable differences in the bedrock materials from that anticipated or assumed in the evaluations and calculations.*

As part of the Final Geotechnical Design and Materials Report, we will clarify and provide guidelines regarding the identification of very weak rock in excavations. These guidelines will include criteria for overall rock mass quality, discontinuity characteristics, discontinuity frequency, discontinuity orientation with respect to the excavation, and evidence for the presence or absence of groundwater. It should be noted, however, that identification of very weak rock in the field and the need for buttress fills will likely be somewhat subjective. As result, as discussed above the Final Report will highlight the need for professional observation and mapping of major excavations during construction.

2. Comments Pertaining to Recommendations

Comment 1

> *In Subsection 12.1.2 Cut Slope Configurations, the excavation design recommendations are contained in Table 12-1. In Table 12-1, recommendations are provided for cut and fill slopes between various stationing points along the project alignment. In light of report discussions pertaining to 1V:2H cut slopes, and in the absence of engineering analyses or other report discussions that support a 1V:2V recommendation, there is an apparent discrepancy between the report discussions and the recommendation for 1V:2H cut slopes*
>
> *...in one section of the report, Cal Engineering discusses the vulnerability of 1V:2H slopes, yet recommendation occurs without any supporting documentation that indicates 1V:2H slopes will be more stable on this project than they were on the adjacent landfill site. Therefore, slope stability evaluations should be completed for the recommended 1V:2H cut slopes utilizing materials strength properties and groundwater conditions that model the cut slopes.*

The 1V:2H cut slope recommendations included in Table 12-1 were for cuts in Cierbo Formation sandstone and conglomerate that are above the water table. Table 12-1 will be revised in the Final Geotechnical Design and Materials Report to show this distinction. The Cierbo Formation materials are primarily granular and are assumed to exhibit greater strength than the sheared, clayey materials that will be exposed in the large excavation between the eastern and main strands of the Greenville fault. Nonetheless, we will complete additional stability analyses for the proposed 1V:2H cuts based on conservative assumptions for the materials that will be exposed in the excavation. Recommendations included in the Final Report will be revised as necessary basedon the results of te additional analyses.

Comment 2

> *The final or update report should incorporate recommendations for the under drainage systems as needed (i.e., filter material, filter fabric [if any], perforated pipe, cleanouts [if any], discharge outlets, etc.).*

This section of the report was inadvertently left out of the Draft Report. The Final Geotechnical Design and Materials Report will include these recommendations. Specific details for under drainage system design will be addressed in subsequent design memorandums which will supplement the Final Report.

CLOSURE

As described in the main body of this letter, we have reviewed DCM/J's comments on the Draft Report and substantially concur with their recommendations. Based on the review comments and recommendations we are completing the above noted additional testing and analyses and are revising the Draft Report accordingly.

We appreciate the opportunity to provide service to the County of Alameda Public Works Agency on such an important project and look forward to working with the County and its representatives to complete the Final Geotechnical Design and Materials Report. If you have questions regarding this letter or if we can be of further assistance, please contact us at your convenience.

Very truly yours,

CAL ENGINEERING & GEOLOGY, INC.

Phillip Gregory, P.E., G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
PHILLIP O. GREGORY
No Geo GE 2193
No Civil C 40728
Exp. 3/31/03
CIVIL · GEOTECHNICAL
STATE OF CALIFORNIA

Attachments (2)

Attachment 1
ADDITIONAL ANALYSES TO ASSESS RESISTANT BEDROCK LAYER

Note:
① 27-33% increase in static FS w/ resistant layer
② w/ resistant layer shallow failure becomes most critical case

Summary of Cut Slope Stability Analyses

	Slope Configuration	Static Factor of Safety		Seismic Factor of Safety-Deep Failure[1] (Far/Intermediate/Near Field)	Pseudostatic Yield Coefficient, k_y	Maximum Displacement (Far/Intermediate/Near Field[2]) (cm)
		Deep Failure[1]	Shallow Failure[3]			
33.8%	Buttress Fill with 50 m long hydraugers	1.51 2.02	1.93	1.27 / 1.10 / 1.03	0.11	NA / 1cm / 1cm
28.5	3.5:1 (horiz.:vert.) cut with 50 m long hydraugers	1.44 1.85	1.69[4]	1.22 / 1.06 / 1.00	0.10	NA/ 1cm / 1cm
27.1	3.5:1 (horiz.:vert.) cut with 70 m long hydraugers	1.55 1.97	1.69[4]	1.32 / 1.15 /1.07	0.123	NA / NA / 1cm

Note:, Displacement analysis is only required for cases where the seismic global stability analysis indicates a factors of safety less than 1.15.

Basis for Analysis of Seismic Slope Stability Results

Field (Fault)	Moment Magnitude	Maximum Acceleration	Seismic Coefficient, k_s
Near Field (Greenville Fault)	M_w=5.2	A_{max}=0.27g	0.10[5]
Intermediate Field (Calaveras Fault)	M_w=6.3	A_{max}=0.15g	0.08
Far Field (San Andreas Fault)	M_w=7.3	A_{max}=0.08g	0.04

---

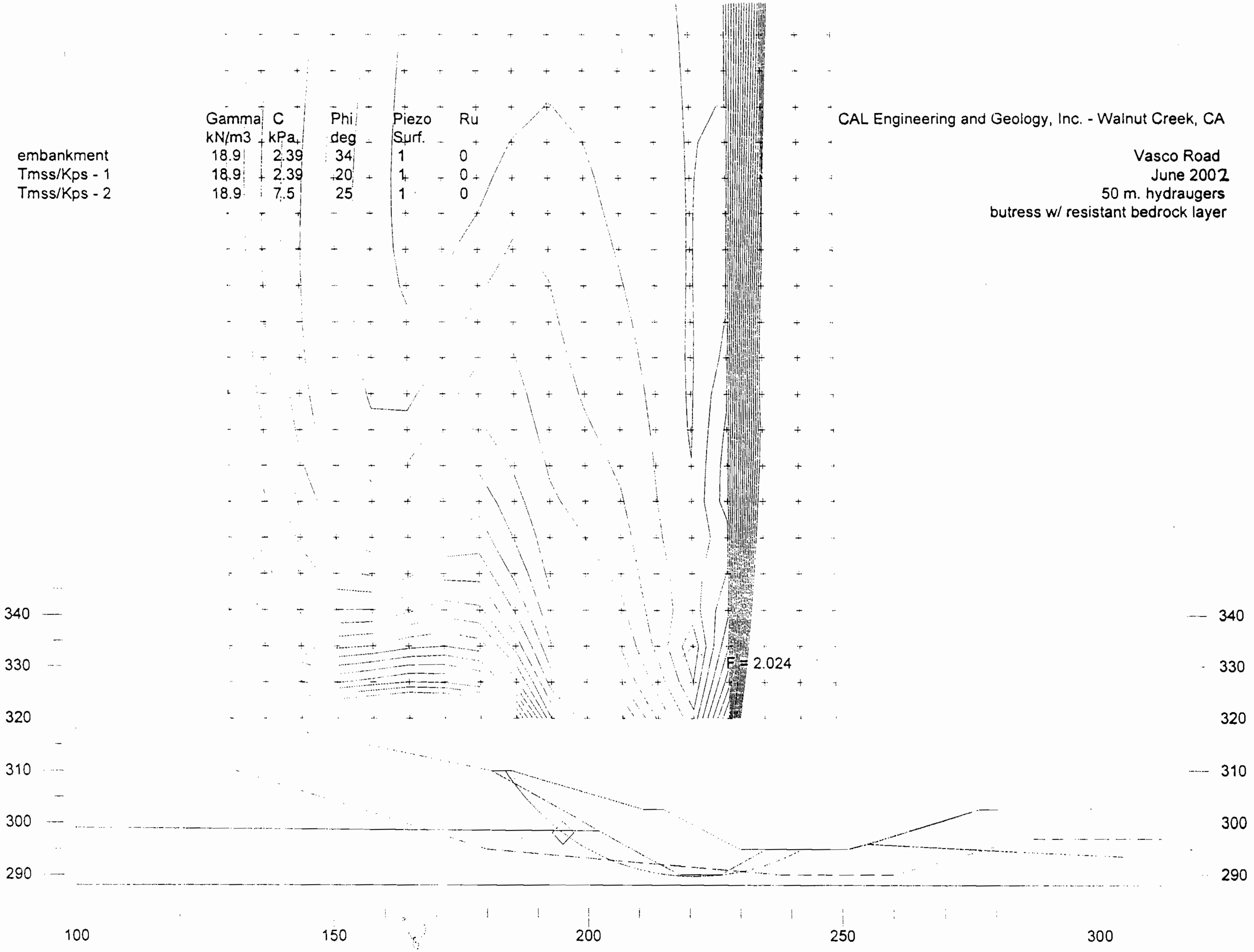
[1] For deep failure analysis, the extent of failure was limited to 45 meters up slope of the main strand of the Greenville fault.

[2] Modified Newmark analysis based upon Figure 53 of Makdissi and Seed (1978). The analysis assumes that the crest acceleration is the same as A_{max}. Note that by inspection a magnitude 5.2 event is incapable of resulting in displacements of greater than approximately 30 centimeters regardless of the induced acceleration.

[3] It should be noted that the surficial stability reduces to below 1.0 if the slope becomes saturated to the face of the slope. This condition is not modeled in these analyses which assumes hydraugers control the piezometric water level.

[4] Shallow Failure analysis is the same for 50m or 70m hydraugers because the failure extends less than 50m into the slope.

[5] Use k_s = 0.10 instead of 0.14 per Seed (1979) because M_w<6.5.



CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
June 2002
50 m. hydraugers
butress w/ resistant bedrock layer

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	7.5	25	1	0

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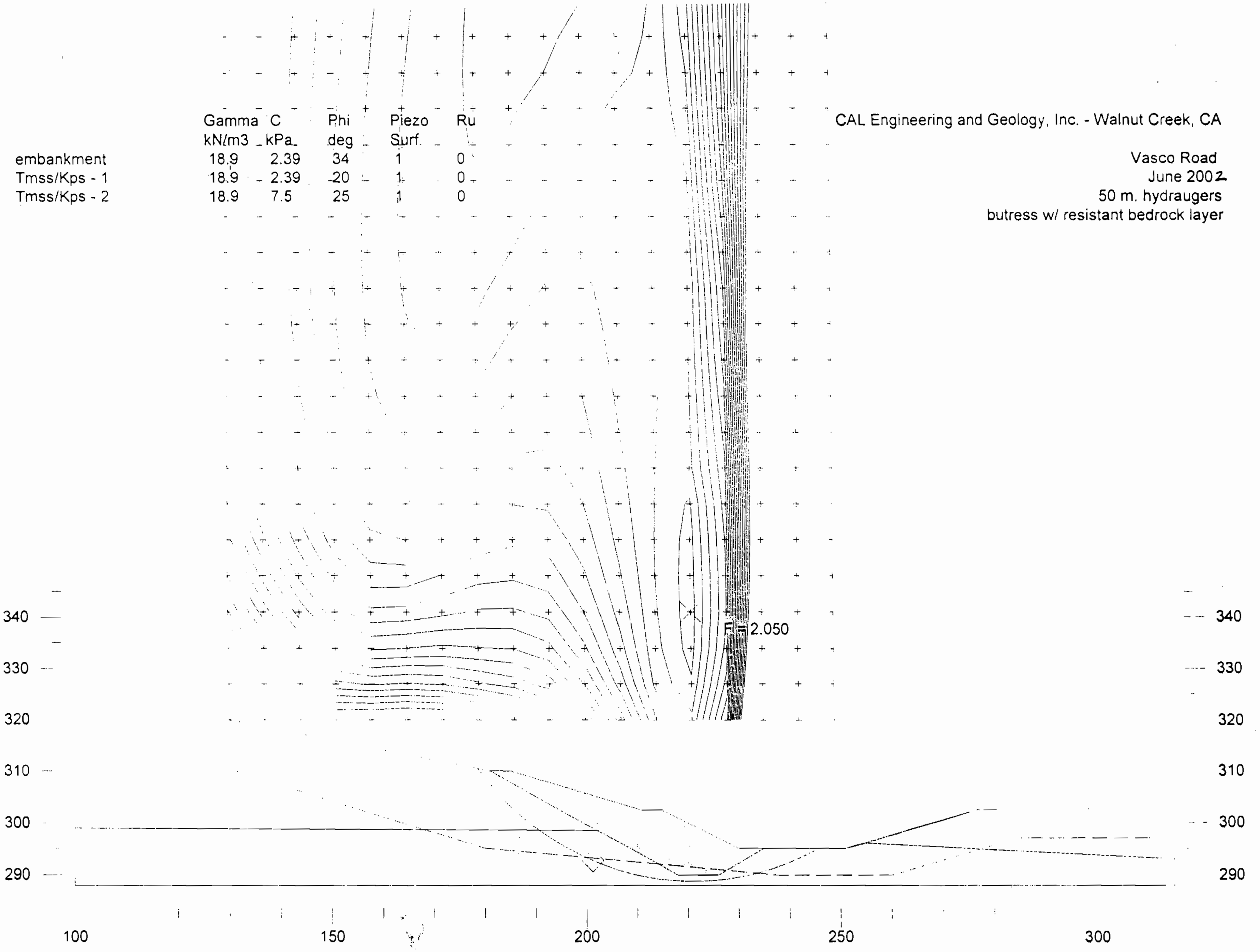
CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
June 2002
50 m. hydraugers
butress w/ resistant bedrock layer

