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Reviewed
RT
1/10/08

October 3, 2007

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

Attention: Carolyn Davis

Subject: **Preliminary Foundation Report** 1P2/307/043
Clay Street Bridge at Hangtown Creek
Placerville, California

In accordance with your request we have completed a preliminary geologic / geotechnical review of the proposed Clay Street Bridge at Hangtown Creek in Placerville, California. The purpose of this review was to evaluate existing geologic and geotechnical reports and information as it relates to the proposed bridge for preliminary planning / evaluation purposes. A brief site reconnaissance visit was performed as part of this study.

Findings and recommendations made herein are strictly preliminary in nature and additional investigation is warranted before final design of the bridge or adjoining roadways.

Project and Site Description

The existing bridge is a two-span concrete arch structure about 60±ft long and 18±ft wide. In addition to spanning Hangtown Creek, the bridge structure also serves as the outfall for the channalized Cedar Ravine, which enters Hangtown Creek after flowing below the southern span of the bridge. The bridge is supported on concrete wall abutments at the banks and a central concrete pier which also serves to separate Hangtown Creek and Cedar Ravine. The central pier appears to merge with the channel wall to the east of the bridge and is assumed to be part of the channel structure for Cedar Ravine. It is our understanding that the exact course of the buried portion of Cedar Ravine is not known and was not apparent from areas accessible during our visit. The abutments and central pier appear to bear directly on exposed bedrock. Existing channel banks are moderately steep to nearly vertical and heavily vegetated in the immediate vicinity of the existing bridge. Walls and hardened bank areas exist both up and downstream of the site investigated. Channel bottom is about 10-ft below deck.

Multiple utilities run below or adjacent to the bridge. These include multiple unidentified pipes or conduits, a sewer line, and a possible water line (attached to the bridge and running parallel to it). A 10-12-inch diameter sewer line runs parallel to the channel approximately 18-inches above ground and passes below the northern span of the bridge. On the western side of the bridge this sewer line connects to two concrete manhole risers. An approximately 8-inch diameter lateral runs from the eastern most riser and runs parallel to the bridge and penetrates the retaining wall on the south side of the creek. A smaller diameter steel sewer line runs along the southern side of the channel and intercepts a short concrete riser near the western side of the central pier. An apparent sewer line exits the south bank retaining wall and then descends to the east and again goes below grade near the southern abutment. Multiple drain/culvert pipes relieve to the stream in the vicinity of the bridge including an approximately 24-inch pipe near the eastern side of the northern abutment and an approximately 6 to 8-inch diameter drain about 10 feet west of the southern abutment. Additional drainpipes appear to be present at random intervals along the retaining structures on both sides of the creek.

It is understood that at this time a replacement bridge type has not been selected. The current plans include augmenting the current structure to increase its width or fully replacing the existing structure. It is understood that several of the in-channel utilities will be removed prior to the repair/replacement project.

Other than removal and replacement of existing bridge (including the concrete sill in the channel), no channel modifications are expected. No "environmental" constraints on typical bridge construction practice have been indicated for this project. It is anticipated that the bridge will be closed for construction.

Regional and Site Geology

Clay Street Bridge at Hangtown Creek lies on the eastern side of the western foothill belt of the Sierra Nevada Range. This area is typified by Paleozoic and Mesozoic metasedimentary, metavolcanic, and igneous rocks with lesser amounts of Tertiary volcanic, volcaniclastic, and buried stream channel deposits. Metamorphic units generally trend north-south, dipping steeply to the east. These rocks commonly display foliation parallel or subparallel to bedding.

The western foothill belt is broken into five sub belts, separated by faults. These are from east to west: the eastern belt (Calaveras Complex); the Logtown Ridge-Mother Lode belt (Mariposa and Logtown-Ridge Formation); a mélange belt; the Bear Mountain volcanic belt (Bear Mountain Ophiolite); and, a western belt (metavolcanics similar to Logtown-Ridge Formation). Ultramafic to granitic intrusive plutonic rocks exist to the east, and further to the south and west, of the project site.

The immediate area surrounding the project site is mapped as the metasedimentary Calaveras Complex (Geologic Map of the Sacramento Quadrangle). Locally these rocks are reported as consisting of weathered to highly weathered slate (Per "Log of Test Borings" for Highway 50 Bridge 25-0063, Schnell School Road UC, and Taber in-house data). During our site visit, we observed similar conditions; thinly foliated / bedded weathered shale / slate outcropping below the bridge, along the faces of cuts in the neighboring hillsides.

A layer of colluvium / alluvium or fill was visible at the surface and in parts of the bank. This material appeared to be composed of sandy silt to sandy clay, but further investigation would be required to determine its true composition.

Moderately weathered shale/slate was exposed along the channel thread, under the weir and the northern abutment. This material was hard, gray to brown in color, and foliation / bedding dipped steeply to the east. This apparently intact bedrock showed little erosion from stream flow and appears "scour resistant". Bedrock exposures further downstream were more highly weathered and the near surface material was easily broken. It is assumed that the bedrock at the weir and bridge abutments had been cleared of highly weathered material before being built. The rock surface exposed along the channel was uneven with ridges and depressions that generally ran parallel to local bedding.

