INFORMATION HANDOUT

For Contract No. 08-3555V4
At 08-SBd-15-42.5/46.0

Identified by
Project ID 0814000086

PERMITS

California Department of Fish and Wildlife

United States Army Corps of Engineers

Water Quality Certification from State Water Resources Control Board

WATER QUALITY

California Regional Water Quality Control Board

Lahontan Region, NPDES Permit No. CAS 000002, No. CAS 000003 & No. CAS 000004

RAILROAD RELATIONS

Railroad Relations and Insurance Requirements

1. EXHIBIT "C" Contractor Requirement

MATERIALS INFORMATION

Summary of Foundation Recommendation Reports

1. Geotechnical Design Report
2. Revised Foundation Report (Br. No. 54-0535)
3. Revised Foundation Report (Br. No. 54C-0661)
4. Revised Foundation Report (Br. No. 54-0483)
5. Revised Foundation Report (Br. No. 54-0484)
6. Revised Foundation Report (Br. No. 54-0484G)
7. Revised Geotechnical Design Report (Retaining Wall No. 124)
8. Geotechnical Report (Grading Factor for Interstate 15 Widening Project in Victorville)
9. Geotechnical Report (Subsurface Conditions at four Proposed Pipe Jacking Locations on the Interstate 15 Widening Project in Victorville)
10. Geotechnical Report (Foundation and Cut Slope Soil Condition at Retaining Wall No. 160 and Retaining Wall No. 163 on the Interstate 15 Widening Project in Victorville

ELECTRONIC FILE

1. HA_VA_KCM

2. Cross_Sections_dgn

3. Slope_Stake_Listing_pdf

4. OG_3D_dgn

ASBESTOS REPORT

Portion of Asbestos Report.

DESERT TORTOISE

Information Brochure for Protection of Desert Tortoise

WATER SOURCE

City of Victorville

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
INLAND DESERTS REGION
3602 INLAND EMPIRE BOULEVARD, SUITE C-220
ONTARIO, CA 91764
(909) 484-0167

STREAMBED ALTERATION AGREEMENT
NOTIFICATION NO. 1600-2014-0019-R6
MOJAVE RIVER

CALIFORNIA DEPARTMENT OF TRANSPORTATION
MOJAVE RIVER INTERCHANGE RECONSTRUCTION PROJECT

This Streambed Alteration Agreement (Agreement) is entered into between the California Department of Fish and Wildlife (CDFW) and the California Department of Transportation (Caltrans), as represented by Scott Quinnell (Permittee).

RECITALS

WHEREAS, pursuant to Fish and Game Code (FGC) section 1602, Permittee notified CDFW on February 18, 2014 that Permittee intends to complete the Project described herein.

WHEREAS, pursuant to FGC section 1603, CDFW has determined that the Project could substantially adversely affect existing fish or wildlife resources and has included measures in the Agreement necessary to protect those resources.

WHEREAS, Permittee has reviewed the Agreement and accepts its terms and conditions, including the measures to protect fish and wildlife resources.

NOW THEREFORE, Permittee agrees to complete the Project in accordance with the Agreement.

PROJECT LOCATION

The Project is located on the Mojave River, a tributary to Soda Dry Lake, in the City of Victorville, in the County of San Bernardino, State of California. Latitude 34°32'44.53"N, Longitude 117°17'48.87"W; Sections 3, 4, 9, 34, and 35, Townships 5 and 6 North, Range 4 West, U.S. Geological Survey (USGS) Victorville quad map. The assessor's parcel numbers are listed in Appendix I of the Notification package provided to CDFW.

PROJECT DESCRIPTION

The proposed Project (Project) is limited to reconstructing three interchanges and upgrading the Interstate 15 Bridge across the Mojave River. The Project includes: the reconstruction of the D Street, E Street, and Stoddard Wells Road interchanges;

widening of the Victorville separation and overhead; the widening of the Mojave River Bridge; and the replacement of the Stoddard Wells Road overcrossing.

A new frontage road will be constructed west of I-15, and the existing east frontage road will be realigned. A retaining wall will be constructed to support widening of the D Street northbound exit ramp and auxiliary lane. Two northbound sound walls and new and replacement landscaping are included in the proposed Project, in addition to upgrades to the onsite and offsite drainage facilities. The specifications and design plans for these features are located in Appendix H of the Notification package.

Temporary impacts to ephemeral wash will result from widening and realignment of existing frontage roads and overpasses. Permanent and temporary impacts to the Mojave River would result from the extension of piers for the widening of the Mojave River Bridge and the construction of new piers for the new bridge. Project impact calculations are listed in Table 2 of Appendix A2 of the Notification package.

PROJECT IMPACTS

Existing fish or wildlife resources the Project could substantially adversely affect include:

BIRDS. The Project could substantially adversely affect: Golden eagle (*Aquila chrysaetos*); Red-tailed hawk (*Buteo jamaicensis*); Le Conte's thrasher (*Toxostoma lecontei*); loggerhead shrike (*Lanius ludovicianus*); song sparrow (*Melospiza melodia*); common yellowthroat (*Geothlypis trichas*); house finch (*Haemorhous mexicanus*); California quail (*Callipepla californica*); spotted towhee (*Pipilo maculates*); black phoebe (*Sayornis nigricans*); Bewick's wren (*Thryomanes bewickii*); lesser goldfinch (*Spinus psaltria*); black-chinned hummingbird (*Archilochus alexandri*); Anna's hummingbird (*Calypte anna*); burrowing owl (*Athene cunicularia*); and other bird species occurring near the Project area.