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	7.5	25	1	0



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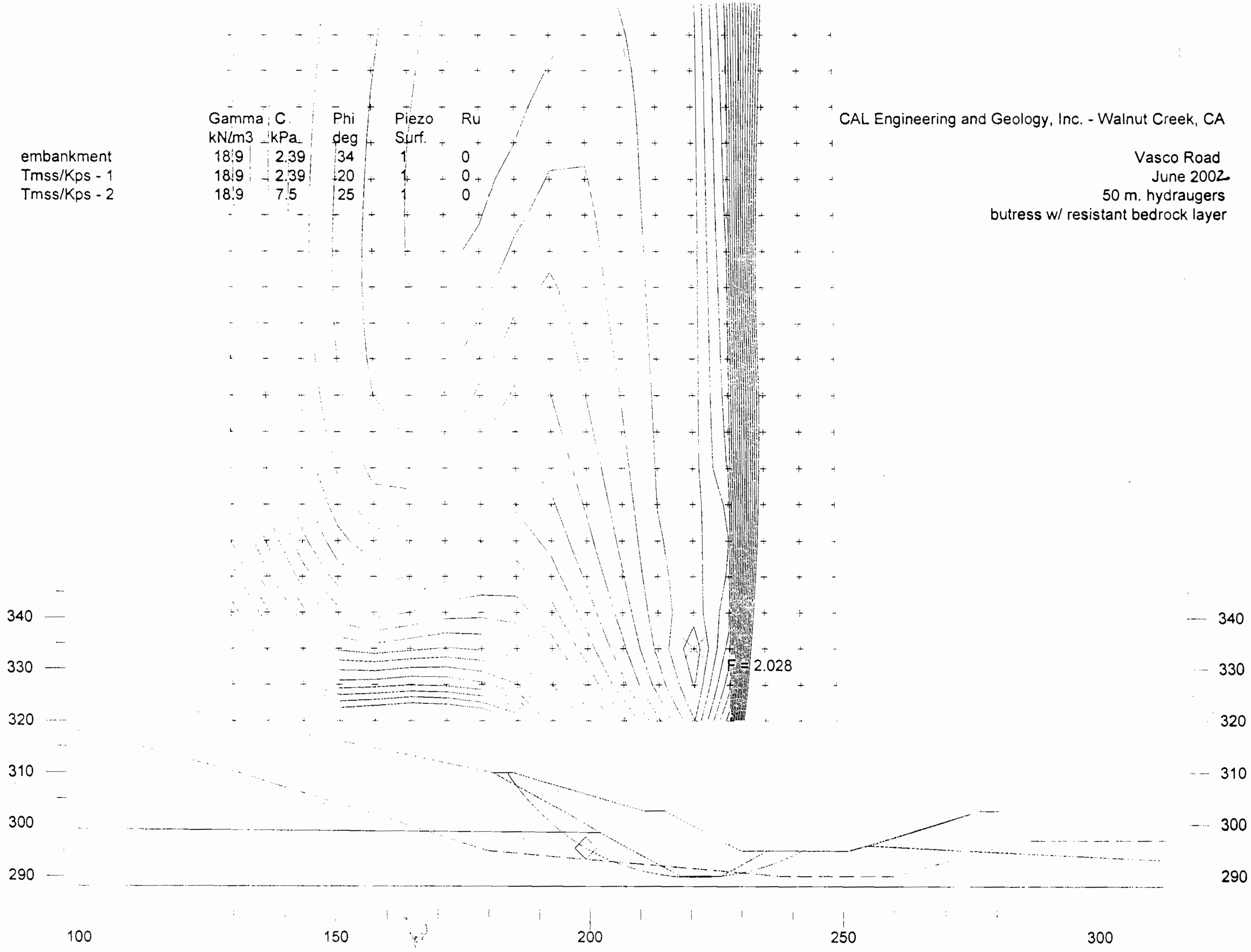

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
June 2002
50 m. hydraugers
butress w/ resistant bedrock layer

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	7.5	25	1	0

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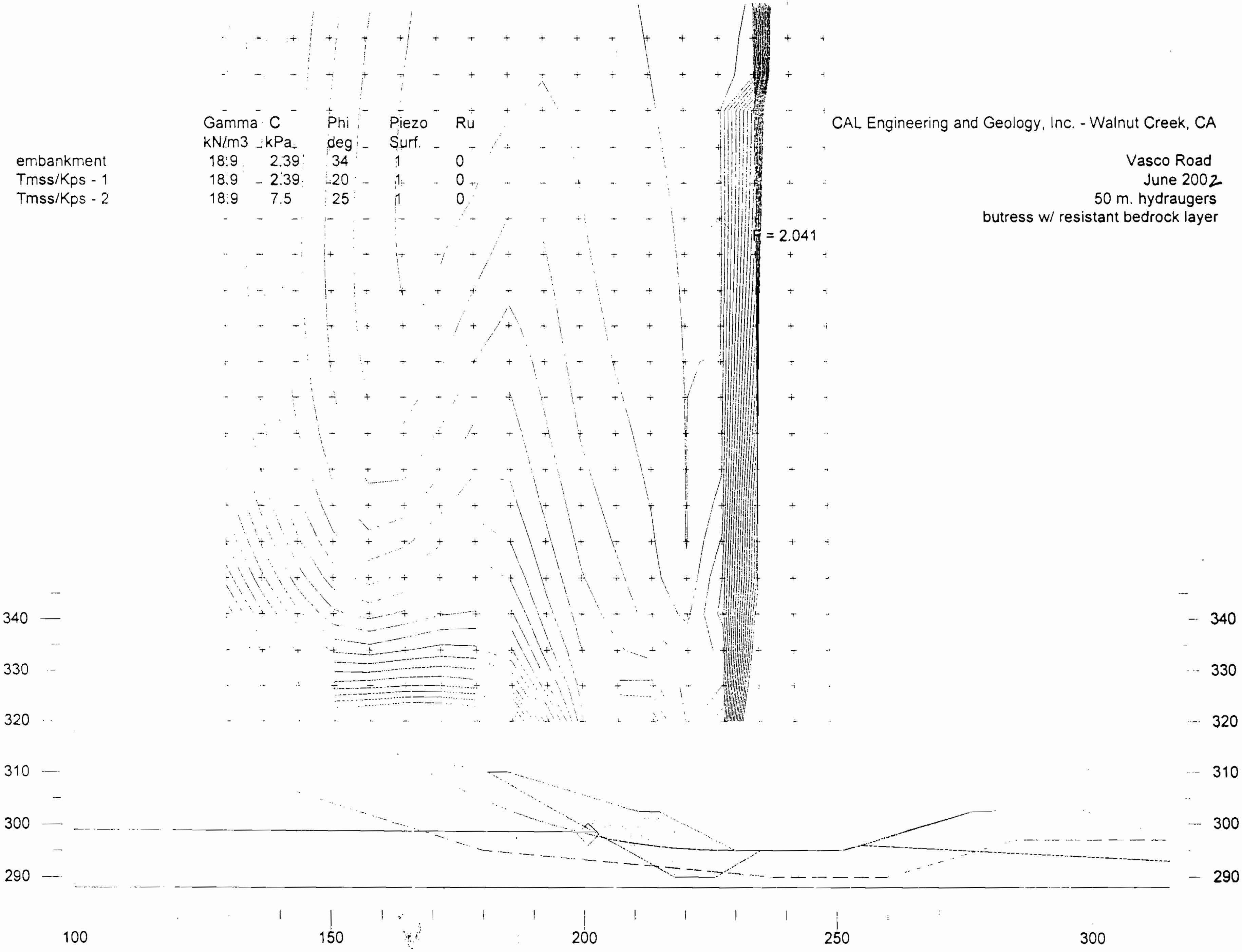

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
June 2002
50 m. hydraugers
butress w/ resistant bedrock layer

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	7.5	25	1	0

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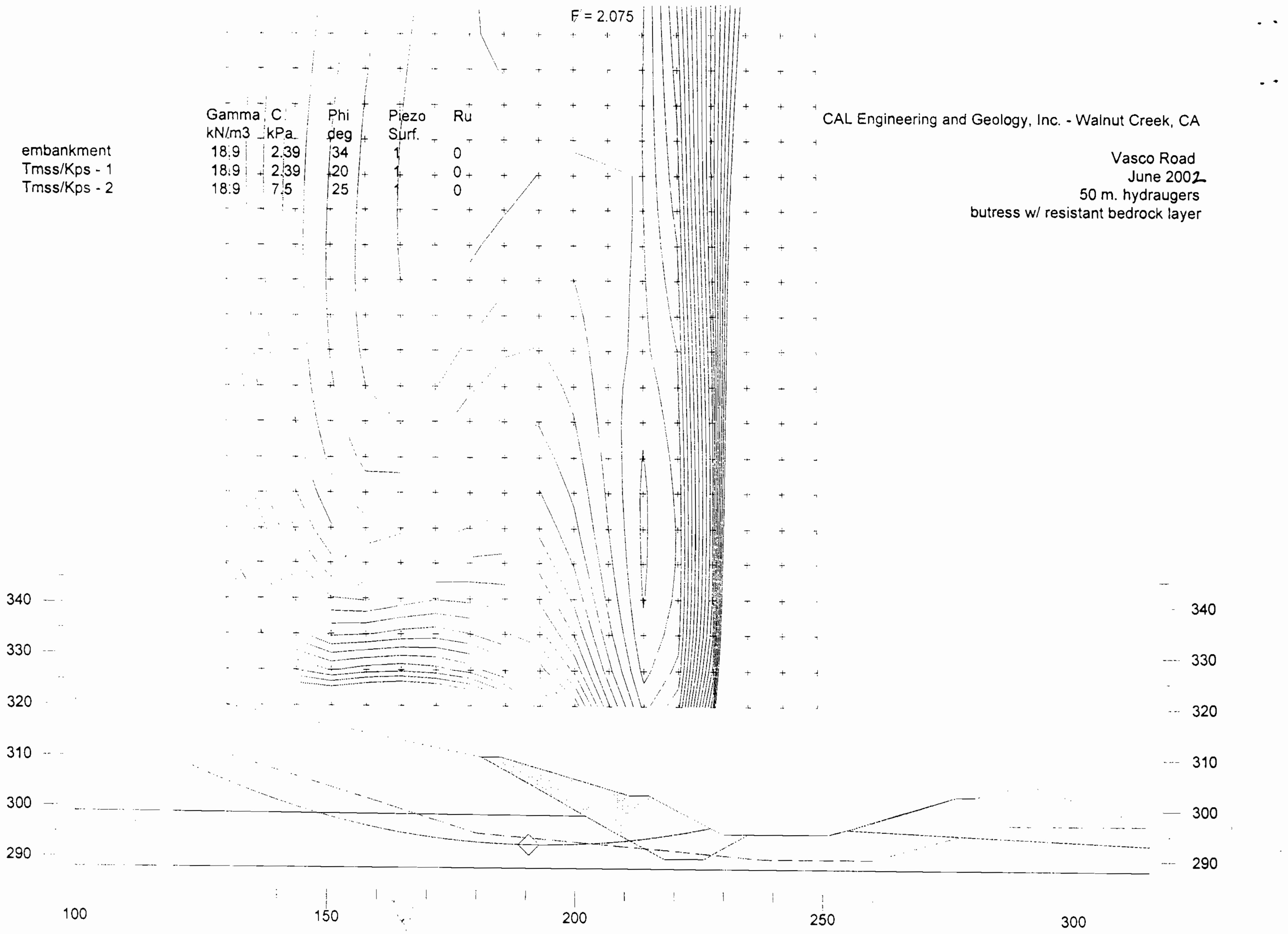