The presence of artificial fill soils can be presumed along Clay Street and behind sections of the existing bridge abutments. The extent, depth and quality of the fill is unknown, but it is likely derived from local materials.

Seismic Refraction

One double-ended seismic refraction profile was completed near the existing bridge to supplement site observations. The seismic profiles were completed using a Seistronix RS-100 Radioseis Wireless Seismic system with a 24-bit high resolution digital refraction seismograph. The energy source was by means of repeated sledge hammer blows. The results of the seismic refraction survey and its location are shown on Figures 2 and 3.

Results of the seismic refraction profile reveal that the site consists of two geotechnically important units. The upper unit possesses a seismic velocity of approximately 1700 ft/sec and is interpreted to be stiff/dense to very stiff/dense alluvium, colluvium, or fill of approximately 10-11± feet depth. The lower unit possesses a seismic velocity of approximately 7500 ft/sec and is interpreted as being weathered bedrock. The seismic data suggests that the contact between upper and lower unit materials is uneven or stepped. Observations along the channel support this interpretation.

Groundwater

Small areas of seepage were noted in the channel bank near the north abutment within 1 foot above the creek water surface. No visible seepage was noted away from the stream banks along the pedestrian trail running parallel to Hangtown Creek or the neighboring parking areas. Based on these observations the groundwater can be assumed to be at or near the level of Hangtown Creek in the immediate vicinity of the bridge. Further from the creek, groundwater depth may vary greatly with surrounding topography and underlying geology. Groundwater data from the surrounding area was found to be generally unavailable.

Slope Stability

The existing banks in the vicinity of the existing bridge are a combination of nonhardened to partially hardened slopes on the north bank and fully hardened wall structures on the southern bank. The stability of the existing walls and partially hardened slopes can not be adequately analyzed with the available information. Revisions to this analysis will likely be required when bank configuration is defined and detailed topographic data is available.

The stability of the north bank was investigated using Slide Version 5.0 computer program, using the Modified Bishop Method for curved failure surfaces. Both static and pseudo-static conditions were investigated. Soil and rock strength were based off of similar materials in the local area, correlations with seismic velocity, and experience with similar materials. For pseudo-static analysis a seismic coefficient of 0.13g (1/2 pga) was used.

The section analyzed lies immediately to the west of the bridge and is only partially hardened. For the purpose of this evaluation the stabilizing effects of the hardening were ignored. This bank section appears to be marginally unstable in the static case, with small areas of oversteepened and unstable material near the channel. The slope is unstable in the pseudo static case, with slope movement initiating near the top of slope. It is likely that earthquake induced lateral accelerations would likely fail portions of one or both banks leading to slumping and distress. The magnitude of this movement would likely be on the order of 1±ft, but could vary significantly. Further study will be required to properly address the possibility of slope failure along the banks of Hangtown Creek and to include the effects of slope hardening and earth retention structures.

Seismic Conditions

In accordance with Caltrans Division of Structures site seismicity evaluation procedures (with reference to Caltrans "Seismic Design Criteria" (SDC) v.1.4 and "California Seismic Hazards Map 1996", including Mualchin attenuation curves), the site can be assigned "peak bedrock acceleration" of 0.26 g associated with a controlling event of 6.5 magnitude along the Bear Mountain West fault zone located approximately 8.0 miles (13 km) westerly from the site. Technical information accompanying the "California Seismic Hazards Map 1996" lists the fault type as "normal." The Forest Hills-Melones (2.0 km) and Gillis Mountain faults (0.5 km) are no longer used by Caltrans for seismicity evaluation (http://www.dot.ca.gov/hq/esc/earthquake_engineering/Seismology/seismicmap.html, downloaded August 10, 2007).

Based on review of subsurface data and our site observations, the site can be tentatively characterized by "Soil Profile Type C" per SDC Table B.1. Classification depends largely on depth of colluvium / alluvium or fill and the degree of weathering of the underlying bedrock at the site location; "Soil Profile Type" B or D might be found to apply. For preliminary design purposes "Soil Type" C may be assumed, but must be verified by a site specific subsurface investigation.

For structures located within 9.3 miles (15 km) of seismic sources, Caltrans procedures require increases in spectral accelerations to account for "near field" effects; this case applies at this site. Typical Caltrans increases to peak bedrock acceleration for fault type (i.e. for "reverse thrust" and "reverse oblique" faults) do not apply to this site.

Based on the guidelines as discussed above, the following seismic design parameters should be considered for preliminary design purposes:

- Bear Mountain West Fault,
- Magnitude 6.5 ± 0.25,
- Soil Profile Type C (may be "Type D" or "Type B")
- A peak bedrock acceleration of 0.3 g

The following increases in Spectral Acceleration apply to the site per standard Caltrans procedures:

Structure Period (Seconds)	Increase in Spectral Acceleration
< 0.5	No Increase
0.5 – 1.0	0% to 20% Linear Interpolation
Over 1.0	20% Increase

Recommended ARS curve derived on this basis is attached.