VEGETATION. The Project will substantially adversely affect three vegetation communities: **Mojave riparian forest** comprised of: Freemont's cottonwood (*Populus fremontii*), black willow (*Salix gooddingii*), white alder (*Alnus rhombifolia*), wild rose (*Rosa woodsii*), sandbar willow (*Salix exidua*), cattail (*Typha latifolia*), bulrush (*Schoenoplectus* spp.), seep monkey flower (*Mimulus guttatus*), and mulefat (*Baccharis salicifolia*); **Freshwater marsh** comprised of: spikerush (*Eleocharis* spp.), wire rush (*Juncus balticus*), sedges (*Carex* spp.), duckweed (*Lemna* spp.) and cattails (*Typha* spp.)]; and **Desert saltbush scrub** comprised of: four-wing salt-bush (*Atriplex canescens*), quailbush (*Atriplex lentiformes*), rabbitbrush (*Chrysothamnus nauseosus*), ephedra (*Ephedra* spp.), California buckwheat (*Eriogonum fasciculatum*), rice grass (*Achnatherum hymenoides*), saltgrass (*Distichlis spicata*), giant reed (*Arundo donax*), and bromes (*Bromus* spp.). Rare or sensitive plant species reported from the Project area include: white pygmy-poppy (*Canbya candida,* S3.2*)*; Beaver Dam breadroot (*Pediomelum castoreum,* S2); southern mountains skullcap *(Scutellaria bolanderi ssp. Austromontana,* S2); and Booth's evening-primrose (*Eremothera boothii ssp. Boothii*).

MAMMALS. The Project could substantially adversely affect: Mohave river vole (*Microtus californicus mohavensis*); dusky-footed woodrat (*Neotoma* fuscipes); San Diego pocket mouse (*Chaetodipus fallax pallidus*); Free-tailed bat (*Tadarida brasiliensis*); *Myotis sp.*; Townsends big-eared bat (*Corynorhinus townsendii*); hoary bat (*Lasiurus cinereur*); raccoon (*Procyon lotor*); Audubon's cottontail (*Sylvilagus audubonii*); black-tailed jackrabbit (*Lepus californicus*); striped skunk (*Mephitis mephitis*); Coyote (*Canis latrans*); Desert kit fox (*Vulpes macrotis arcipes*); grey fox (*Urocyon cineroargenteus*); California ground squirrel (*Spermophilus beecheyi*); White-tailed antelope squirrel (*Ammospermophilus leucurus*); Botta pocket gopher (*Thomomys bottae*); and bobcat (*Lynx rufus*).

AMPHIBIANS. The Project could substantially adversely affect: Pacific chorus frog (*Pseudacris regilla*); and western toad (*Anaxyrus boreas*).

The adverse effects the Project could have on the wildlife resources identified above include the disturbance to, alteration of, and/or temporary loss of nesting, refugia, and foraging habitat. The construction of the Project will impact 3.78 acre of CDFW jurisdiction, including temporary impacts to 0.156 acre of ephemeral washes and 3.27 acres Mojave River riparian habitat and permanent impacts to 0.217 acre of ephemeral wash and 0.086 acre of Mojave River wetlands. Specifically, the Project will result in the removal of 38 Fremont cottonwoods (*Populus fremontii*) with a DBH greater than 4 inches.

MEASURES TO PROTECT FISH AND WILDLIFE RESOURCES

1. Administrative Measures

Permittee shall meet each administrative requirement described below.

1.1 Documentation at Project Site. Permittee shall make the Agreement, any extensions and amendments to the Agreement, and all related notification materials and California Environmental Quality Act (CEQA) documents, readily available at the Project site at all times and shall be presented to CDFW personnel, or personnel from another state, federal, or local agency upon request.

1.2 Providing Agreement to Persons at Project Site. Permittee shall provide copies of the Agreement and any extensions and amendments to the Agreement to all persons who will be working on the Project at the Project site on behalf of Permittee, including but not limited to contractors, subcontractors, inspectors, and monitors.

1.3 Notification of Conflicting Provisions. Permittee shall notify CDFW if Permittee determines or learns that a provision in the Agreement might conflict with a

provision imposed on the Project by another local, state, or federal agency. In that event, CDFW shall contact Permittee to resolve any conflict.

1.4 Compliance with other Agencies. This Agreement does not relieve the Permittee of responsibility for compliance with applicable federal, state, or local laws, ordinances or grant conditions.

1.5 Project Site Entry. Permittee agrees that CDFW personnel may enter the Project site at any time to verify compliance with the Agreement.

1.6 Nesting Birds. This Agreement does not authorize take of Nesting Birds. Sections 3503, 3503.5 and 3513 pursuant to FGC prohibits the take of all birds and their active nests, including raptors and other migratory non-game birds (as listed under the United States Migratory Bird Treaty Act).

2. Avoidance and Minimization Measures

To avoid or minimize adverse impacts to fish and wildlife resources identified above, Permittee shall implement each measure listed below.

2.1 Permittee shall not impact any wetland and/or riparian habitats other than those specified in the Project description. If additional impacts to wetland and/or riparian habitats are anticipated, the Permittee shall contact CDFW in advance of anticipated impacts and incorporate appropriate mitigation and monitoring. CDFW shall be contacted at the address below under Contact Information.

2.2 Permittee shall have a CDFW approved Designated Biologist(s) (DB) at each Project site while Project activities are occurring to ensure Agreement conditions are being met and impacts to fish and wildlife habitat are minimized. To protect fish and wildlife resources, The DB shall have the authority to immediately stop any Project activity. Permittee shall ensure that the DB (s) is knowledgeable and experienced in the biology, natural history, collecting, and handling of appropriate species. The DB (s) shall be responsible for monitoring activities addressed by the Agreement, including, but not limited to all activities that result in the clearing or grading of sensitive habitats, as well as grading, excavation, and/or other ground-disturbing activities in CDFW jurisdictional areas. The DB (s) shall flag the limits of grading and the jurisdictional areas, perform necessary surveys, and take photographs during the construction process. If a State listed Species of Special Concern, or threatened or endangered species are found within the Project work area, the DB(s) shall immediately stop work within the Project work area and notify CDFW, via email (Nick.Buckmaster@widlife.ca.gov), and by calling Nick Buckmaster, Environmental Scientist at (760) 872-1110. Consultation with CDFW is required prior to cancellation of a stop work order. Permittee shall submit to CDFW in writing the name, qualifications, resume or curriculum vitae, and contact information of DB(s) responsible for monitoring of Project activities. This

information shall be submitted to CDFW via email to: Nick.Buckmaster@widlife.ca.gov. Permittee shall obtain CDFW approval of DB (s) in writing 14 days before the commencement of Project activities (including site preparation), and shall also obtain approval in writing five days in advance if the DB (s) must be changed.