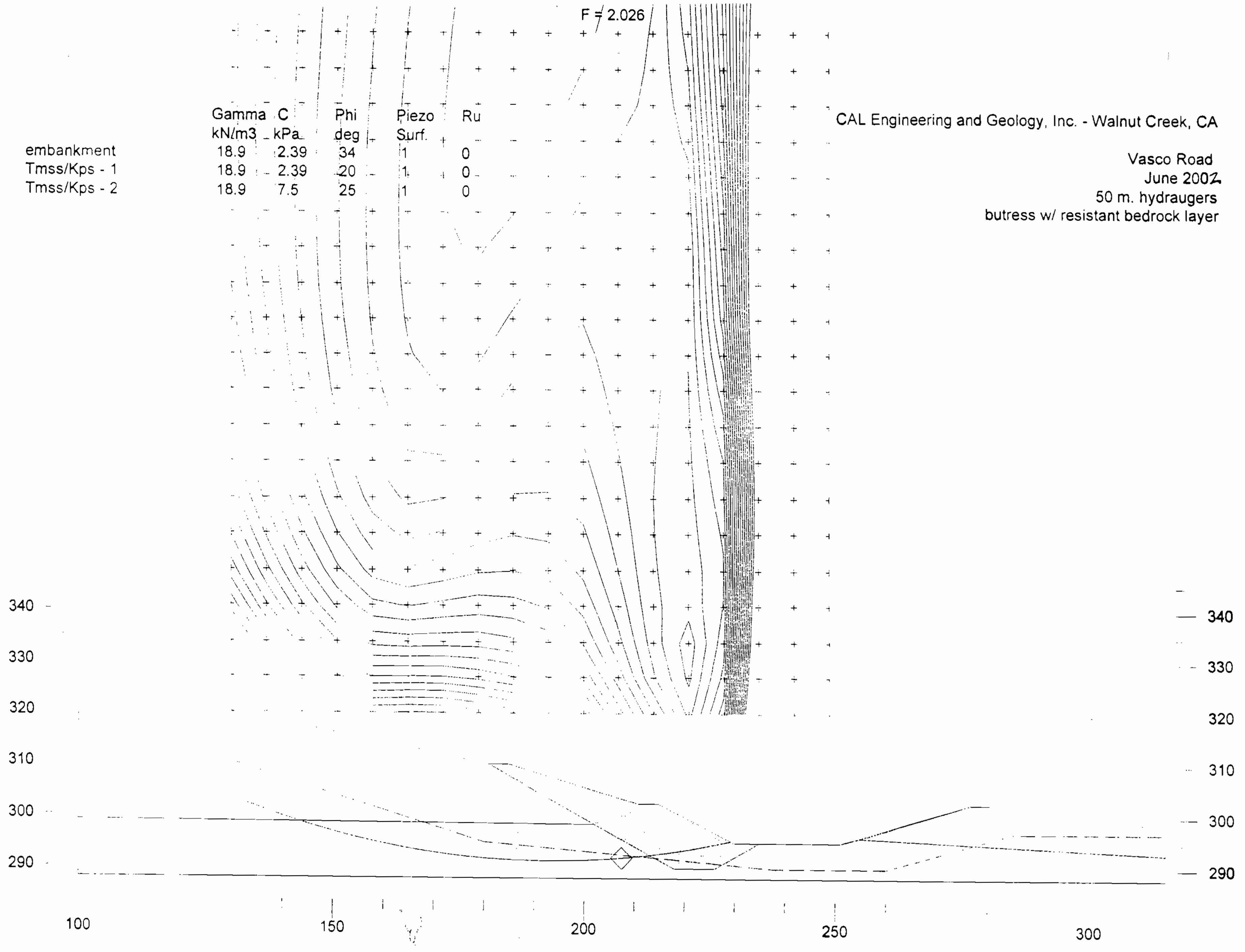

CAL Engineering and Geology, Inc. - Walnut Creek, CA

Vasco Road
June 2002
50 m. hydraugers
butress w/ resistant bedrock layer

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	34	1	0
Tmss/Kps - 1	18.9	2.39	20	1	0
Tmss/Kps - 2	18.9	7.5	25	1	0

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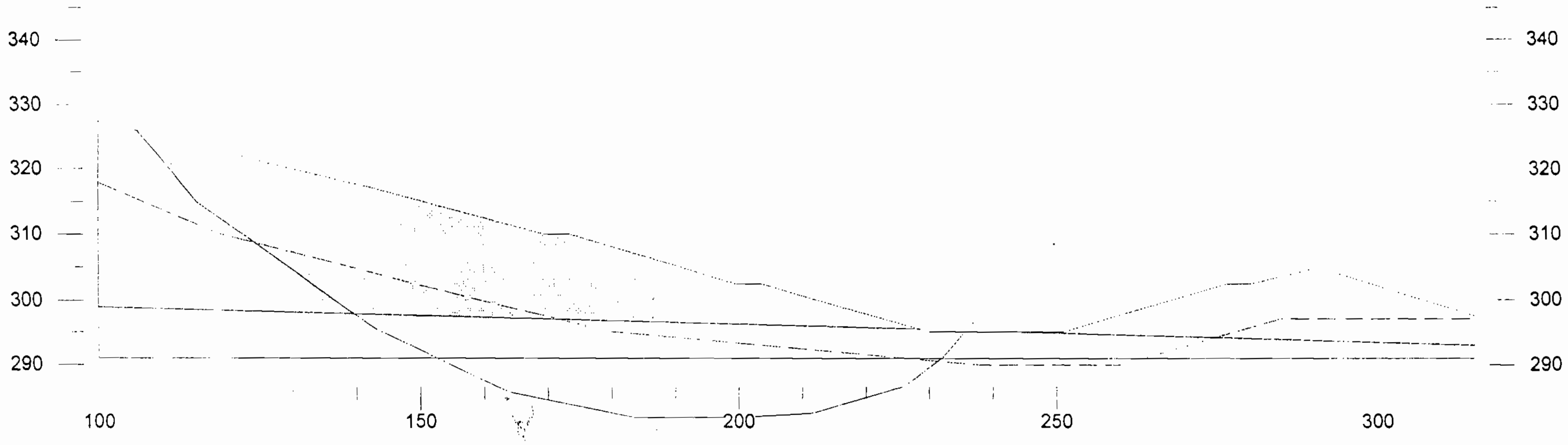
Tmss/Kps-1	18.9	2.39	20	1	0
Tmss/Kps-2	18.9	7.5	25	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Resistant Bedrock Analysis
June 2002
50m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

F = 1.847



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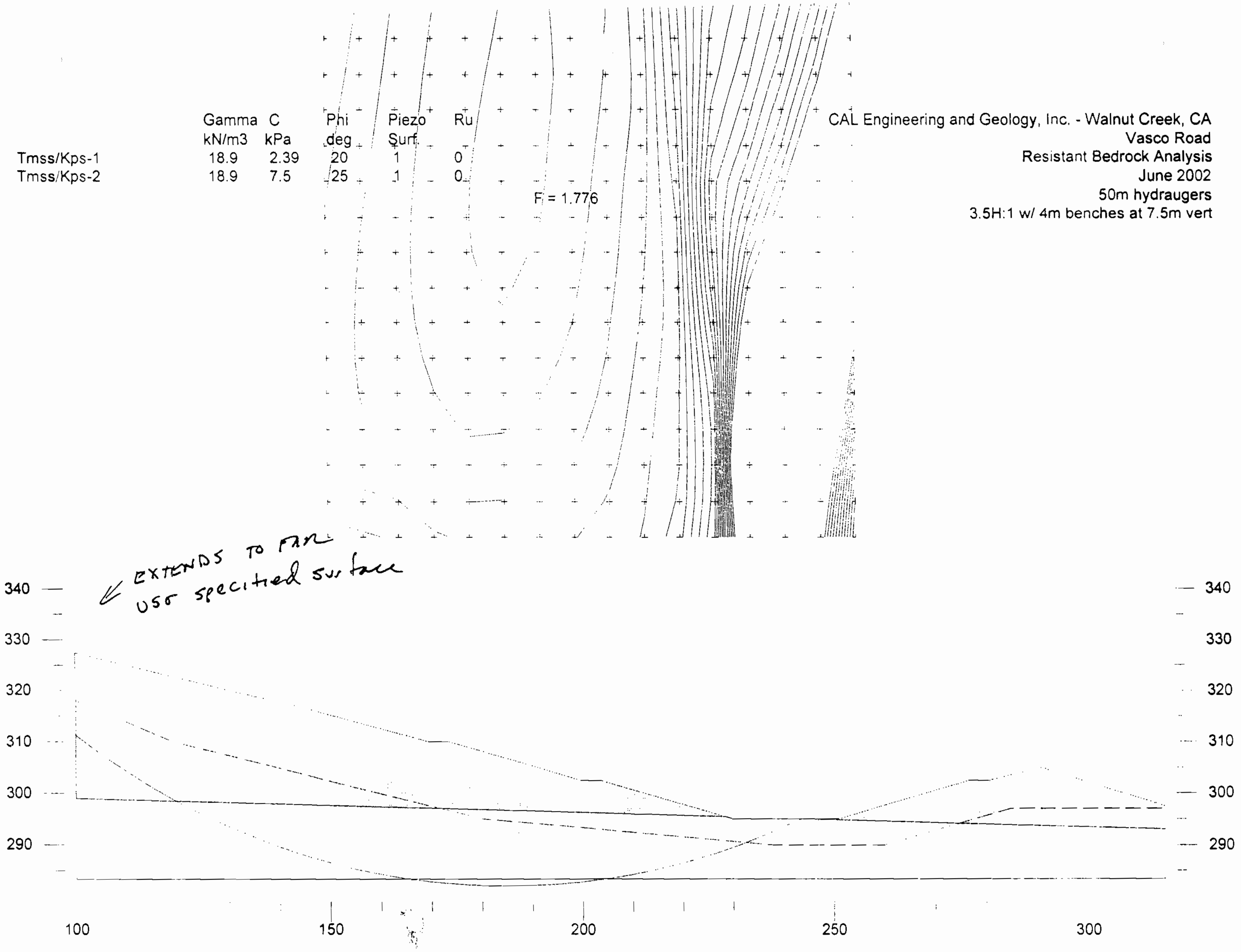
CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Resistant Bedrock Analysis
June 2002
50m hydraugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf	Ru
Tmss/Kps-1	18.9	2.39	20	1	0
Tmss/Kps-2	18.9	7.5	25	1	0



EXTENDS TO FAR
USE specified surface

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F = 1.968

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
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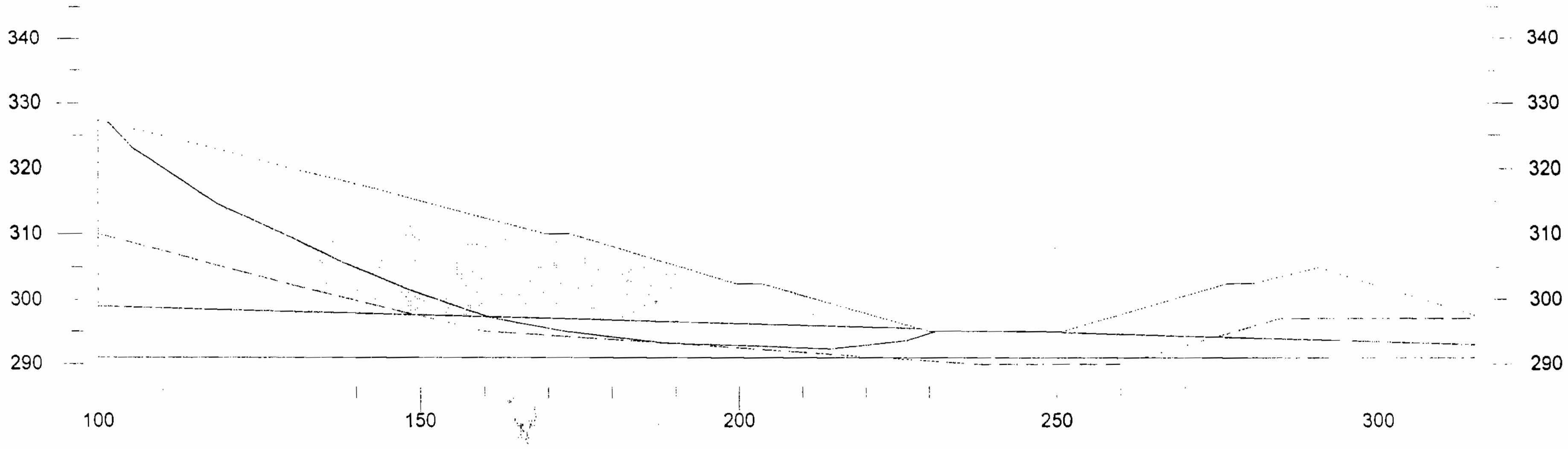
Tmss/Kps-2	18.9	7.5	25	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Resistant Bedrock Analysis
June 2002
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert



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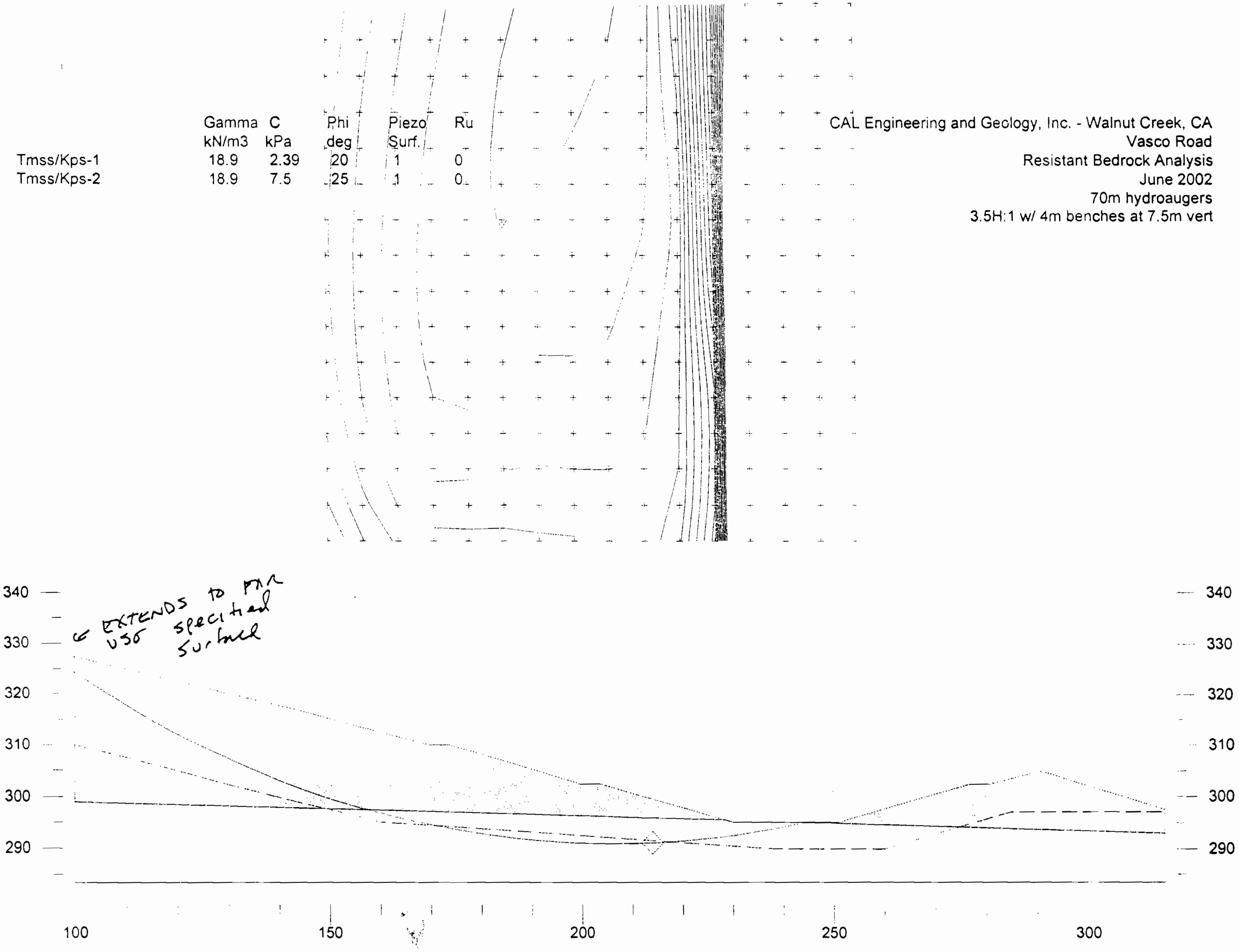
CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Resistant Bedrock Analysis
June 2002
70m hydroaugers
3.5H:1 w/ 4m benches at 7.5m vert

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
Tmss/Kps-1	18.9	2.39	20	1	0
Tmss/Kps-2	18.9	7.5	25	1	0



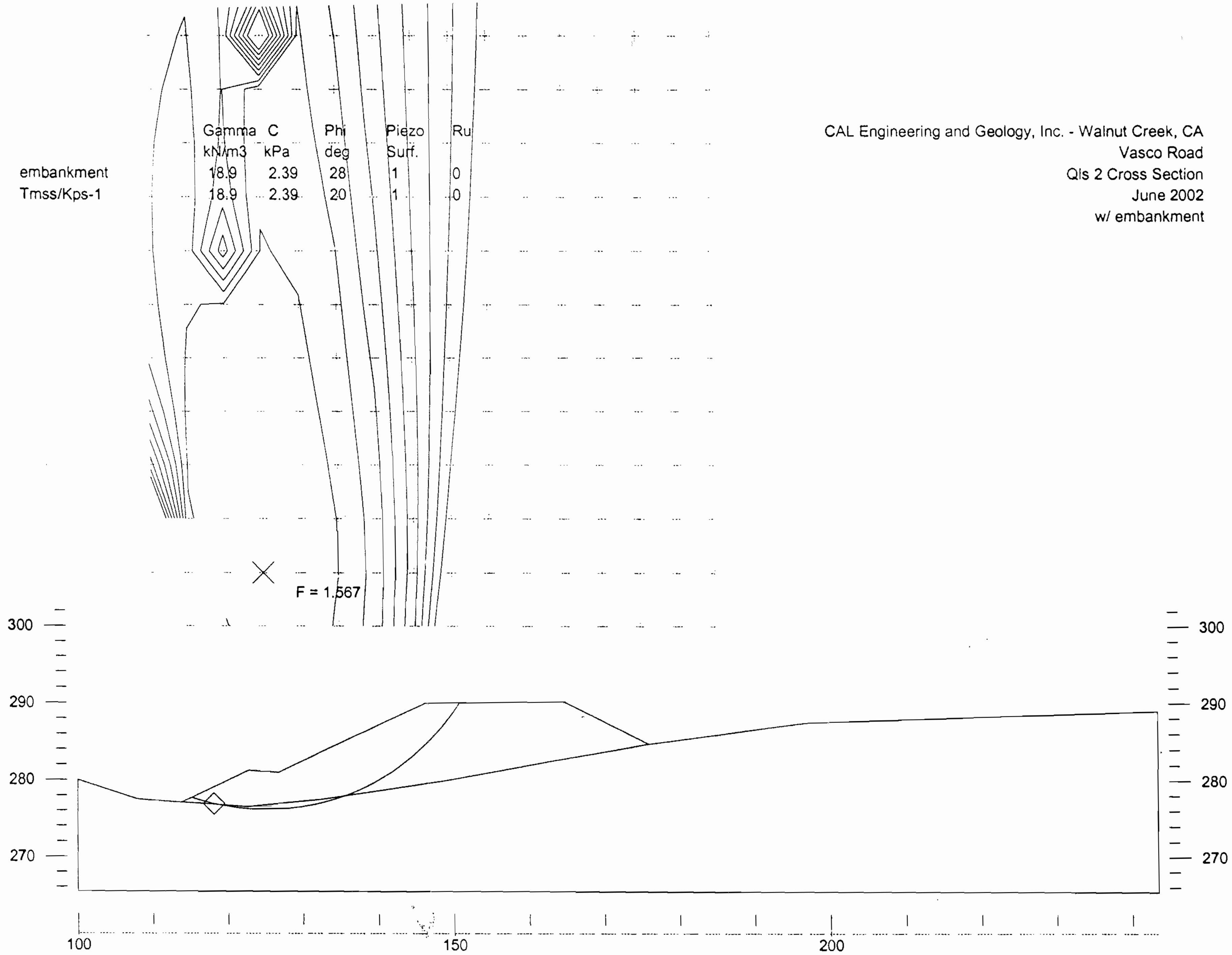
← EXTENDS TO FAR
USE specified surface

6/5/2002 4:08:54 PM Z:\3TO170M.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.970

Attachment 2

ADDITIONAL ANALYSES TO ASSESS STABILITY OF EMBANKMENT FILL

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/ embankment

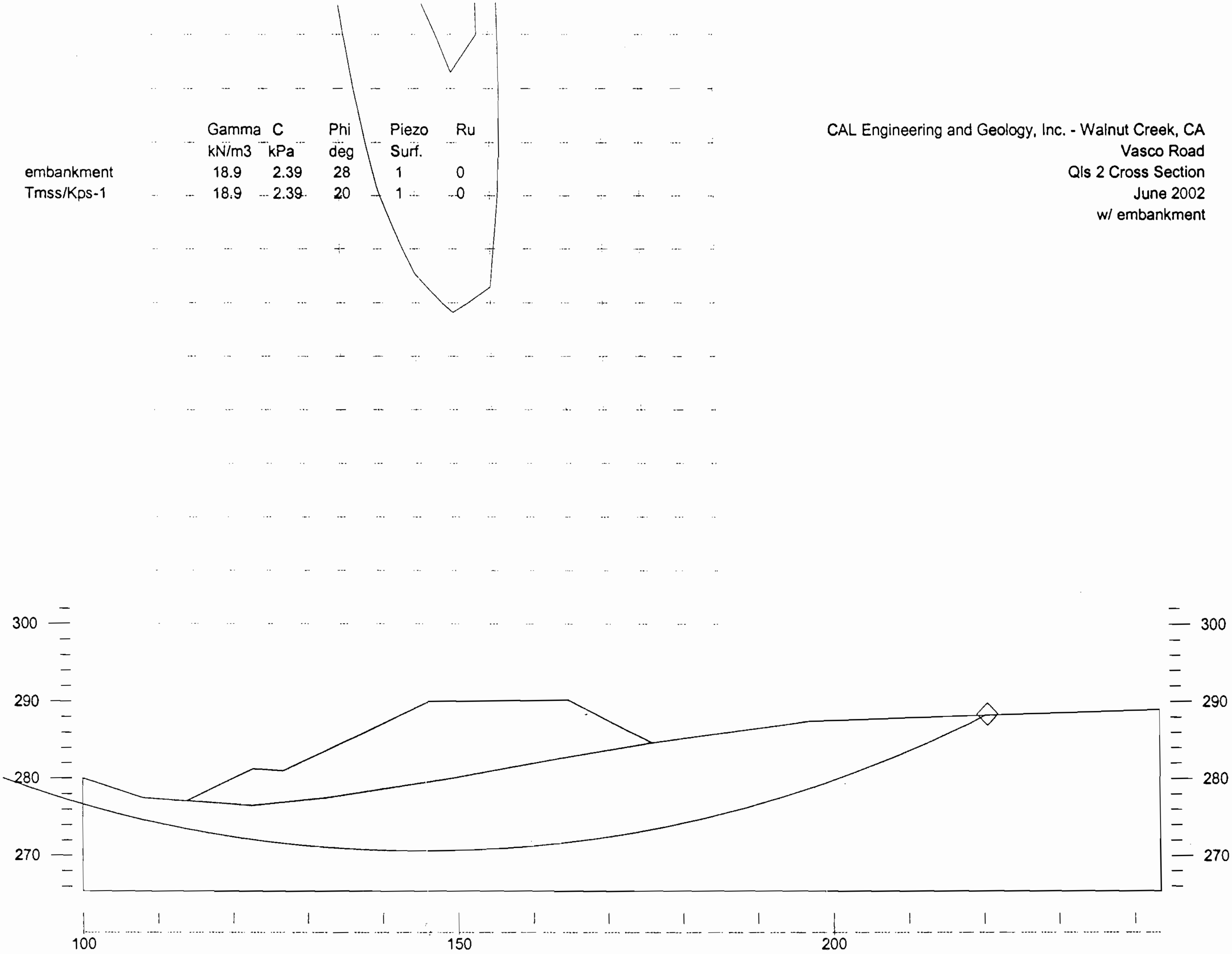


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	28	1	0
Tmss/Kps-1	18.9	2.39	20	1	0