Based on this review, the colluvial/alluvial and fill soils possibly present along Clay Street may, under seismic shaking, be susceptible to densification or liquefaction during periods of high water. Overall, the potential for seismically induced hazards, such as soils liquefaction, lateral spreading, densification, etc. to occur at this site is considered low and such conditions are not expected to be of substantial concern for structures supported by foundations bearing in bedrock.

Conclusions

Based on available subsurface data and observations made during our site visit the site materials generally appear to be adequately stable and capable of providing support for the proposed bridge. Competent bedrock material appears to exist at shallow depths, possibly less then 10 feet below top of bank. Based on site exposures, we expect the rock to be relatively fresh and hard at or slightly above / below channel bottom; becoming fresher and harder with increasing depth. Shallow groundwater can be expected at the proposed bridge site.

New cut slopes made within the Calaveras Complex at slopes of 1½H:1V or flatter are expected to be generally appropriate. No areas of significant slope instability were observed during our review, but slope instability during shaking is considered possible.

Site materials are generally expected to be workable by conventional heavy construction equipment, though areas of harder material may exist that are difficult to excavate even using air-tools. Limiting factors to excavation and drilling operations at the site will be the existing underground and above ground pipes and other utilities, shallow groundwater, and maintaining the traffic throughway during construction.

For preliminary design purposes allowable bearing pressure can be expected to be in the range of 3 to 5 tons pounds per square foot for footing excavations of 18-inches or deeper into competent rock. Actual allowable values should be confirmed during future investigations.

At bridge abutments, anchored or doweled spread footings appear to be the most straight forward foundation type, although shoring during excavation may prove problematic if the current Clay Street bridge is to stay in service during construction. Installation of cast-in-drilled-hole (CIDH) piling may also be considered, which is expected to require casing for water control. Bored into place piles ("micropiles") are expected to be a feasible alternative and may prove "ideal", owing to the clearance issues present at the site. Driven concrete or steel piles are not recommended, due to the presence of shallow bedrock and lack of overhead clearance.

Tip elevations for large diameter CIDH pile and micropile foundations will depend on depth of scour, type of bearing material encountered, pile diameter, and compressive, tensile and lateral loading requirements. Although the Calavaras Complex bedrock at this site appears "scour resistant" (at least for local scour), confirmation by field study is required. A conservative approach to bridge planning would assume that channel bottom is fully susceptible to scour.

* * * * * *

Please contact this office if you have any questions or comments regarding the information contained in this report. We appreciate the opportunity to be of service.

Very Truly Yours,

TABER CONSULTANTS

REGISTERED GEOLOGIST DAVID KITZMANN NO. 2412 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

David Kitzmann
C.E.G. 2412

Reviewed By: Ronald E. Loutzenhiser
R.C.E. 64089

REGISTERED PROFESSIONAL ENGINEER RONALD ERIC LOUTZENHISER NO. 64089 Exp. 9/30/08 CIVIL STATE OF CALIFORNIA

DAK/REL

Distribution: Addressee (4)

Attachments:

"Selected References"
"Figure 1 – Site Location Map"
"Figure 2 – Location of Field Tests"
"Figure 3 – Seismic Refraction Data"
"Figure 4 – Caltrans SDC ARS Curve
"Appendix A – Slope Stability Trials"
"Appendix B – Log of Test Borings Bridge 25-0063"