2.3 The DB (s) shall conduct preconstruction surveys for sensitive species or species of special concern prior to the initiation of project activities. The results of these surveys shall be submitted to Nick Buckmaster Environmental Scientist at 407 W. Line Street, Bishop, CA 93514. If a sensitive species or species of special concern is found during preconstruction surveys, notification shall be submitted to CDFW via email to: Nick.Buckmaster@widlife.ca.gov.

2.4 The dewatering and diversion plan included in the Notification package will be implemented under the supervision of the DB. All reasonable efforts shall be made to capture and move all stranded aquatic life observed in the dewatered areas. Capture methods may include fish landing nets, dip nets, buckets and by hand. Captured aquatic life shall be released immediately in the closest body of water adjacent to the work site. This condition does not allow for the take or disturbance of any State or federally listed species, or State listed species of special concern.

2.5 The Permittee shall provide a copy of the Caltrans Standard BMPs Strom Water Data Report or an Oil Spill Contingency Plan to CDFW. At minimum, this plan shall include spill containment measures, a plan for clean-up and disposal of contaminated soil, and the use of secondary containment under fuel storage sites and parked vehicles. All equipment operators shall carry an oil spill containment kit suitable for containing an oil spill of less than one gallon. If any oil spill should occur where it may enter state waters or is in excess of 42 gallons (one barrel), California State Law requires that it be reported to the California Governor's Office of Emergency Services (800-852-7550). In addition, Fish and Game code section 5650 prohibits any discharge of any petroleum into state waters, and if an oil spill occurs where it may pass into state waters or exceeds 42 gallons, it shall be reported to CDFW within 24 hours of the spill. Spills that exceed 42 gallons or occur where they may pass into state waters shall be reported by phone and email to Nick Buckmaster at (760) 872-1110 and Nick.Buckmaster@wildlife.ca.gov. All other oil spills should be reported to CDFW in the Annual Report described in Condition 4.4. Regardless of spill size, cleanup activities shall begin immediately.

2.6 Prior to any construction activities on the Project site, the Permittee will implement a Worker Environmental Awareness Program (WEAP) or an Biological Resource Information Plan to educate on-site workers about sensitive environmental issues associated with the Project. The program will be administered to all on-site personnel, including the Applicant's personnel, contractors, and all subcontractors, prior to the employee's commencing work on the site. The plan will include but not be limited to protected species and species of special concern that have potential

to occur within the Project footprint (burrowing owl, Le Conte's thrasher, white pygmy-poppy, beaver dam breadroot, southern mountains skullcap, Booth's evening-primrose, Mohave river vole, dusky-footed woodrat, San Diego pocket mouse, and nesting birds).

2.7 At the end of each workday, the Permittee shall place an escape ramp at each end of any open trenches or pits to allow any animals that may have become entrapped in the trench to climb out overnight. The ramp may be constructed of either dirt fill or wood planking or other suitable material that is placed at an angle no greater than 30 degrees. Open trenches and pits shall be checked each morning by the DB for wildlife sheltering within them.

2.8 A Nesting Bird Plan (NBP) shall be submitted to CDFW for review and approval 30 days prior to the commencement of Project activities. CDFW shall approve in writing the NBP prior to vegetation clearing or ground disturbance associated with construction or grading that would occur during the nesting/ breeding season (February through August, unless determined otherwise by a qualified biologist based on observations in the region). The NBP shall include Project-specific measures to ensure that impacts to nesting birds do not occur and that the Project complies with all applicable law related to nesting birds and birds of prey. The NBP shall include at a minimum: monitoring protocols; survey timing and duration; the creation, maintenance, and submittal to CDFW of a bird-nesting log; and Project-specific avoidance and minimization measures. Avoidance and minimization measures shall include, at a minimum: Project phasing and timing, monitoring of Project-related noise, sound walls, and buffers where appropriate. This information shall be submitted to CDFW via email to. Nick.Buckmaster@widlife.ca.gov.

2.9 Permittee shall comply with the following bridge-dwelling wildlife protection measures if bridge-dwelling wildlife is detected in the bridges or culverts. All contractors, subcontractors, and employees shall also comply with these measures and it shall be the responsibility of Permittee to ensure compliance.

2.9.1 The CDFW approved DB (s) shall design and direct implementation of exclusionary devices designed to prevent birds and bats from utilizing bridges/culverts before construction activities begin. Exclusionary devices shall be installed on all bridges prior to the initiation of nesting season (February 1). Exclusionary devices shall cover both the sides and bottom of each bridge. Passage underneath each bridge (through the channel) shall not be impeded. Exclusionary materials shall be installed within seven (7) days of surveying the bridge for bridge-dwelling wildlife, shall not pose an entanglement risk to wildlife, and shall be regularly maintained. Exclusionary materials shall not be installed if nesting bird activity is detected. If bats are found using any bridge, roost entrances shall be fitted with one-way doors that allow bats to exit but prevent entrance for a period of several days to encourage bats to relocate.

2.9.2 Alternate bat roosting structures (*i.e.*, lightweight concrete panels) shall be

installed within the vicinity of the Project area. Construction and installation of roosting structures shall be supervised by the CDFW-approved Designated Biologist(s). The total length of the roosting structures shall be no less than one-half the total length of the expansion joints, or other suitable roosting structures, that will impacted during construction. The alternate roosting structures shall remain in place following construction and shall not be removed. Alternate bat roosting structures shall be installed as soon as possible and no later than 3 months prior to starting construction. A plan on the construction, placement, and timing of installation of the alternative roosting structures shall be submitted to CDFW for review and concurrence no later than 90 days prior to the commencement of Project activities.

2.9.3 No gasoline or diesel engines shall be stored or operated under any bridge, unless the bridge has been cleared of all bats.

2.9.4 All night work (dusk until dawn) in the vicinity of the structure (*i.e.*, roadway widening, resurfacing, lighting, lane-closure setup, etc.) shall have concurrence from CDFW and the DB(s) prior to any work or scheduling of any work between March 1 and October 1.