6/7/2002 1:44:39 PM Z:\QLS2EMBK.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = 1.567

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/ embankment

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	28	1	0
Tmss/Kps-1	18.9	2.39	20	1	0



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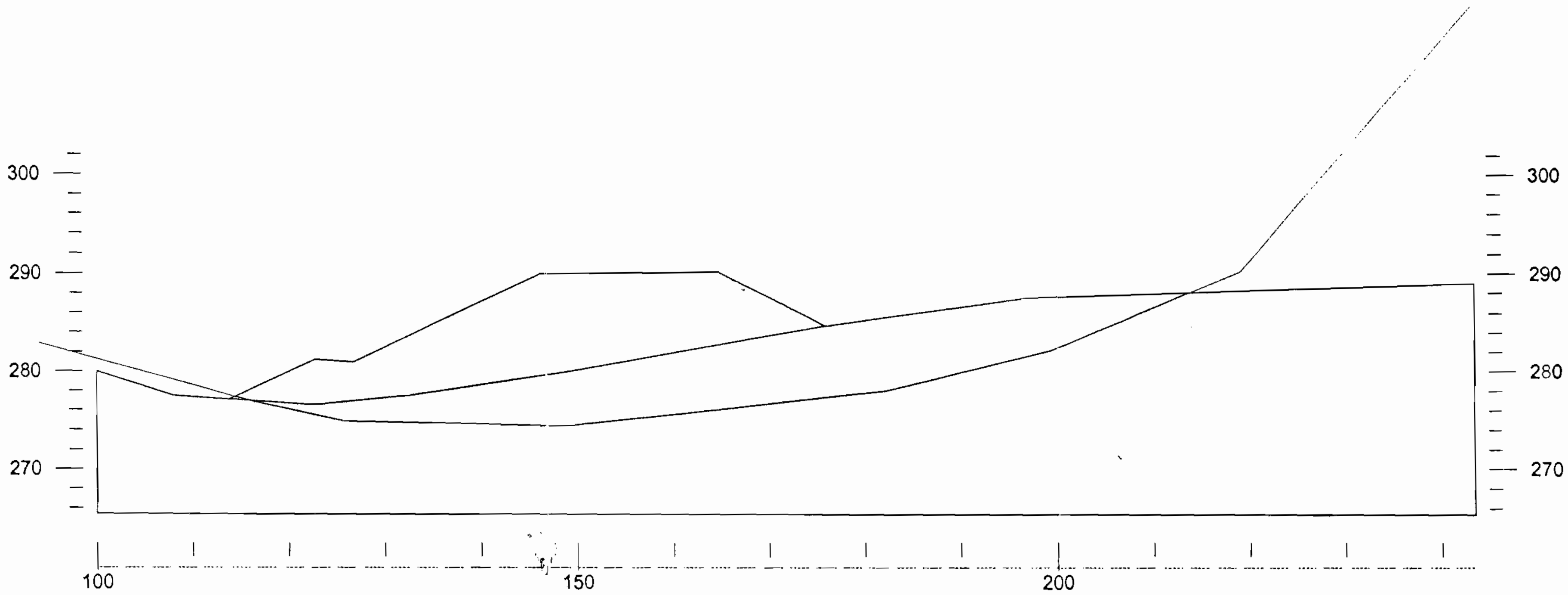
CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/ embankment

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	28	1	0
Tmss/Kps-1	18.9	2.39	20	1	0



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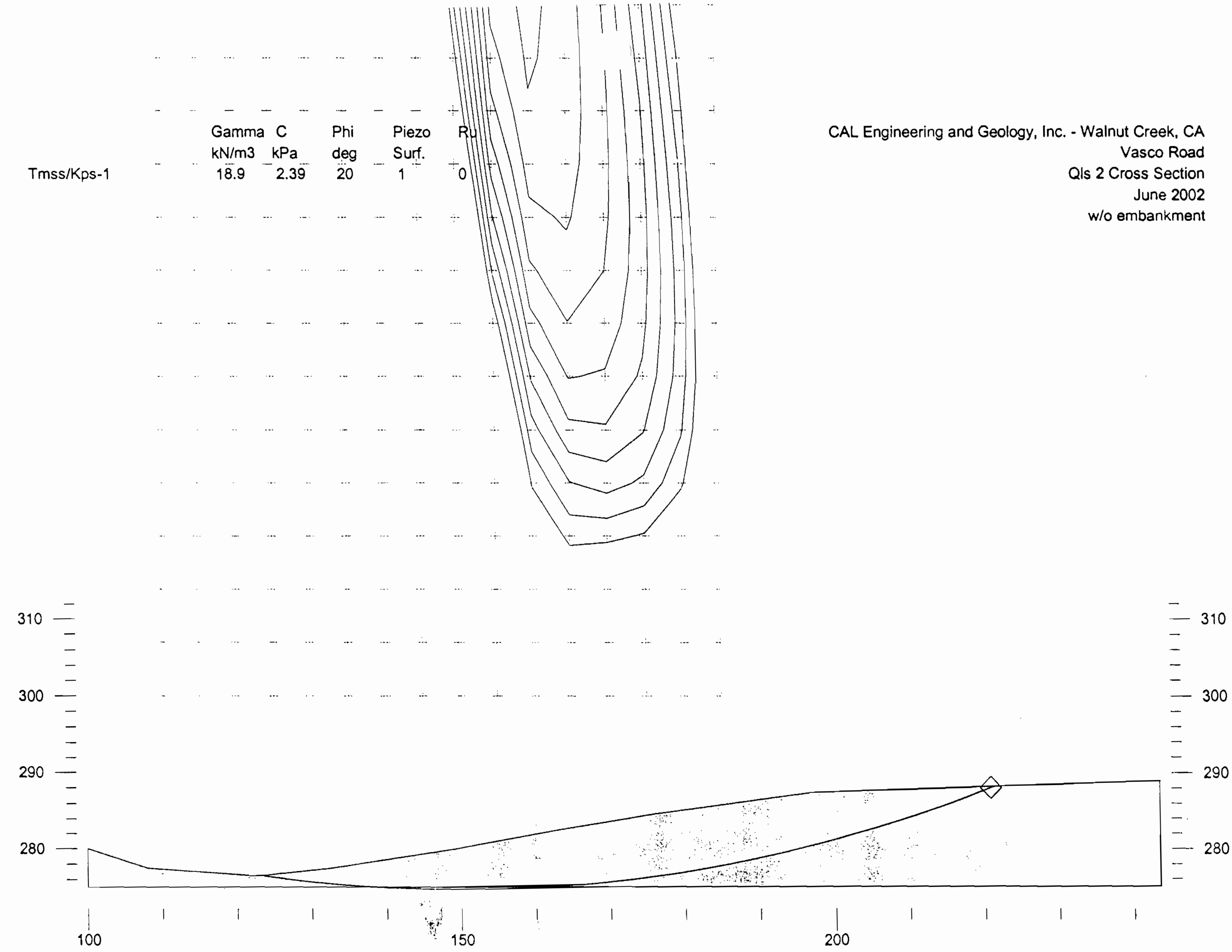

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/o embankment

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
Tmss/Kps-1	18.9	2.39	20	1	0

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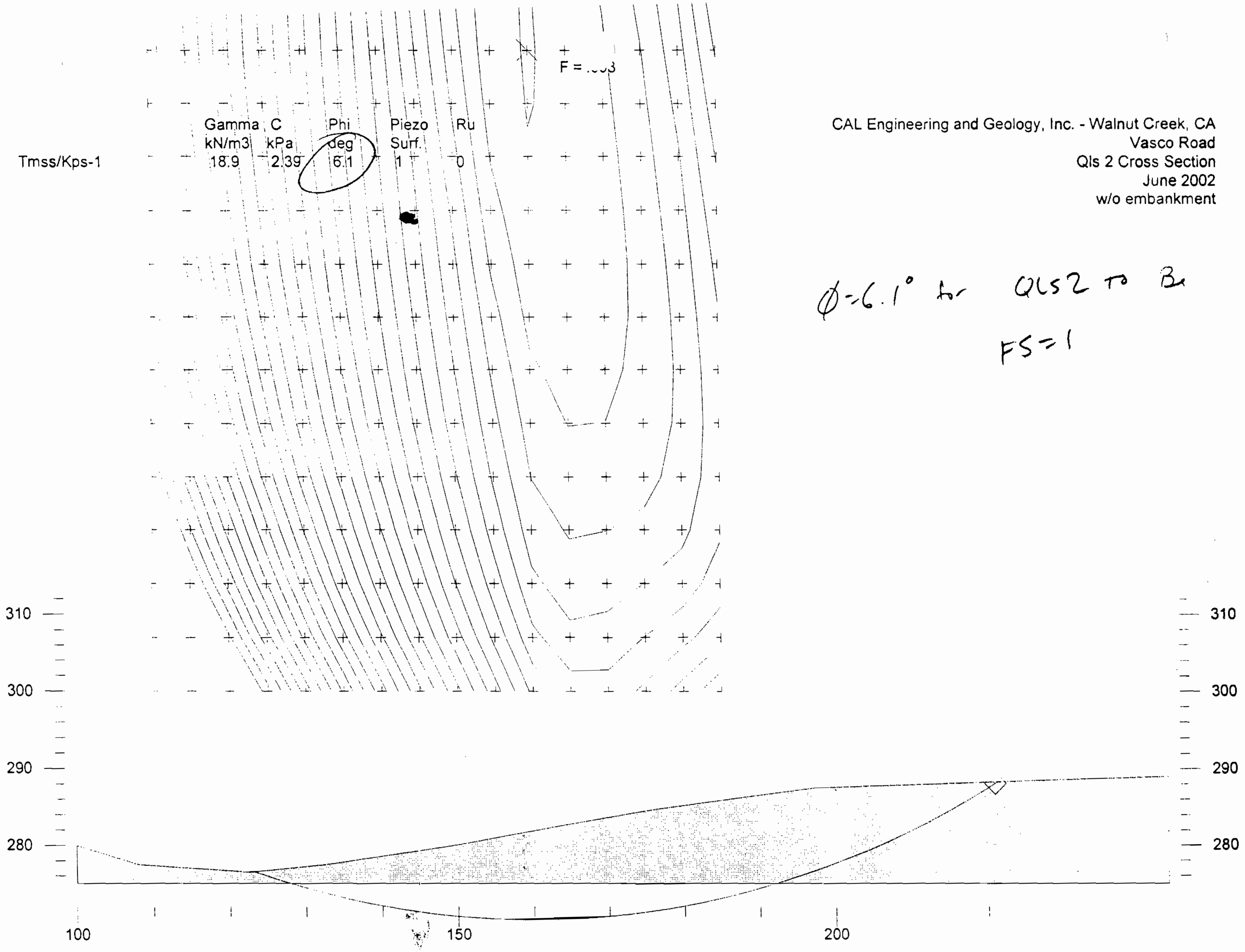


CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/o embankment

ϕ=6.1° for QLS2 to B

FS=1

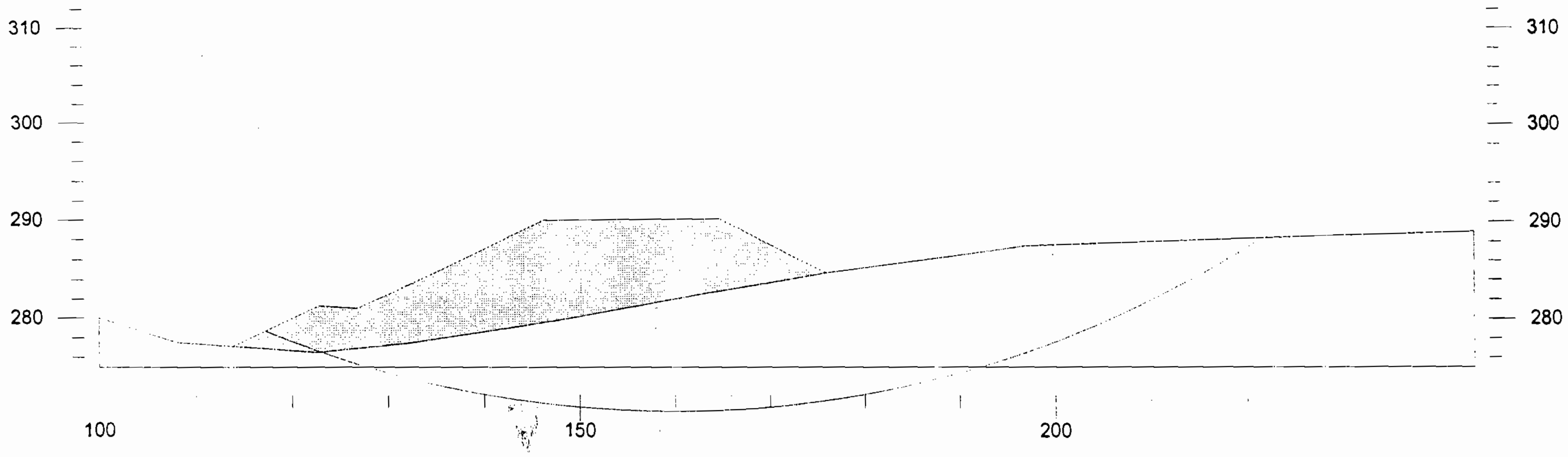
6/7/2002 2:01:00 PM Z:\QLS2.GSL CAL Engineering and Geology, Inc. - Walnut Creek, CA F = .993

F 24

	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.	Ru
embankment	18.9	2.39	28	1	0
Tmss/Kps-1	18.9	2.39	6.1	1	0

CAL Engineering and Geology, Inc. - Walnut Creek, CA
Vasco Road
Qls 2 Cross Section
June 2002
w/ embankment

FS = 2.4 w/ ϕ = 6.1°
when Vasco road embankment
present



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DCM/Joyal Engineering

David C. Mathy
Norman A. Joyal
Robert A. Kahl
Dru R. Nielson
Brian R. Dodge
Mark D. Sinclair
Marc M. Gelinas

May 16, 2002
File: J-4286-13

Mr. Moses Tsang
County of Alameda Public Works Agency
399 Elmhurst Street
Hayward, CA 94544-1395

Subject: **Geotechnical Engineering Peer Review**
Vasco Road Safety Improvement Project (Phase 1)
Between Mile Posts 3.4 and 4.3
Alameda County, California

Dear Moses,

This letter presents our geologic and geotechnical review comments pertaining to the proposed Vasco Road Safety Improvement Project in Alameda County, California. Our services were provided in accordance with the Alameda County Public Works Agency's Engineering and Road Construction Department's request for Geological and Geotechnical Review, dated April 11, 2002. The Alameda County Public Works Agency's request for Geological and Geotechnical Peer Review of the Draft Geotechnical Design and Material Report, Reference A, is based on the scope of work outlined by DCM/Joyal Engineering in a proposal letter dated April 8, 2002.

The Vasco Road Safety Improvement Project (Phase 1) entails the realignment (straightening) of approximately 1.61 km of roadway in northeastern Alameda County between Mile Post (MP) 3.4 and MP 4.3. The improvement project will require extensive cut and fill earthwork, retaining structures, and surface and subsurface drainage provisions. To address the geologic and geotechnical engineering aspects of the roadway improvement project, the County retained Cal Engineering and Geology (Cal Engineering) to complete a Draft Geotechnical Design and Material Report which entailed extensive and detailed geotechnical engineering investigations and evaluations for the proposed project. That draft report has been completed and the County has requested that DCM/Joyal Engineering provide a peer review of the Cal Engineering work completed to date.

I. REVIEW TASKS

As outlined in our proposal letter of April 8, 2002, our review included the following tasks:

484 N. Wiget Lane • Walnut Creek, CA 94598 • (925) 945 0677 • Fax: (925) 945-1294 • dcmjoyal@dcmjoyal.com

A. Task No. 1 – Document Review

Copies of the documents prepared by Cal Engineering provided for our review are listed in the References at the end of this review letter. In accordance with our proposal letter, we reviewed References A through E. In accordance with the County's request, particular emphasis was made on the following sections of the Draft Geotechnical Design and Material Report:

- Section 4 - Physical Setting
- Section 8 - Geotechnical Analysis and Design
- Section 12 - Recommendations and Specifications

Other than a general comment section, the review comments presented in this letter are generally grouped into these three sections.

B. Task No. 2 – Site Reconnaissance

The document review was supplemented by a walkover reconnaissance of the site on May 13, 2002, by Norman A. Joyal and Dru R. Nielson to assess site conditions with respect to the proposed roadway realignment and the document References A through E.

C. Task No. 3 – Slope Stability Analyses

As part of our review, we completed a spot check review of the Cal Engineering slope stability calculations for selected critical slopes. Our spot check review included independent computer analysis of selected sections analyzed by Cal Engineering, and independent hand calculation methods for verification of the computer analyses.

D. Task No. 4 – Meeting with Cal Engineering and County Staff

Our peer review included a meeting with Cal Engineering and County staff to review the findings presented in this review letter.

E. Task No. 5 – Geologic and Geotechnical Peer Review Letter

This report represents the culmination of our geologic and geotechnical peer review for the Vasco Road Safety Improvements Project (Phase 1) from MP 3.4 to MP 4.3 in Alameda County, California.

Given the complexity, scope and importance of this project and the volume and detail of geotechnical materials generated by Cal Engineering provided for our review, our scope of work only allowed for a general peer review of the documents and information only. Our scope of work did not include independent research, data gathering, testing or detailed geotechnical analysis, except for spot checking of the slope stability analyses. Therefore, our review is based on the data gathered and presented by Cal Engineering.

II. PEER REVIEW COMMENTS

A. <u>General Geologic Review Comments</u>

In the report discussions, Cal Engineering does not provide the bibliographic source for many of it's cited references (e.g., Crane 1990, indicated on Figure 4-3, Dibblee, 1980, indicated on page 7-1, and others). Cal Engineering should provide a complete bibliographic list of all references cited and/or viewed (i.e., aerial photographs) as part of their investigation. Cal Engineering does not cite recent geologic and seismic research pertinent to the project area including the following references which are cited in our review comments:

- Crane, R., 1995, Geology of the Byron Hot Springs Quadrangle; Privately published at H & L Hendry in Concord, California, in conjunction with the release of Northern California Geological Society's, Geology of the Mt. Diablo Region, Guidebook-1995.

- California Division of Mines and Geology, 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada – to be used with the 1997 Uniform Building Code: International Conference of Building Officials.

- California Division of Mines and Geology, 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California; Special Publication 117.

- Graymer, R.W., Jones, D.L., and Brabb, E.E., Preliminary Geologic Map Emphasizing Bedrock Formations in Alameda County, California: U.S. Geological Survey Open-File Report 96-252.

- Mualchin, L., 1996, California Seismic Hazard Detail Index Map and Technical Report: Caltrans.

- Working Group on Northern California Earthquake Potential, 1999, Earthquake Probabilities in the San Francisco Bay Region: 2000 to 2030-A Summary of Findings: U.S. Geological Survey Open-File Report 99-517.

- Working Group on Northern California Earthquake Potential, 1996, Database of Potential Sources for Earthquakes Larger than Magnitude 6 in Northern California: U.S. Geological Survey Open-File Report 96-705.

A large part of this project will consist of making significant excavation cuts and placing significant embankment fills. These cuts will be made in a structurally complex geologic setting that includes an active fault zone cutting through regionally mapped, southwest down dipping sedimentary bedrock that is described as pervasively fractured/sheared/shattered. Consequently, geologic instabilities are bound to be exposed in the proposed slope cuts. The performance of portions of Vasco Road recently improved as part of the Los Vaqueros Reservoir project could serve as a benchmark for performance of proposed cut and fill slopes for this project. As such, it is important that Cal Engineering review/discuss the earthwork "construction failures" that occurred as part of that road realignment improvement project. In each case, the controlling mechanism of failure should be reviewed (presuming investigations were undertaken to evaluate the causation and repair of earthwork failures), and any back-calculated slope strength data should be compared with the rock strengths used by Cal Engineering in their stability analyses. The intent should be to have this project learn from past history and not repeat it. As such, final cut slope recommendations should be predicated upon a review of slope failures (i.e., construction precedence) which occurred during construction of other nearby areas of Vasco Road (e.g., in Contra Costa County).

Even though no bedrock structure (strike and dip) could be measured during field work along the alignment by Cal Engineering, there is sufficient information in the geologic literature with respect to regionally mapped bedrock strike and dip. Based on regional geology, west-facing excavations into bedrock will tend to be more unstable (due to bedrock bedding) than east-facing excavations into bedrock. This aspect of the regional geology could potentially control slope stability and this should be addressed in more detail in the final or update reports.

B. General Geotechnical Review Comments

In addition to reviewing the documents listed in the Reference section of this report for consistency and uniformity, the documents were also reviewed for general conformance with generally accepted geotechnical principles and practices.

In consideration of the fact that the Cal Engineering Reference A report is identified as a Draft Report (which Cal Engineering states should be updated and finalized around the 70% design level), from a geotechnical engineering point of view, the field investigations and explorations and the engineering analyses completed to date were performed in general conformance with accepted geotechnical principles and practices. Although some of the comments we present in this review letter may require additional engineering analyses, we consider additional engineering analyses a normal part of the Draft Report process whereby input to the Draft Report is accomplished through a review process with the review comments addressed and/or incorporated in a final or updated report.

In general, the report recommendations for cut and fill slopes, slope dewatering, embankment fill placement, and embankment slope alternatives appear reasonable for the planning stage of the project. Final slope recommendations should be predicated upon a review of the "construction precedence" of already realigned portions of Vasco Road.

It should be noted that the use of hydraugers for slope dewatering do require periodic maintenance, such as high pressure hydroflushing to maintain their effectiveness. As such, the design should contemplate provisions (i.e., access road, and ingress and egress points) for equipment access to the hydraugers for their periodic maintenance, especially those installed on slope benches above the roadbed. Hydrauger maintenance should be included in a routine maintenance program for this segment of the roadway. In addition, because weathering of the cut slopes is anticipated (Subsection 8.2.5), the maintenance program should include yearly inspections of the slopes and drainage improvements.

The final designs will incorporate subsurface drainage (i.e., under drainage provisions) beneath some of the embankment fills and where reinforced segmental retaining walls or geogrid reinforced slopes are constructed. The final or updated report needs to address specific recommendations for the under drainage systems.

C. Specific Review Comments

Although we were asked to review the documents listed in the References with a particular emphasis on Sections 4, 8 and 12, our services also required a diligent review of all report sections to gain a complete and thorough understanding of the project, and the project designs and analyses. In doing so, we noted some general editorial inconsistencies in the report and figures and/or enhancements that could be incorporated in a final or updated report. In general, the noted inconsistencies are editorial in nature and do not affect the conclusions and recommendations. The following presents our general review comments.

Item 1

In Section 6.0, Geotechnical Testing, Figure 6-2 (1 of 2 and 2 of 2), the depth of the test is referenced in feet which is not consistent with the metric report format.

Item 2

In Section 7.0, Subsection 7.1.3 Landslides, reference is made to two landslides within the project area not shown on a landslide map (Figure 7-1) and those two landslides are referenced as landslides LS-1 and LS-2. However, on the Map of Geologic Features, Figure 4-3, there are four landslides and their identification nomenclature is either QLS ①, QLS ② or QLS. This inconsistency needs to be clarified.

In the Landslide discussion of this subsection, reference is made to Boring B-7 being located within LS-1; however, in Figure 4-3, Boring B-7 is located within an un-numbered landslide identified only as QLS. Near the end of the discussions in this subsection, reference is made to *"two landslides (LS-3 and LS-4)."* as being located within the main and eastern strand of the Greenville Fault. However, on Plate 4-3, these two landslides are identified as QLS ① and

QLS ②. Although the landslide discussion appears to be correct, the landslide numbering and report text references are in conflict.