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Scale: 1:24,000

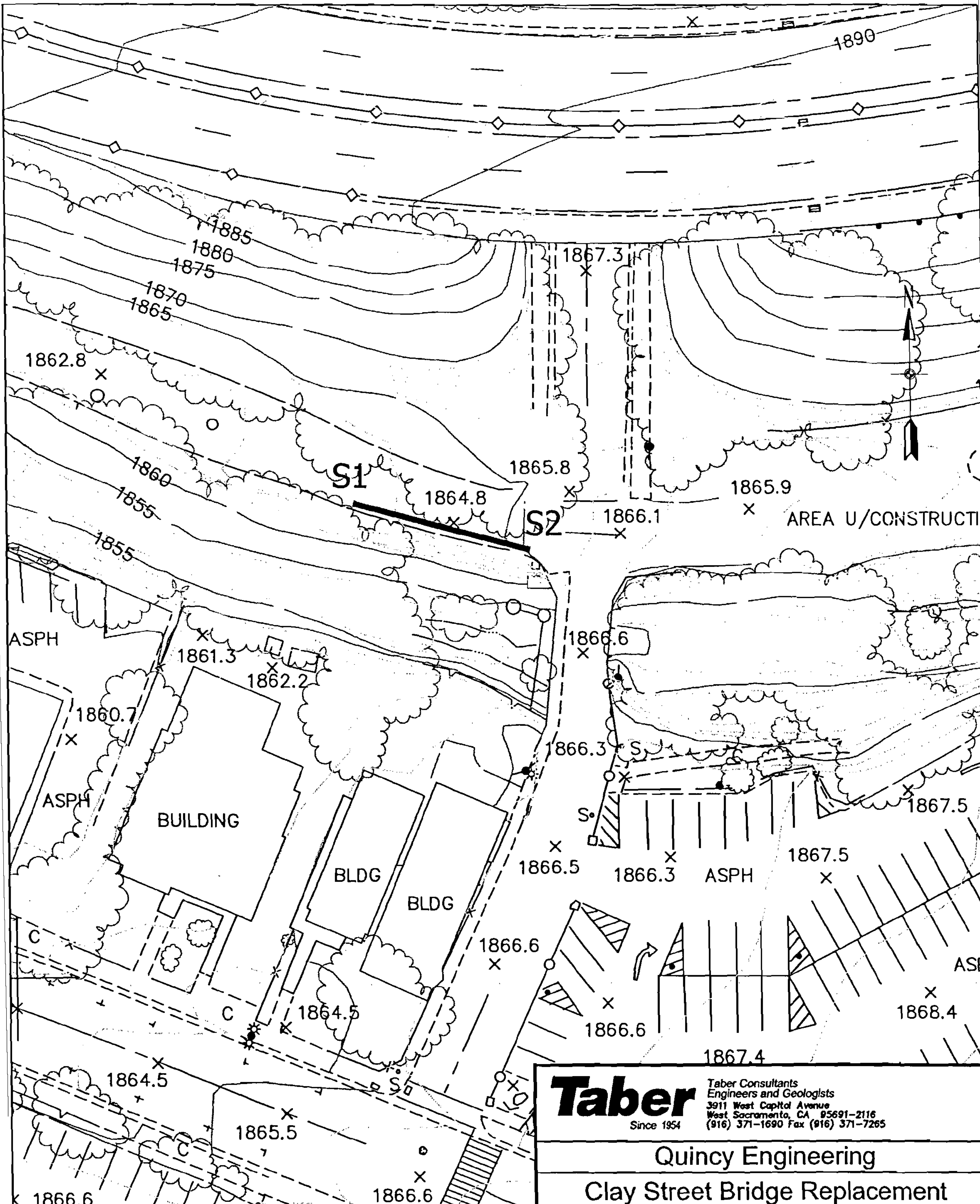
USGS
"PLACERVILLE, CA"
QUADRANGLE 7.5 MINUTE
SERIES (TOPOGRAPHIC),
DATE 1949
PHOTOREVISED 1973

Quincy Engineering

Clay Street Bridge at Hangtown Creek
Placerville, California

Vicinity Map

1P2/307/043	August 2007	Figure - 1



S1 —— S2 Approximate Location of Seismic Refraction Line