2.9.5 The dimensions of existing hinges/expansion joints shall remain the same during and after construction.

2.9.6 Construction activities on, under, or around, or within close proximity to bridges/culverts will be limited to October 1 to March 1, unless all bats have been excluded from the structure and concurrence has been received from CDFW.

2.9.7 If any roosting bats are discovered during construction activities, all work shall stop on, under, around, or within 500-feet of the structure.

2.9.8 Using an appropriate combination of structure inspection, sampling, exit counts, and acoustic surveys, the CDFW-approved DB(s) shall survey each structure and the surrounding area that may be impacted by the Project for bats. If bats are found using any bridges or culverts within the Project area, the biologist shall identify the bats to the species level, and evaluate the colony to determine its size and significance. The bat survey shall include: 1) the exact location of all roosting sites (location shall be adequately described and drawn on a map), 2) the number of bats present at the time of visit (count or estimate), 3) each species of bat present shall be named (include how the species was identified), 4) the location, amount, distribution and age of all bat guano shall be described and pinpointed on a map, and 5) the type of roost: night roost (rest at night while out feeding) versus a day roost (resting during the day) must also be clearly stated. The results of the bat survey shall be submitted to CDFW for review and concurrence no later than 10 days prior to commencement of

Project activities. Reports shall be submitted to CDFW via email to. Nick.Buckmaster@widlife.ca.gov, and mailed to 407 W. Line Street, Bishop, CA 93514, Attn: Nick Buckmaster.

2.10 Any lighting or fencing for infrastructure adjacent to jurisdictional areas shall be designed or reviewed by a qualified biologist to allow wildlife to move within the open space and conserved areas without hindrance. Fencing shall also be monitored to ensure wildlife is not trapped against the fence or otherwise impacted by the installation or presence of the fence.

2.11 No work shall occur in wet weather conditions (*e.g.* rain).

2.12 Habitat assessments, surveys, impact assessments, and all associated reports shall be completed following the recommendations and guidelines provided within the *Staff Report on Burrowing Owl Mitigation* (Department of Fish and Game, March 2012). The burrowing owl is protected under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (50 C.F.R. Section 10.13) and Sections 3503, 3503.5 and 3513 of the FGC, which prohibit take of all birds and their nests. Therefore, it is the responsibility of the Project proponent to ensure compliance with these laws for the entire Project site.

Prior to the initiation of any Project activities, Permittee shall conduct a burrowing owl habitat assessment. The assessment shall be conducted by a biologist knowledgeable of burrowing owl habitat, ecology, and field identification of the species and burrowing owl sign and in accordance with the attached *Staff Report on Burrowing Owl Mitigation* (Department of Fish and Game, March 2012). The assessment shall consist of walking the entire Project site and adjoining areas within 150 meters, including areas that may be indirectly impacted by the Project, to identify the presence of burrowing owl habitat. A report summarizing the results of the habitat assessment shall be submitted to CDFW within 30 days following the completion of the assessment and shall include all information as outlined in Appendix C of the *Staff Report on Burrowing Owl Mitigation* (Department of Fish and Game, March 2012). Please note that Burrowing Owl habitat assessments dated more than one year prior to the construction start date will not be accepted by CDFW. If no suitable habitat is found on-site (*i.e.*, if the site is completely covered in chaparral habitat, cement, or asphalt), no additional surveys are necessary. If suitable habitat is found onsite, burrowing owl surveys shall be conducted by a qualified biologist during the breeding season of February 1 through August 31 in accordance with the attached *Staff Report on Burrowing Owl Mitigation* (Department of Fish and Game, March 2012). Survey results shall be submitted to CDFW within 30 days of completion of surveys following the guidelines provided in Appendix D of the *Staff Report on Burrowing Owl Mitigation* (Department of Fish and Game, March 2012). If surveys confirm occupied Burrowing Owl habitat in or adjoining the Project area, the Permittee shall contact CDFW and conduct an impact assessment, in accordance with *Staff Report on*

Burrowing Owl Mitigation (Department of Fish and Game, March 2012), to assist in the development of avoidance, minimization, and mitigation measures, prior to commencing Project activities. Reports shall be mailed to CDFW at 407 W. Line Street, Bishop CA 93514, Attn: Lake and Streambed Alteration Program-Nick Buckmaster. **Please reference SAA # 1600-2014-0019-R6.**

2.13 CDFW recommends the use of native plants to the greatest extent feasible in the landscaped areas adjacent to and/or near mitigation/open space areas and within or adjacent to stream channels. Permittee shall not plant, seed, or otherwise introduce invasive nonnative plant species to the landscaped areas adjacent to and/or near mitigation/open space areas and within or adjacent to stream channels (minimum 100-foot setback from open space areas and 150-foot setback from stream channels and wetland/riparian mitigation sites). Invasive nonnative plant species not to be used include those species listed on the "California Invasive Plant Inventory, February 2006" and the "February 2007 Inventory Update", (which are updates to Lists A & B of the California Exotic Pest Plant Council's list of "Exotic Pest Plants of Greatest Ecological Concern in California as of October 1999"). This list includes: pepper trees, pampas grass, fountain grass, ice plant, myoporum, black locust, capeweed, tree of heaven, periwinkle, bush lupine, sweet alyssum, English ivy, French broom, Scotch broom, Spanish broom, and pepperweed. A copy of the complete list can be obtained by contacting the California Invasive Plant Council by phone at (510) 843-3902, at their website at www.cal-ipc.org, or by email at info@cal-ipc.org

2.14 Permittee shall actively implement Best Management Practices (BMPs), defined in the "State of California Department of Transportation Construction Site Best Management Practice Field Manual and Trouble Shooting Guide," to prevent erosion and the discharge of sediment and pollutants into streams during Project activities. BMPs shall be monitored and repaired if necessary to ensure maximum control of erosion, sediment, and pollution. Permittee shall prohibit the use of erosion control materials potentially harmful to fish and wildlife species, such as monofilament netting (erosion control matting) or similar material, within and adjacent to CDFW jurisdictional areas. All fiber roles, straw waddles, and/or hay bales utilized within and adjacent to the Project site shall be free of nonnative plant materials. Fiber rolls or erosion control mesh shall be made of loose-weave mesh that is not fused at the intersections of the weave, such as jute, or coconut (coir) fiber, or other products without welded weaves. Non-welded weaves reduce entanglement risks to wildlife by allowing animals to push through the weave, which expands when spread.