Item 3

In Section 7.3, Subsection 7.3.2 Groundwater, reference is made to the highest groundwater level shown on Figure 4-3. This appears to be an inaccurate reference and the correct reference should be to Figure 4-4.

Item 4

Section 11.2, Subsection 11.2.3 Existing Utilities, discusses the fact that *"A large PG&E gas main exists along the design excavations"* and that *"the excavations would expose the pipeline over significant distance."* We understand that PG&E is supposed to inform the County about a relocation decision soon.

The geotechnical issues of importance for the relocation are the location of the new line and the type of backfill used for the pipe embedment material. Where granular embedment material is used, the material can and often acts as a collector and/or conduit for subsurface water, and this can potentially result in unstable conditions. As such, if the gas pipeline relocation consists of an overland route that is within or skirts the project cuts and fills, the physical location and the type of backfill material used needs to be given special consideration to avoid having the pipeline, in its relocated environment, from possibly contributing to an unstable condition.

Item 5

In Appendix C, Log of Test Borings, on Sheet C7, there is a misidentification of the boring elevations for Boring B-5. For example, the boring is reported to have been terminated at Elevation 285.6 m, yet the elevation scale on the right side noted near the bottom of the boring is Elevation 275 m. The elevation scale on the left side of Boring B-3 appears to be the correct scale.

Item 6

In Appendix D, Trench Logs, the format for the trench log scales is feet. For report consistency, the trench log scales should reflect the metric format.

D. Section 4 – Physical Setting Review Comments

In our review of Section 4, some general editorial inconsistencies in the report were noted, and we noted some enhancements that could be incorporated in a final or updated report. In general, most of the noted inconsistencies are editorial in nature and do not affect the conclusions and recommendations. The following presents our comments pertaining to the physical setting.

Item 1

In Section 4.0, Physical Setting, Figure 4-3 could be enhanced by showing the location of the seismic refraction lines completed for the project. This would visually delineate the location of the seismic refraction lines with respect to the geologic sections without having to reference the geophysical data in Appendix E for the location of the seismic refraction lines.

Item 2

In Section 4.0, Physical Setting, Figure 4-4, the P-wave velocity identified in the figure is presented in terms of feet per second which contrasts the metric report format and Section 8.2.2, Rippability, which discusses the P-wave velocity data in a metric format.

Also on Figure 4-4, the data presented for *"Layer 2 (V_p = 6900-9100 fps)"* should be corrected to identify this as Layer 3.

Item 3

In Section 4.4.1, no reference is made to geologic maps of Contra Costa County (e.g., Crane, 1995, and Graymer and others, 1996) that post-date maps cited by Cal Engineering (i.e., Majmundar, 1991).

Item 4

In Section 4.4.2, the seismogenic sources described in this section and included on Table 4-1 should also include additional sources recently described by the Working Group on Northern California Earthquake Potential (1996 and 1999; e.g., Mt. Diablo and Great Valley Thrust Systems). In addition, a regional map showing the location of seismic sources described in this section would be helpful.

Figure 4-2

- A legend, scale, north arrow, and box indicating mapped area shown on Figure 4-3 should be added. Part of the legend can be handled by indicating that mapping units are as described in Section 4.4.1 of the report.

Figure 4-3

- Approx. Stationing 22+00 to 24+00 is shown on Figure 4-2 to be Kps but shown on Figure 4-3 to be Tmss.
- Dots indicative of concealed faulting should be differentiated from those indicative of resistant pebble conglomerate and sandstone outcrops.
- Orientation of fault movement (inferred if not known) should be shown (e.g., per Section 7.4.1).
- Slide motion vectors indicated for Qls-2 near Station 22+00 are consistent with a cross-fault extrapolation of a down-dip direction of movement (i.e., parallel to the dip of nearby bedrock bedding). Direct downslope movement slide vectors would be perpendicular to topographic contours (i.e., a southwest direction for slide Qls-2). Are the directions of the slide motion vectors accurately shown? If so, this observation of discontinuity controlled sliding (e.g., bedding plane slip) should be addressed in slope stability analysis for the project.
- Landslides indicated by Majmundar (1991) should be shown (see comments for Section 7.1.3).

Figure 4-4

- Section lines shown on Figure 4-3 should be equivalent to the limits of the cross-sections shown on Figure 4-4.
- Structural data provided on Figure 4-3 should be expressed in the cross-sections of Figure 4-4 (i.e., apparent dips). We anticipate that this would show that cut slopes would expose southwestwardly down-dipping bedrock (adversely oriented for cutslopes east of the centerline of the proposed alignment—i.e., westward-facing cutslopes).
- What is basis for the orientation of the Greenville fault shown at depth? Relative fault displacement directions should be shown per Section 7.4.1.

Table 4-1

- What is the basis for the given Maximum Credible and Maximum Probable Magnitudes? Maximum Magnitudes on faults to be used with the 1997 UBC, and justifications for their use, are provided in the 1998 publication by the California Division of Mines and Geology. Maximum Credible Magnitudes suggested by Caltrans for use in deterministic designs are provided by Mualchin (1996). A database of potential sources for earthquakes larger than Magnitude 6 in Northern California is provided with estimated magnitudes by the Working Group on Northern California Earthquake Potential (1999). These reputable sources post-date sources cited by Cal Engineering.

- Maximum Probable Magnitudes should be at least as large as known historic earthquakes (e.g., the Maximum Probable Magnitude of the Greenville Fault should at least reflect the January 24, 1980, Magnitude 5.8 earthquake cited by Cal Engineering from Bonilla, et al., 1980). This is consistent with Cal Engineering's recommendation in Section 7.4.1 stating the design should anticipate future surface rupture of a similar magnitude to that which occurred in 1980 [right-lateral and dip slips on the order of 2 to 4 cm] during the operational life of the roadway. Such an occurrence should be considered during design of the roadway and during development of maintenance and operation plans (Cal Engineering's Maximum Probable Magnitude for the Greenville Fault is indicated as 5.2 in Reference A).

E. Section 5 – Field Explorations

Item 1

In Section 5.2, the source and date of aerial photographs reviewed should be referenced.

Item 2

In Section 5.3, the text refers to two seismic refraction lines that were 800 feet long. For report consistency, this reference should be in metric.

Cal Engineering should discuss their extrapolation of results from the seismic refraction lines to cross-sections as shown on Figure 4-4 in consideration of the fact that the seismic lines run perpendicular to the cross-section.

F. Section 7 – Geotechnical Conditions

Item 1

Regional structural data (e.g., provided by Dibblee, 1980, Crane 1995, Majmundar, 1991, and Graymer and others, 1996) should be used in cross-sections (Figure 4-4) and stability analysis where not superseded by site specific data from Cal Engineering fieldwork.

Item 2

In Section 7.1.3, the Nilsen (1975) base map for Figure 7-1 should be replaced with more recent maps by Majmundar (1991; particularly Maps 27A and 27B) which show landslides along the alignment not indicated by Nilsen. Majmundar (1991) indicates on Map 27A that most of the slopes along the alignment are *"naturally unstable and subject to failure even in* *the absence of the activities of man.*" A legend, scale, north arrow, and box indicating mapped area shown on Figure 4-3 should be added. Landslides identified along or near the alignment by Majmundar (1991) should also be shown on Figure 4-3.

Item 3

In Section 7.1.4, uniaxial compressive strengths are discussed for the Panoche formation materials, but not for Tmss (Cierbo) materials.

Given the number of possible kinematically unfavorable orientations, the discontinuity orientation factor assumed for the evaluation could easily be assumed to be unfavorable (-50) to very unfavorable (-60), with the rock mass underlying the proposed expansion area (including in Borings B-2, B-3, B-4, and B-5 on Table 7-2) being classified as very poor rock (Class V).

Item 4

Governing shear strength properties for the project cut slopes will most likely be along discontinuities (e.g., bedding planes and fractures). Precedent failure/repair studies by others pertaining to prior instabilities along nearby reaches of Vasco Road would be useful to establish shear strength properties along geologic discontinuities typical of the area.

Figure 7-2

A legend describing the numbered geomorphic features would be helpful.

G. Section 8 – Geotechnical Analysis and Design

In our review of Section 8, we again noted some general editorial inconsistencies in the report and we noted some report discussions that could be augmented to provide additional information and/or clarifications in a final or updated report. In general, most of the noted inconsistencies are editorial in nature and do not affect the conclusions and recommendations. However, some aspects of the analysis and design were noted that may affect the conclusions and recommendations. The following presents the editorial inconsistencies followed by our specific comments pertaining to geotechnical analysis and design.

1. General Editorial Comments

Item 1

In Section 8.0, Subsection 8.1.1 Seismic Parameters Used in Analysis, reference is made to a U.S. Department of Transportation design guidance which allows the seismic coefficient for use in pseudo static analyses to be one-half (1/2) of the peak horizontal ground acceleration of the applicable fault source. As an example, for the near-field source seismic event (Greenville Fault) Cal Engineering states that for *"...a design PHGA of 0.27g, a seismic coefficient of 0.14 was assumed..."* However, in the tables summarizing the slope stability data (Appendix I, Slope Stability Analyses), the seismic coefficient (k_s) used in analyses for the near-field source is 0.10 with a footnote in regards to its reduction from 0.14 to 0.10. This reduction in seismic coefficient should also be made a part of the text discussion in Subsection 8.1.1 Seismic Parameters Used in Analysis.

The discussions in this section need to reflect comments in Section 4 (particularly with regard to selecting Maximum Probable Earthquakes). The selection of appropriate MPE's will affect PHGA and seismic coefficients pursuant to reported U.S. Department of Transportation guidance (1997). Seismic coefficients are generally linked to recommended pseudo-static factors of safety. Many state and local agencies in California require the use of a seismic coefficient of 0.15, and a minimum computed pseudo-static factor of safety of 1.0 to 1.2 for analysis of natural, cut, and fill slopes (CDMG 1997).

Regional structural data (e.g., provided by Dibblee, 1980; Crane, 1995; Majmundar, 1991; and Graymer and others, 1996) should be used in stability analysis where not superseded by site specific data from Cal Engineering fieldwork.

Item 2

In Section 8.0, Subsection 8.2.1.7 Results of Analyses, the report states that *"Pseudo static safety factors were less than 1 for all conditions analyzed."* However, this contradicts Table 8-1 in which all of the reported pseudo static safety factors are greater than 1.0. In the same subsection, the *"potential seismic displacements"* are reported to be less that 30 cm for the slope conditions analyzed. This is inconsistent with Table 8-1 in which the maximum displacements are reported to be less than 1 cm.

Item 3

In Section 8.0, Subsection 8.3.1.4 Shear Strength Assumed for Stability Analyses, there is a discrepancy between what was reportedly used for analyses *("...cohesion intercept of 7.7 kPa and a friction angle of 26 degrees")* as discussed in Section 8.3.1.4, and what was actually used in analyses (cross sections used in the embankment slope analyses reports the fill strength used to be 7.17 kPa with a friction angle of 26 degrees).

Item 4

In Section 8.0, Subsection 8.3.1.6 Results of Stability Analyses, the report states that in Table 8-2 the *"...static safety factors that range from about 1.5 to 1.7 for the different conditions that were analyzed."* However, in Table 8-2, the static safety factors reported are between

1.53 and 1.57. As such, there is a discrepancy between the text discussion and the tabulated data.

In this same subsection, the report states that *"Pseudo static safety factors were less than 1 for all conditions analyzed."* However, in Table 8-2, the tabulated data for the pseudo static safety factors are all greater that 1.16, thus the report text is not consistent with the tabulated data.

Item 5

In Section 8.0, Subsection 8.3.2 Post-Construction Embankment Movements, recommendations are provided for *"zoning and fill control measures."* The issue of concern is that there is no upper bound limit on moisture content (i.e., *"+4% or +2% of optimum or greater"*, respectively) for the *"uppermost 5m"* and the *"mid-embankment"* fill material. The *"or greater"* qualification potentially allows the contractor to incorporate very high moisture contents in the fill material while still meeting the report recommendations. Compacting material with very high moisture contents could result in an unstable subgrade (i.e., pumping subgrade) which is not desirable for an embankment fill.