Scale: 1"=40'

Topographic Base Map Provide By Quincy Engineering

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Clay Street Bridge Replacement
Placerville, California

Location of Field Tests

1P2/307/043	August 2007	Figure - 2

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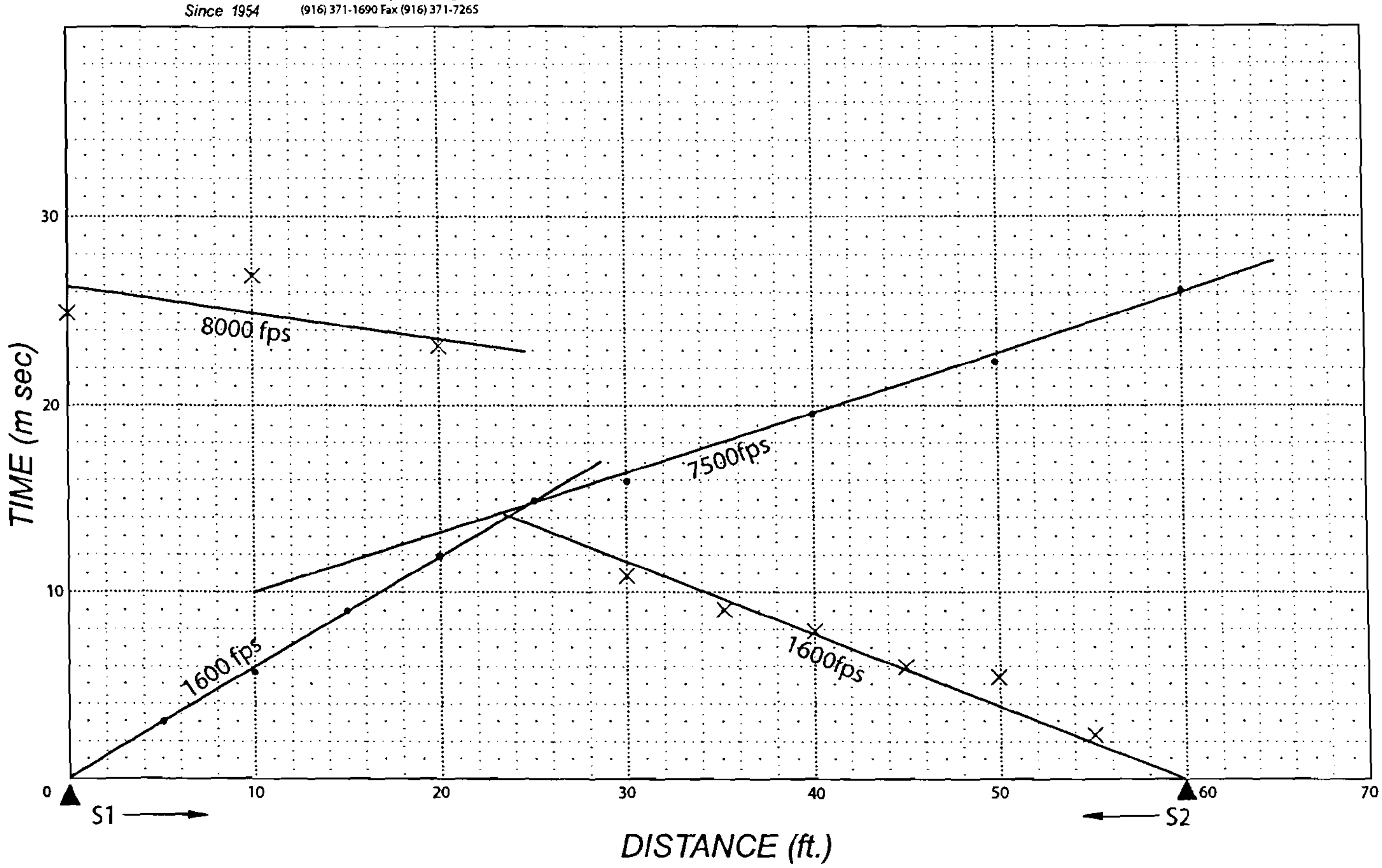
1P2/307/043
Figure - 3