2.15 Permittee shall comply with all litter and pollution laws. All contractors, subcontractors, and employees shall also obey these laws and it shall be the responsibility of Permittee to ensure compliance. Trash shall be placed in a sealed container and emptied at the end of each day.

2.16 Permittee shall not allow water containing mud, silt, or other pollutants from grading, aggregate washing, or other activities to enter a streambed, pond, or flowing stream, or be placed in locations that may be subjected to high storm flows.

2.17 Spoil sites shall not be located within a streambed, pond, or flowing stream or locations that may be subjected to high storm flows, where spoil shall be washed back into a streambed, pond, or flowing stream where it will impact streambed habitat and aquatic or riparian vegetation.

2.18 Raw cement/concrete or washings thereof, asphalt, paint, or other coating material, oil or other petroleum products, or any other substances which could be hazardous to fish and wildlife resources resulting from Project related activities shall be prevented from contaminating the soil and/or entering a streambed, pond, or flowing stream. These materials, placed within or where they may enter a streambed, pond, or flowing stream by Permittee or any party working under contract or with the permission of Permittee, shall be removed immediately.

2.19 No broken concrete, cement, debris, soil, silt, sand, bark, slash, sawdust, rubbish, or washings thereof, oil or petroleum products, or other organic or earthen material from any construction or associated activity of whatever nature shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into a streambed, pond, or flowing stream. When operations are completed, any excess materials or debris shall be removed from the work area. No rubbish shall be deposited within 150 feet of the high water mark of any streambed, pond, or flowing stream.

2.20 No equipment maintenance shall be done within or near any streambed, pond, or flowing stream where petroleum products or other pollutants from the equipment may enter these areas under any flow.

2.21 If any equipment, has been used in a different watercourse prior to use for Project activities, it should be pressure washed or steam-cleaned prior to use in the Project area to ensure it is free of water, mud, and debris that could harbor and transport invasive, non-native aquatic species.

2.22 All equipment or vehicles driven and/or operated within or adjacent to a stream, channel, wetted or ponded area shall be checked daily and maintained as need to prevent deleterious material leaks.

2.23 All temporary impacts to ephemeral washes and unvegetated CDFW jurisdictional habitats shall be re-contoured to match pre-existing conditions.

2.24 With the qualified biologist present and prior to ground-disturbing activities, Permittee shall install temporary exclusionary fencing around any active construction area, lay down area, and storage area (whether on-site or off-site),

prior to the onset of vegetation removal, or any other project construction activities that require overnight work or disturbance of desert tortoise habitat.

3. Compensatory Measures

3.1 Temporary impacts totaling 3.43 acre of shall be mitigated at a 1:1 ratio, and 0.35 acre of permanent impacts shall be mitigated at a 5:1 ratio to compensate for the loss of desert riparian habitat. The Permittee shall either purchase mitigation from a CDFW approved location in the Mojave Desert region of San Bernardino County, California or use Caltrans-owned land. Land proposed for mitigation shall be restored as needed and managed and preserved in perpetuity. In total, 5.20 acres (3.43 x 1 + 0.35 x 5) of land will be maintained to mitigate for Project impacts to desert riparian habitat. Proof of purchase shall be provided to CDFW within 9 months of the commencement of Project activities. The Habitat Monitoring and Mitigation Plan (HMMP) described in Condition 4.1 shall include a planting schedule and contingency plans to ensure the success criteria are met.

3.2 Impacts to 36 Fremont cottonwood trees will be mitigated at a 2:1 ratio. 72 Fremont cottonwood trees will be planted along the bank of the Mojave River, and shall have a survival rate of 75% after five years.

4. Reporting Measures

4.1 No later than 9 months following the commencement of Project activities, the Permittee shall submit to CDFW for review and approval a Final HMMP designed to meet the habitat restoration goals identified in Conditions 3.1 and 3.2 of this Agreement. At a minimum, the HMMP shall include the following information: (a) a description of the existing physical conditions of the restoration site, including water resources and habitat types, and a map that identifies the location of the site; (b) a plan for the preparation of the restoration site, including the removal of nonnative plant species, and recontouring of the streambed, if appropriate; (c) a local California native plant palette; (d) procedures to ensure that nonnative plants are not introduced or allowed to sustain within the restoration site and a nonnative plant removal plan; and (e) success standards and contingency measures. Monitoring and maintenance of the restoration site shall be conducted for a minimum of five years, or until CDFW determines the restoration site to be successful.

4.2 An annual report shall be submitted to CDFW each year for a minimum of five years following mitigation land acquisition, or until CDFW determines any restoration, revegetation, and enhancement activities on the mitigation land are successful and meet mitigation site meets the mitigation required under this Agreement. At a minimum, this report shall include the following information: (1) a description of the enhancement, establishment, and restoration activities conducted during the previous year, including: (a) site preparation, (b) an overview

of the planting effort, (c) the number by species of plants replaced or naturally recruited, and (d) when the activities were conducted; (2) current site conditions, including: (a) the percent survival, percent cover, and height of both tree and shrub species planted, (b) the status of the 72 Fremont cottonwood trees planted along the Mojave River, and (c) the methods used to assess these parameters; and (3) information regarding nonnative plant removal, including: (a) the methods used for removal, (b) the amount removed and/or treated, (c) the frequency and timing of removal and treatment, (d) disposal specifics, and (e) a summary of the general successes and failures or failure of the nonnative removal plan. The report shall also include wildlife species observed at the restoration site during monitoring surveys including sensitive species and/or listed species. Photos from designated photo stations shall be included. **The first annual report is due to CDFW no later than December 31, 2015 or December 31, 2016 if Project activities are delayed until 2015.** This report shall be sent via email to Nick.Buckmaster@wildlife.ca.gov

4.3 If any sensitive species are observed on or in proximity to the Project site, or during Project surveys, Permittee shall submit California Natural Diversity Data Base (CNDDB) forms and maps to the CNDDB within five working days of the sightings, and provide the regional CDFW office with copies of the CNDDB forms and survey maps. The CNDDB form is available online at: www.dfg.ca.gov/whdab/pdfs/natspec.pdf. **This information shall be mailed within five days to:** California Natural Diversity Data Base, 1807 13th Street, Suite 202, Sacramento, CA 95814, Phone (916) 324-3812. A copy of this information shall also be mailed within five days to CDFW Inland Deserts Region at the address below under Contact Information. **Please reference SAA # 1600-2014-0019-R6.**

4.4 No more than 60 days following the completion of construction activities, the Permittee shall submit a report to CDFW summarizing the results from the DB's monitoring activities. This report shall include: a summary of Project impacts to CDFW jurisdiction; photos taken by the DB; a list of plant and wildlife species that were observed during monitoring; and a summary of any oil spills that occurred. This report shall be sent via email to Nick.Buckmaster@wildlife.ca.gov.