Item 6

Section 8.5 Culverts, discusses the corrosion potential of the soils and bedrock for steel and concrete structures. This section could be augmented by a discussion of the corrosion problems Contra Costa County encountered in some of their culvert crossings during construction of the Vasco Road realignment as part of the Los Vaqueros project. During construction, at least one local newspaper reported that accelerated failure occurred in some of the culvert crossings because backfill materials used around the culvert crossings were highly corrosive. The "lessons learned" from these prior culvert failures should be applied to this project to prevent a repetition.

2. Comments Pertaining to Geotechnical Analysis and Design

Comment 1

In Subsection 8.3.1.4 Shear Strength Assumed for Stability Analyses, the report states that *"...where the embankment will be underlain by the weaker Panoche formation materials, the strength parameters discussed in Section 8.2.1.5 were assumed for those materials."* The strength reported in Section 8.2.1.5 for the Panoche Formation includes a cohesion intercept of 2.39 kPa and a friction angle of 20 degrees. However, on the slope stability embankment cross sections at Station 1+160 where the material is identified as "native" (which we presume is the native Panoche formation material), the reported strength used in analyses includes a cohesion intercept of 7.17 kPa and a friction angle of 20 degrees. The strength parameters associate a cohesion intercept of 2.39 kPa with a friction angle of 20 degrees for the Panoche

Formation (Subsection 8.2.1.5), and a cohesion intercept of 7.7 [7.17?] with a friction angle of 26 degrees for the Cierbo Formation (Subsection 8.3.1.4). As such, there is an apparent commingling of the reported strengths properties for the slope stability analyses that involves the Panoche formation. The slope cross section that involves the Panoche formation should be analyzed with the appropriate material strengths discussed in the report.

Comment 2

In Subsection 8.2.4 Rebound/Swell of Excavation, the report generally addresses elastic rebound of the bedrock and swelling of the bedrock as events that will occur after bedrock overburden is removed from the roadbed subgrade level. However, in Cal Engineering's discussion of the analyses employed to evaluate these conditions, their discussion is weighted toward elastic rebound of the claystone and swelling of the claystone is lumped in with the elastic rebound discussion.

We concur with Cal Engineering that elastic rebound and swelling of the claystone bedrock will occur. For the most part, these two events will occur separately and they will be characterized as time-dependent events. Elastic rebound will occur at the time of, or shortly after, overburden load is removed. Because overburden removal is also a time-dependent event, elastic rebound of the bedrock will probably be an imperceptible event. On the other hand, swelling of the claystone bedrock is a long-term event (month to years) that is controlled by the availability of free water being absorbed in the claystone fabric. These two separate events have to be correctly modeled by laboratory tests in order to obtain meaningful data. As such, we question the use of a free swell test on a core sample of claystone bedrock to model elastic rebound. Performing a free swell test is one way of modeling the behavior of claystone when subjected to free water and to assess the magnitude of swelling that could be anticipated. Therefore, performing a free swell test on a claystone sample is more a measure of the swelling magnitude than it is elastic rebound. That being the case, the reported magnitudes of rebound/heave (100 mm to 400 mm) could be significant if most of the measure is associated with swelling heave and the fact that swelling heave is a time-dependent behavior. Therefore, the roadbed could become significantly distorted over time resulting in an adverse impact on the roadway improvements (i.e., pavement section, drainage gradients, etc.). The impacts could be significantly magnified in the case where the claystone is interbedded with low or non-expansive bedrock materials resulting in abrupt changes in the roadbed profile.

Comment 3

Based on our review of the stability analyses performed by Cal Engineering for the major cut and fill slopes on this project, and performing our own analyses utilizing hand calculations and independent computer modeling to spot check the Cal Engineering calculations for selected critical sections, the static safety factors calculated by Cal Engineering for the cut and fill slopes appear to be reasonable. Additionally, the slope strength parameters used in the stability analyses appear to be reasonable based on the laboratory testing and the discussion presented with respect to the Rock Mass Strength in Subsection 7.1.4. in the case of cut slopes, and Subsection 8.3.1.4 Shear Strength Assumed for Stability Analyses in the case of the embankment fill material.

With the respect to the major cut slope on this project, Cal Engineering modeled the major cut slope as a uniform rock mass slope for the full depth of the cut and beyond, and reasonable strength parameters were assigned for the rock mass. However, the engineering data (shear strength data and shear wave velocity) summarized on the geologic cross section on Figure 4-4 indicates a marked difference in the bedrock between Elevations 295 m and 300 m at Cross Section B-B′. According to the data summarized on Cross Section B-B′, the shear strength data and the shear wave velocities are several orders of magnitude greater than the bedrock materials above it resulting in a "resistant bedrock layer". This marked change in the bedrock daylights in the cut slope a few meters above the roadbed at the report stationing of about 23+50 (Figure 4-3). Because bedrock strength and shear wave velocity data suggests this geologic condition could control slope stability, this geologic condition should be modeled in a slope stability cross section to evaluate the impact a "resistant bedrock layer" might have on slope stability and the resulting safety factor.

Comment 4

One of the documents provided for our review (Reference E) which was not prepared by Cal Engineering is a plan map of what is identified as the Modified High Alignment. Among other things, the map delineates the location where cuts and fills will be made for this particular alignment. This map was used as a base map upon which we transferred the locations of the subsurface explorations and the geologic features presented on Figure 4-3. This aided visualization of the cut and fill locations with respect to the reported geologic conditions.

In doing so, one aspect of the reported geologic conditions stands out with respect to the cut and fill slopes. The geologic condition that stands out is the relatively large landslide mapped on Plate 4-3 (identified as QLS ② on the plate), and the slope condition that stands out is the roadway embankment fill that will be placed on the toe of this mapped landslide.

In the Reference A report, this landslide is addressed in Subsection 7.1.3 Landslides in the last paragraph of that subsection. The report states that *"...two landslides (LS-3 and LS-4) were tentatively located between the main and eastern strands of the Greenville fault."* [Note: Plate 4-3 actually identifies these two landslides as QLS ① and QLS ②. The landslide of concern is QLS ②.] Cal Engineering further states that *"The presence of these landslides is questionable because definitive geomorphic evidence of landsliding was not apparent on the ground surface and clear evidence of sliding was not noted in the borings or test trenches in this area."* However, Cal Engineering further states that *"...evaluation of aerial photographs provides some indistinct evidence of past slides in this area. These slides, if present, are likely* *very old features that developed in the Panoche or Cierbo Formations and may represent zones of relatively weaker bedrock..."*

From a geotechnical engineering point of view, placing an embankment fill on the toe of a *"questionable"* landslide or *"zones of relatively weaker bedrock"* is a condition that can result in hillside instability and warrants further evaluations. As such, the existence or non-existence of a *"questionable"* landslide or *"zones of relatively weaker bedrock"* identified as QLS ② needs further evaluations and/or assessment to ascertain whether or not it exists. If it does exist, the impact of placing a roadway embankment fill at the toe of the instability feature needs to be evaluated through slope stability analyses. Depending on the results of such evaluations and assessments, recommendations may be necessary to address this geologic and embankment slope condition in order to accommodate the roadway embankment fill. For example, significant project grading costs could be incurred if the landslide toe has to be removed and replaced as engineered fill to accommodate the roadway embankment fill. In any case, this geologic condition warrants further review and evaluations to accommodate the roadway embankment fill.

H. Section 12 – Recommendations and Specifications

Much like Sections 8 and 12, in our review of Section 12, we noted some general report discussions that could be augmented to provide additional information and/or clarifications in a final or updated report. In general, the noted discussions that could be augmented would not necessarily affect the conclusions and recommendations. However, our specific comments pertaining to the report recommendations may affect the final conclusions and recommendations. The following presents the general report discussion comments followed by our specific comments pertaining to recommendations.

1. General Report Discussion Comments

Item 1

Section 12, Subsection 12.1.4 Stability Fills, the need for stability fills is unclear with respect to where *"very weak rock"* is exposed by the design excavations. For example, the Rock Mass Strength discussed in Subsection 7.1.4 generally identifies the rock in the major project excavations as very poor to poor rock. As such, it could be interpreted that stability fills could be required along a significant portion of the major excavation cuts resulting in a significant project expense. Adverse geologic conditions within design excavations is probable based on: (1) regional geologic structure; (2) descriptions of bedrock provided in Section 7; and (3) nearby construction precedence during the Vasco Road realignment associated with the Los Vaqueros Reservoir.

It is unclear if the *"very weak rock"* discussed in this section is any weaker or has substantially less strength than that anticipated for the very poor to poor rock discussed in

Subsection 7.1.4. Because constructing buttress fills could be a substantial project expense, guidelines should be presented or discussed on how *"very weak rock"* can be distinguished or identified from the other very poor to poor rock anticipated in the project excavations. The need for buttress fills should be based on measurable and identifiable differences in the bedrock materials from that anticipated or assumed in the evaluations and calculations.

2. Comments Pertaining to Recommendations

Comment 1

In Subsection 12.1.2 Cut Slope Configurations, the excavation design recommendations are contained in Table 12-1. In Table 12-1, recommendations are provided for cut and fill slopes between various stationing points along the project alignment. In light of report discussions pertaining to 1V:2H cut slopes, and in the absence of engineering analyses or other report discussions that support a 1V:2H recommendation, there is an apparent discrepancy between the report discussions and the recommendation for 1V:2H cut slopes.

In Subsection 11.1.2 Sheared and Weak Rock, Cal Engineering warns that *"the complex geology and presence of the Greenville fault traces create the potential for localized adverse geologic conditions within the design excavations."* They go on to note that *"A moderately inclined (1V:2H) excavation made at the nearby landfill reportedly failed several days after originally being cut."* In the context of the discussion in this section of the report, Cal Engineering cautions about the short-term stability of 1V:2H excavations cuts, and the need to plan excavation cuts so that there is no inadvertent oversteepening of cut slopes. As such, in one section of the report, Cal Engineering discusses the vulnerability of 1V:2H slopes, yet 1V:2H slopes are included as part of the recommendations. This transition from warning to recommendation occurs without any supporting documentation that indicates 1V:2H slopes will be more stable on this project than they were on the adjacent landfill site. Therefore, slope stability evaluations should be completed for the recommended 1V:2H cut slopes utilizing material strength properties and groundwater conditions that model the cut slopes.

Where cut slopes are configured to be steeper than the natural slopes, the possibility greatly increases that they may become candidates for buttress fill stabilization due to instabilities related to unfavorable bedrock discontinuities (e.g., bedding, fractures, faulting).

Comment 2

Subsection 8.3.1 Stability Analyses, discusses the design assumption of incorporating under drain provisions beneath embankment fills. In addenda subsequent to the Draft Report, under drainage provisions are also recommended for the reinforced segmental retaining walls, geogrid reinforced embankment, and pile and lagging wall alternatives. The final or update report should incorporate recommendations for the under drainage systems as needed (i.e., filter material, filter fabric [if any], perforated pipe, cleanouts [if any], discharge outlets, etc.).

III. CLOSURE

In its current version, the Cal Engineering report fulfills its role as a "Draft Report" with sufficient design information and recommendations for the designers to prepare a preliminary design of the roadway realignment. The report now needs to be updated in context of the preliminary designs put forth, and to respond to the geotechnical concerns and issues addressed in the body of this review letter. To accelerate the response process and afford Cal Engineering an opportunity of discussing our review comments in productive dialogue, we met with Cal Engineering and County staff to review and discuss the geotechnical concerns and issues in advance of publishing this letter review.

We appreciate the opportunity to be of service to the Alameda County Public Works Agency's Engineering and Road Construction Department on this project and trust that this review letter provides the information you need at this time. Please call us if you have any questions regarding this review letter or the comments presented herein.

Very truly yours,

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REFERENCES

Reference A: Draft Geotechnical Design and Materials Report
Dated: August 8, 2001
By: Cal Engineering

Reference B: Draft Geotechnical Design and Materials Report
Appendices A-F, Volume 1
Dated: August 8, 2001
By: Cal Engineering

Reference C: Draft Geotechnical Design and Materials Report
Appendices G-K, Volume 2
Dated: August 8, 2001
By: Cal Engineering

Reference D: Design Memorandum No. 1
Design Memorandum No. 2
Design Memorandum No. 3
Dated: January 18, 2002
By: Cal Engineering

Reference E: Preliminary Design
Modified High Alignment
Dated: July 2001
By: Author Not Attributed