REFRACTION SEISMIC RECORD

1P2/307/043
October, 2007

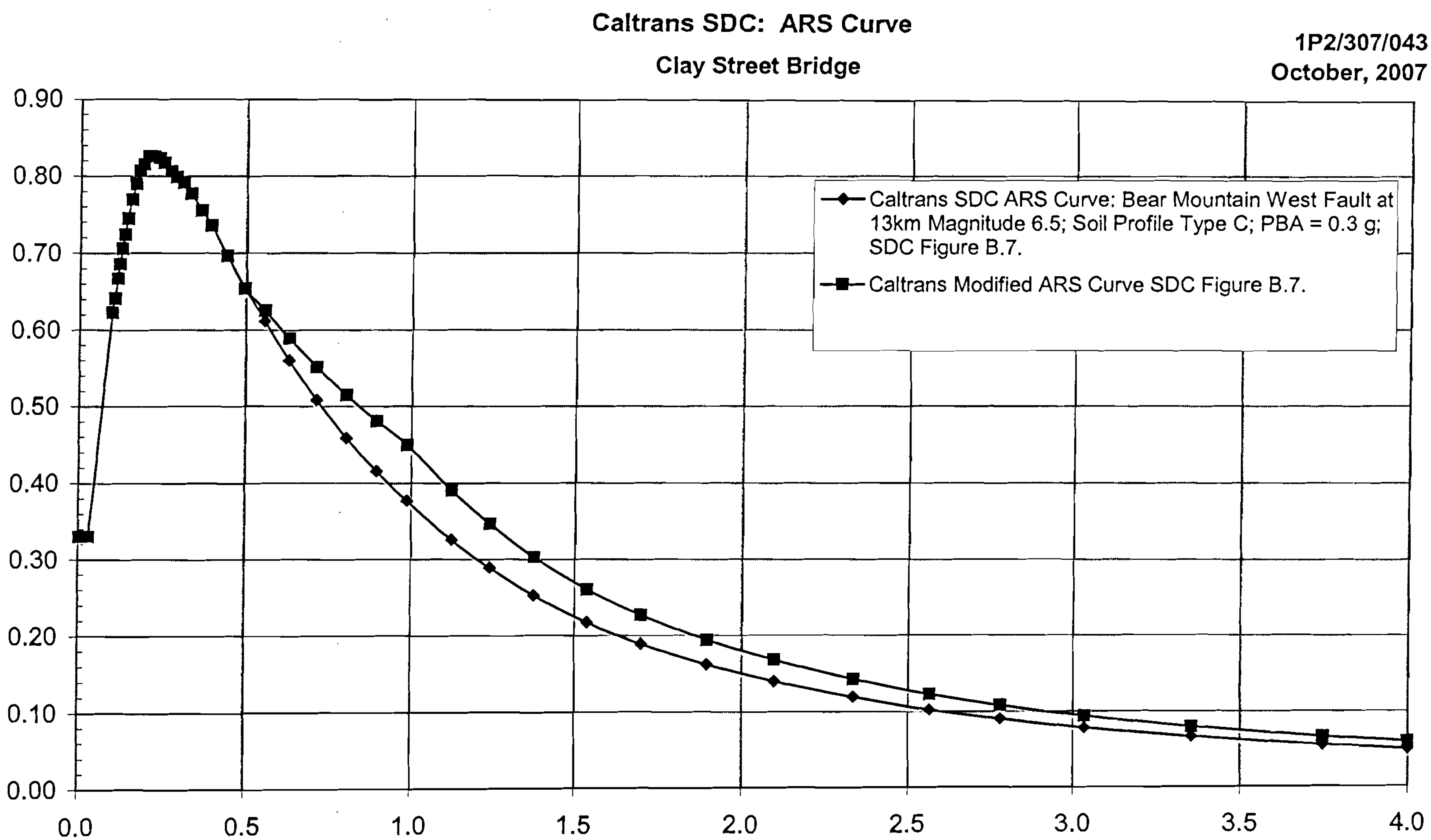