4.5 The Permittee shall notify CDFW, in writing, at least five (5) days prior to completion of Project activities in jurisdictional areas. Notification shall be sent via email to Nick.Buckmaster@wildlife.ca.gov.

CONTACT INFORMATION

Any communication that Permittee or CDFW submits to the other shall be in writing and any communication or documentation shall be delivered to the address below by U.S. mail, fax, or email, or to such other address as Permittee or CDFW specifies by written notice to the other.

To Permittee:

Scott Quinnell
California Department of Transportation
464 West 4th Street
San Bernardino, CA 92401
(909) 383-6936
scott_quinnell@dot.ca.gov

To CDFW:

Department of Fish and Wildlife
Inland Deserts Region
407 West Line Street
Bishop, CA 93514
Attn: Lake and Streambed Alteration Program – Nick Buckmaster
Notification #1600-2014-0019-R6
(760) 872- 1110
Nick.Buckamster@wildlife.ca.gov

LIABILITY

Permittee shall be solely liable for any violations of the Agreement, whether committed by Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents or contractors and subcontractors, to complete the Project or any activity related to it that the Agreement authorizes.

This Agreement does not constitute CDFW's endorsement of, or require Permittee to proceed with the Project. The decision to proceed with the Project is Permittee's alone.

SUSPENSION AND REVOCATION

CDFW may suspend or revoke in its entirety the Agreement if it determines that Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, is not in compliance with the Agreement.

Before CDFW suspends or revokes the Agreement, it shall provide Permittee written notice by certified or registered mail that it intends to suspend or revoke. The notice shall state the reason(s) for the proposed suspension or revocation, provide Permittee an opportunity to correct any deficiency before CDFW suspends or revokes the Agreement, and include instructions to Permittee, if necessary, including but not limited

to a directive to immediately cease the specific activity or activities that caused CDFW to issue the notice.

ENFORCEMENT

Nothing in the Agreement precludes CDFW from pursuing an enforcement action against Permittee instead of, or in addition to, suspending or revoking the Agreement.

Nothing in the Agreement limits or otherwise affects CDFW's enforcement authority or that of its enforcement personnel.

OTHER LEGAL OBLIGATIONS

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from obtaining any other permits or authorizations that might be required under other federal, state, or local laws or regulations before beginning the Project or an activity related to it.

This Agreement does not relieve Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, from complying with other applicable statutes in the FGC including, but not limited to, FGC sections 2050 *et seq.* (threatened and endangered species), 3503 (bird nests and eggs), 3503.5 (birds of prey), 5650 (water pollution), 5652 (refuse disposal into water), 5901 (fish passage), 5937 (sufficient water for fish), and 5948 (obstruction of stream).

Nothing in the Agreement authorizes Permittee or any person acting on behalf of Permittee, including its officers, employees, representatives, agents, or contractors and subcontractors, to trespass.

AMENDMENT

CDFW may amend the Agreement at any time during its term if CDFW determines the amendment is necessary to protect an existing fish or wildlife resource.

Permittee may amend the Agreement at any time during its term, provided the amendment is mutually agreed to in writing by CDFW and Permittee. To request an amendment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the corresponding amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

TRANSFER AND ASSIGNMENT

This Agreement may not be transferred or assigned to another entity, and any purported transfer or assignment of the Agreement to another entity shall not be valid or effective, unless the transfer or assignment is requested by Permittee in writing, as specified below, and thereafter CDFW approves the transfer or assignment in writing.

The transfer or assignment of the Agreement to another entity shall constitute a minor amendment, and therefore to request a transfer or assignment, Permittee shall submit to CDFW a completed CDFW "Request to Amend Lake or Streambed Alteration" form and include with the completed form payment of the minor amendment fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5).

EXTENSIONS

In accordance with FGC section 1605(b), Permittee may request one extension of the Agreement, provided the request is made prior to the expiration of the Agreement's term. To request an extension, Permittee shall submit to CDFW a completed CDFW "Request to Extend Lake or Streambed Alteration" form and include with the completed form payment of the extension fee identified in CDFW's current fee schedule (see Cal. Code Regs., tit. 14, § 699.5). CDFW shall process the extension request in accordance with FGC 1605(b) through (e).

If Permittee fails to submit a request to extend the Agreement prior to its expiration, Permittee must submit a new notification and notification fee before beginning or continuing the Project the Agreement covers (FGC section 1605(f)).

EFFECTIVE DATE

The Agreement becomes effective on the date of CDFW's signature, which shall be: 1) after Permittee's signature; 2) after CDFW complies with all applicable requirements under the California Environmental Quality Act (CEQA); and 3) after payment of the applicable FGC section 711.4 filing fee listed at http://www.wildlife.ca.gov/habcon/ceqa/ceqa_changes.html.

TERM

This Agreement shall expire on **May 18, 2019**, unless it is terminated or extended before then. All provisions in the Agreement shall remain in force throughout its term. Permittee shall remain responsible for implementing any provisions specified herein to protect fish and wildlife resources after the Agreement expires or is terminated, as FGC section 1605(a) (2) requires.

AUTHORITY

If the person signing the Agreement (signatory) is doing so as a representative of Permittee, the signatory hereby acknowledges that he or she is doing so on Permittee's

behalf and represents and warrants that he or she has the authority to legally bind Permittee to the provisions herein.