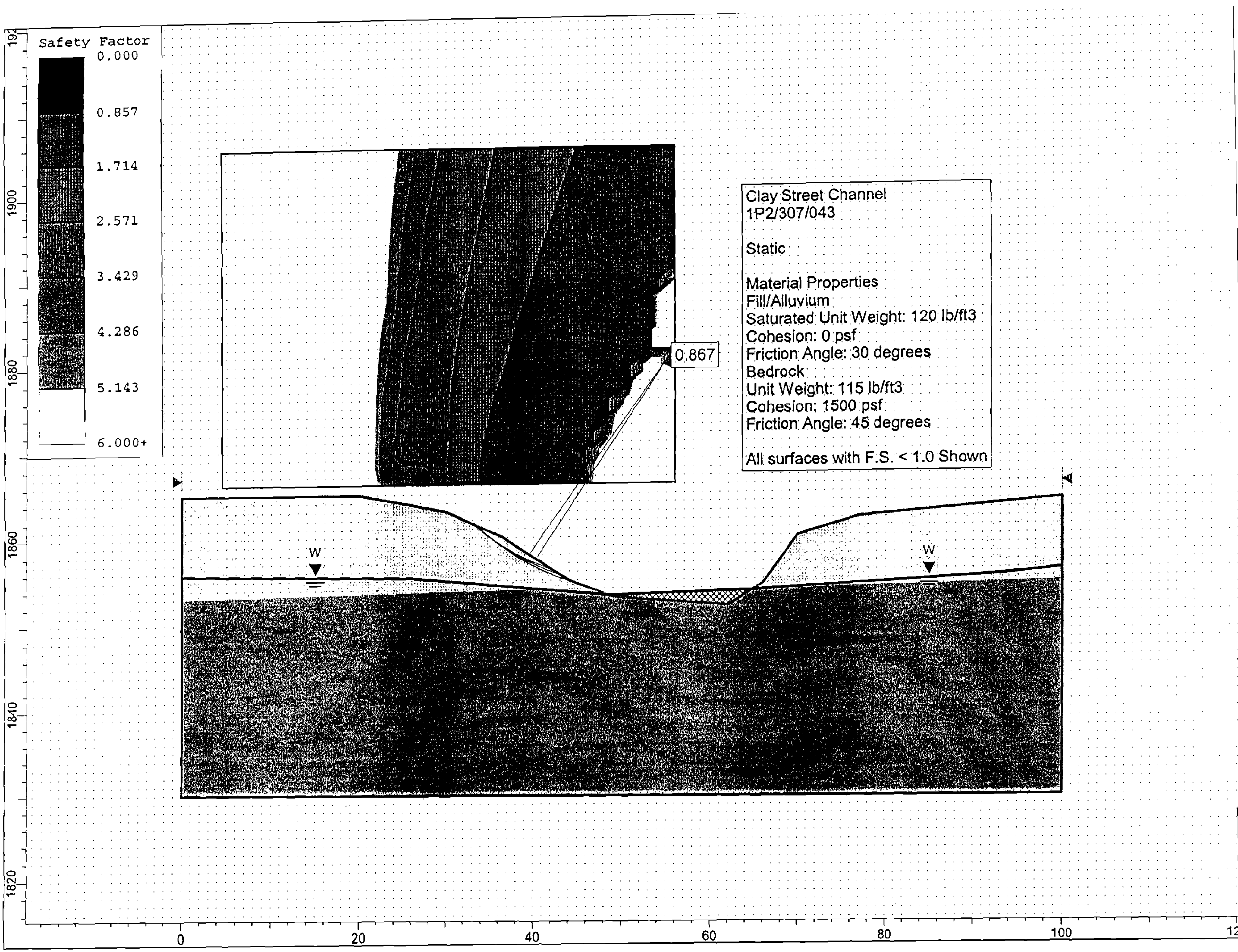
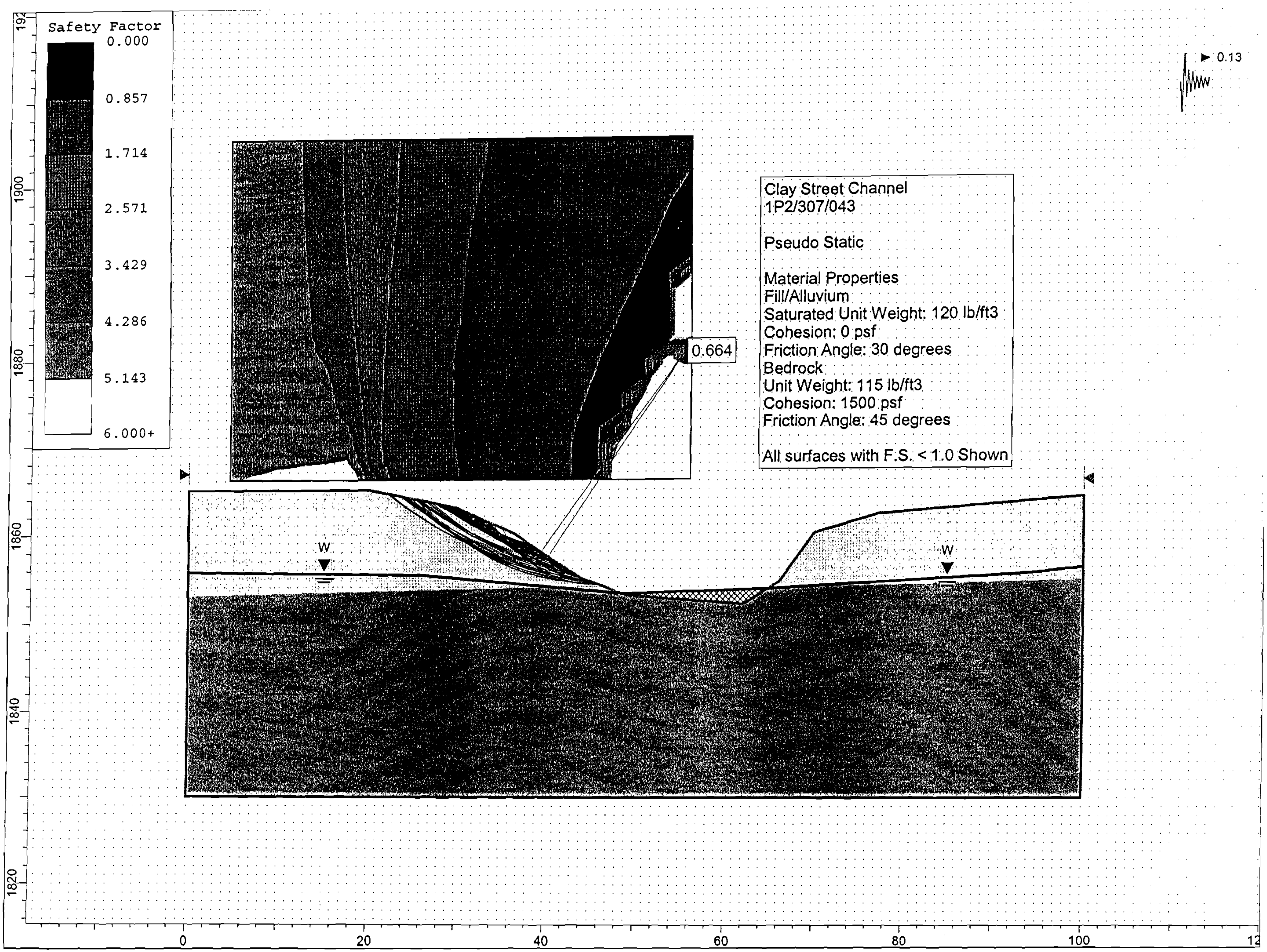


Figure-4

Appendix A

Slope Stability Trials


Safety Factor
0.000
0.857
1.714
2.571
3.429
4.286
5.143
6.000+
0.867
Clay Street Channel
1P2/307/043
Static
Material Properties
Fill/Alluvium
Saturated Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Bedrock
Unit Weight: 115 lb/ft3
Cohesion: 1500 psf
Friction Angle: 45 degrees
All surfaces with F.S. < 1.0 Shown
W
W
1900
1880
1860
1840
1820
0
20
40
60
80
100


Safety Factor
0.000
0.857
1.714
2.571
3.429
4.286
5.143
6.000+
0.13
0.664
Clay Street Channel
1P2/307/043
Pseudo Static
Material Properties
Fill/Alluvium
Saturated Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 30 degrees
Bedrock
Unit Weight: 115 lb/ft3
Cohesion: 1500 psf
Friction Angle: 45 degrees
All surfaces with F.S. < 1.0 Shown
W
W
1900
1880
1860
1840
1820
0
20
40
60
80
100

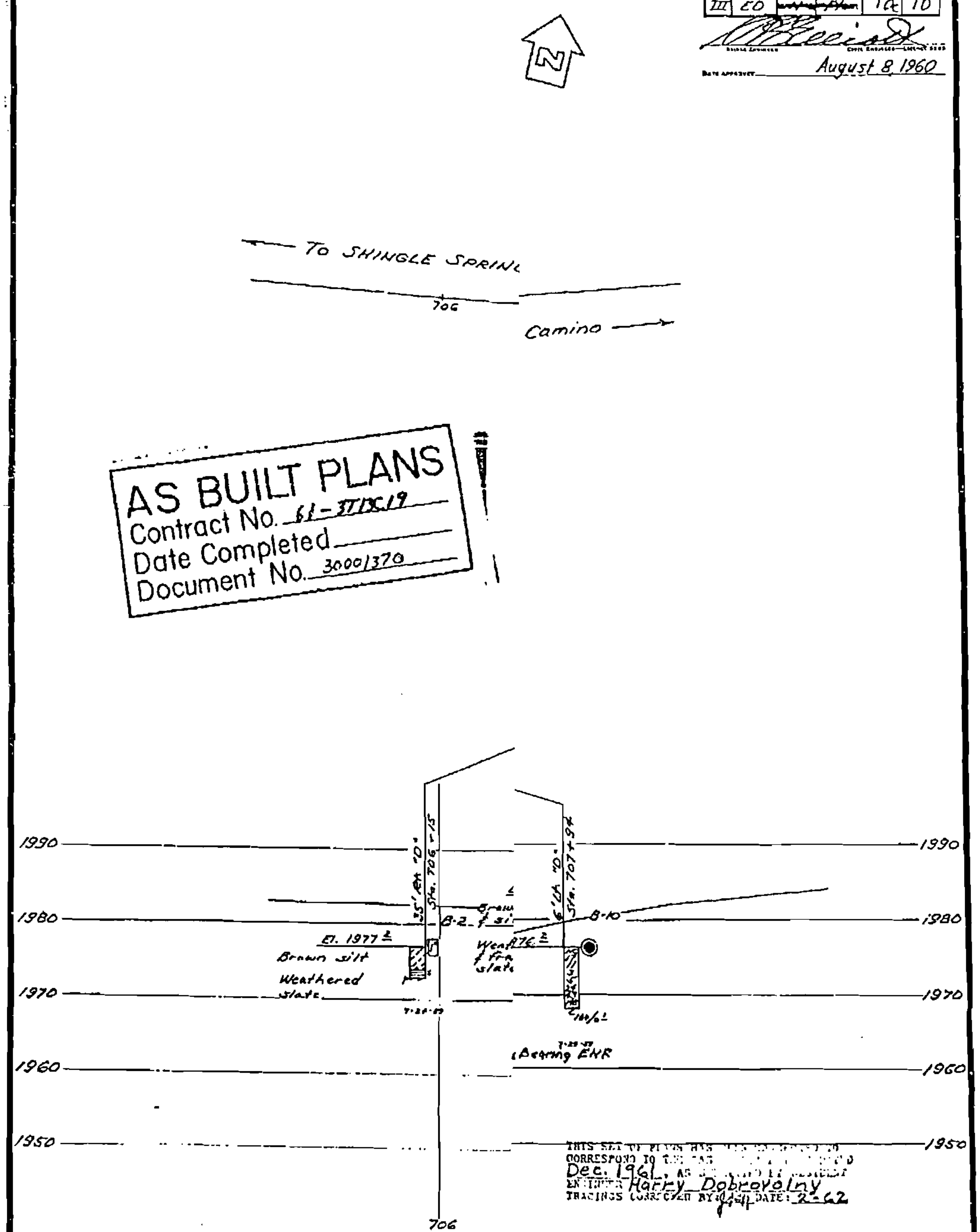
Appendix B

Log of Test Borings Bridge 25-0063

FED. ROAD DIV. NO.	STATE	FED. AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
7	CAL.				

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
III	ED			10a	10

DATE APPROVED August 8, 1960



AS BUILT PLANS
Contract No. 61-3T1X19
Date Completed
Document No. 30001370

THIS SET OF PLANS HAS BEEN ... TO CORRESPOND TO THE ... Dec. 1961, AS ... RESIDENT ENGINEER Harry Dobrovolny
TRACINGS CORRECTED BY ... DATE: 2-62

BRIDGE DEPARTMENT

DRAWN by M. Heaney 8-11-59
CHECKED by G. Miller 8-17-59

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

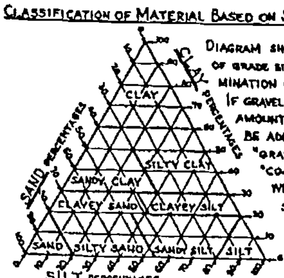


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

NOTES

... contractor's attention is directed to Section 2-1.03 of the Standard Specifications ... the Special Provisions accompanying this set of plans.
... classification of earth material as shown on this sheet is based upon field inspection and is ... be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WILTSE ROAD UNDERCROSSING

LOG OF TEST BORINGS

1" = 10' | BRIDGE 25-63 R/L | FILE 2-15 | DRAWING C-6542-10

NO. F-6542 36 40 50 PR-6542-G

12