AUTHORIZATION

This Agreement authorizes only the Project described herein. If Permittee begins or completes a Project different from the Project the Agreement authorizes, Permittee may be subject to civil or criminal prosecution for failing to notify CDFW in accordance with FGC section 1602.

CONCURRENCE

The undersigned accepts and agrees to comply with all provisions contained herein.

FOR CALIFORNIA DEPARTMENT OF TRANSPORTATION

Scott Quinnell — 6-19-14

Scott Quinnell
Senior Environmental Planner

Date

FOR DEPARTMENT OF FISH AND WILDLIFE

Heidi Sickler — 6/27/14

for Leslie MacNair
Environmental Program Manager

Date

Prepared by: Nick Buckmaster
Environmental Scientist

MEMORANDUM

TO: Scott Quinnell
California Department of Transportation, District 8
464 W. 4th Street, 6th Floor, MS 822
San Bernardino, CA 92401-1400
Email: scott_quinnell@dot.ca.gov

Patty Z Kouyoumdjian

FROM: PATTY Z. KOUYOUMDJIAN, EXECUTIVE OFFICER
LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD

DATE: June 30, 2014

SUBJECT: **AMENDED ORDER NO. R6V-2014-0053A1, FOR CLEAN WATER ACT SECTION 401 WATER QUALITY CERTIFICATION, INTERSTATE 15 MOJAVE RIVER INTERCHANGE RECONSTRUCTION PROJECT, SAN BERNARDINO COUNTY, WDID NO. 6B361402003**

The California Regional Water Quality Control Board, Lahontan Region (Water Board) issued a Clean Water Act (CWA) Section 401 Order for Water Quality Certification (WQC) to the California Department of Transportation (Applicant) for the above-referenced project (Project) on June 27, 2014. On June 30, 2014, Water Board staff received from the Applicant information that included: 1) a request to amend the WQC to modify the Project's permanent and temporary impacts to waters of the U.S. based on information contained in the Alternatives Analysis Report; and 2) a revised Habitat Mitigation Monitoring Plan (HMMP) that references the corrected permanent and temporary impacts to waters of the U.S. This amendment modifies the proposed Project impacts and corrects the reference to the HMMP, as presented in the Order. The Waste Discharge Identification (WDID) No. previously assigned, WDID No. 6B361402003, is retained for this amendment. Please reference this WDID number in all future correspondence regarding this Project.

Any person aggrieved by this action of the Water Board may petition the State Water Resources Control Board (State Water Board) to review the action in accordance with California Water Code (CWC), section 13320, and California Code of Regulations (CCR), title 23, sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., 30 days after the date of this Order, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day.

Copies of the law and regulations applicable to filing petitions may be found on the internet at http://www.waterboards.ca.gov/public_notices/petitions/water_quality, or will be provided upon request.

PROJECT DESCRIPTION

Details regarding the Project are provided in the Table of Project Information. Changes from the original Project are ~~strikethrough~~ for deletions and **bold underline** for additions.

Table of Project Information:

WDID Number	6B361402003
Applicant	California Department of Transportation, District 8 464 W. 4th Street, 6th Floor, MS 822 San Bernardino, CA 92401-1400 Contact: Scott Quinnell
Agent	Josh Jaffery, California Department of Transportation
Project Name	Interstate 15 Mojave River Interchange Reconstruction Project
Project Purpose and Description	The Project is to widen and improve the existing Interstate 15 (I-15) between Mojave Drive and Stoddard Wells Road to meet current highway standards and improve operational characteristics and public safety. Project components include: reconstruction and relocation of several interchanges; widening of the existing I-15 bridge over the Mojave River; construction of a frontage road and bridge over the Mojave River west of I-15; realignment of the existing frontage road east of I-15; and upgrading the existing onsite and offsite drainage facilities to accommodate Project components.
Project Type	Transportation, Roads and Highways
Project Address or other Locating Information	Interstate 15 from Mojave Drive to Stoddard Wells Road, Victorville, San Bernardino County
Latitude/Longitude	Latitude: 34.55168 Longitude: -117.29272 (center) Latitude: 34.52909 Longitude: -117.31572 (Mojave Drive) Latitude: 34.55435 Longitude: -117.28937 (Stoddard Wells Road)
Hydrologic Unit(s)	Mojave Hydrologic Unit 628.00, Upper Mojave Hydrologic Area 628.20
Project Area	240 acres
Receiving Water(s) Name	Mojave River
Water Body Type(s)	Intermittent stream, minor wetlands
Designated Beneficial Uses	MUN, AGR, GWR, FRSH, REC-1, REC-2, COMM, WARM, COLD, WILD, RARE, WQE, FLD
Potential Water Quality Impacts to Waters of the United States (WOUS)	Permanent hydrogeomorphic changes in the flow regime on the Project site may result in downstream erosion, sedimentation, and/or siltation.

Table of Project Information:

Project Impacts (Fill) to WOUS	**Waterbody Type**	**Permanent**			**Temporary**		
		Acres	Linear Feet	Cubic Yards	Acres	Linear Feet	Cubic Yards
	Stream	~~0.14~~ **0.233**	2,698	1,834	~~2.368~~ **2.129**	1,318	6,510
	Wetland	0.009	-	1,147	0.13	-	0
Federal Permit(s)	The Applicant has applied for coverage under a U.S. Army Corps of Engineers (USACOE) Individual Permit (SPL-2013-00081) pursuant to section 404 of the CWA.						
Non-Compensatory Mitigation	During construction, the Applicant will follow Best Management Practices (BMPs) including construction storm water controls designed to minimize the short-term degradation of water quality.						
Compensatory Mitigation	To compensate for Project impacts to WOUS, the Applicant will implement the **revised** Habitat Mitigation and Monitoring Plan (HMMP) ~~dated June 17, 2014~~ **submitted on June 30, 2014**. The HMMP includes the acquisition, preservation, and enhancement of waters in the Cronese Hydrologic Sub Area (628.72) of the greater Mojave Watershed. A minimum of 5.2 acres of waters will be preserved and enhanced. Implementation of the offsite mitigation will be concurrent with construction of the Project. Onsite mitigation includes recontouring of temporary impact areas to match pre-Project conditions once construction is complete. Qualitative and quantitative monitoring of the mitigation will occur over a period of no less than 10 years. Reports documenting the success of the mitigation will be submitted to the Water annually for the first two years of monitoring, then biannually (every two years) after that for a minimum of 10 years or until the success criteria outlined in the HMMP have been met. The first monitoring report is due on December 31, 2015.						
Applicable Fees	$50,160 ($1,097 base fee + [4,016 linear feet of permanent and temporary stream impacts x $10.97 per linear foot of discharge] + [0.139 acres of wetland impact x $4,717 per acre of discharge] + $4,352 ambient surcharge);[1] fees calculated based on impacts to federal waters; **minor Project changes for amended WQC, therefore no additional fee required.**						
Fees Received	$ 50,160						

[1]Discharge fees shall not exceed $68,558, plus any applicable surcharges; the ambient surcharge is 9.5% of the sum of the base fee plus the discharge fee.

Additional Conditions

Changes to pertinent Additional Conditions are ~~strikethrough~~ for deletions and **bold underline** for additions.

1. To compensate for Project impacts to WOUS, the Applicant will implement the **revised** HMMP ~~dated June 17, 2014~~ **submitted on June 30, 2014**. The HMMP

includes the acquisition, preservation, and enhancement of waters in the Cronese Hydrologic Sub Area (628.72) of the greater Mojave Watershed. A minimum of 5.2 acres of waters will be preserved and enhanced. Onsite mitigation includes recontouring of temporary impact areas to match pre-Project conditions once construction is complete. Implementation of the offsite mitigation will be concurrent with construction of the Project. Qualitative and quantitative monitoring of the mitigation will occur over a period of no less than 10 years. Reports documenting the success of the mitigation will be submitted to the Water Board annually for the first two years of monitoring, then biannually (every two years) after that for a minimum of 10 years or until the success criteria outlined in the HMMP have been met. The first monitoring report is due on December 31, 2015.

All other conditions and requirements of the original Order (enclosed) remain in effect. We look forward to working with you in your efforts to protect water quality. If you have any questions, please contact Jan Zimmerman, Engineering Geologist, at (760) 241-7376 (jzimmerman@waterboards.ca.gov), or Patrice Copeland, Senior Engineering Geologist, at (760) 241-7404 (pcopeland@waterboards.ca.gov). Please use the WDID in the subject line for future correspondence concerning this project.

Enclosure: WQC ORDER NO. R6V-2014-0053 (JUNE 27, 2014)

cc: Josh Jaffery, California Department of Transportation
(via email, josh.jaffery@dot.ca.gov)
Veronica Chan, U.S. Army Corps of Engineers
(via email, Veronica.C.Chan@usace.army.mil)
Nick Buckmaster, California Department of Fish and Wildlife
(via email, Nick.Buckmaster@wildlife.ca.gov)
SWRCB, Division of Water Quality
(via email, stateboard401@waterboards.ca.gov)

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DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT, U.S. ARMY CORPS OF ENGINEERS
915 WILSHIRE BOULEVARD, SUITE 930
LOS ANGELES, CA 90017-3401

June 26, 2014

Scott Quinnell
California Department of Transportation, District 8
Senior Environmental Planner 464 West 4th Street Fl 6, MS-822
San Bernardino, California 92401-1400

Dear Mr. Quinnell:

This correspondence is in reply to your application (File No. SPL-2013-00081-VCC), dated June 17, 2014, for a Department of the Army Permit. Your proposed project, Interstate 15 Mojave River Interchange Reconstruction Project, would result in discharges of permanent fill into approximately 0.01 acre of wetland and 0.14 acre of non-wetland waters of the U.S. and temporary fill into approximately 0.13 acre of wetland and 2.37 acres of non-wetland waters of the U.S. Therefore, pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344; 33 C.F.R. parts 323 and 330), your proposed project requires a Department of the Army permit. The proposed work would take place within the Mojave River and several unnamed tributaries, within the City of Victorville, San Bernardino County, California.

Enclosed is a "Provisional Permit." This provisional permit is NOT VALID and does not constitute authorization for you to do work. The provisional permit describes the work that will be authorized, including general and special conditions which will be placed on your final DA permit, if you receive a Section 401 water quality certification from the California Regional Water Quality Control Board (RWQCB). No work is to be performed until you have received a validated copy of the DA permit.

By Federal law, no DA permit can be issued until a Section 401 water quality certification has been issued or waived by the RWQCB. This requirement can be satisfied by obtaining 401 certification/waiver or providing evidence that 60 days have passed since you submitted a valid application to the RWQCB for certification. Be aware that any conditions placed on your 401 certification will become conditions of your DA permit, unless the U.S. Army Corps of Engineers (Corps) deems these conditions to be either unreasonable or unenforceable.

WHEN YOU RECEIVE SECTION 401 CERTIFICATION/WAIVER, THE FOLLOWING STEPS NEED TO BE COMPLETED:

1. **The owner or authorized responsible official must sign and date both copies of the provisional permit indicating that he/she agrees to comply with all conditions stated in the permit.**

2. **The signer's name and title (if any) must be typed or printed below the signature.**

3. **Both signed copies of the provisional permit must be returned to the Corps at the above address (Attention: CESPL-RG).**

4. The Section 401 certification must be sent to the Corps with the signed copies of the provisional permit.

Should the Section 401 certification contain conditions which might result in a modification to the provisional permit, by signing and dating both copies of the provisional permit and returning them to the Corps (along with the appropriate permit fee and Section 401 certification), I will assume you agree to comply with all Section 401 certification conditions which are added to the provisional permit.

Should the RWQCB deny the required certification, then the DA permit is considered denied without prejudice. If you subsequently obtain Section 401 certification, you should contact Veronica Chan to determine how to proceed with your permit application.

Thank you for participating in the Regulatory Program. If you have any questions, please contact Veronica Chan at 213-452-3292 or via e-mail at Veronica.C.Chan@usace.army.mil. Please complete the customer survey form at http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey, which would help me to evaluate and improve the regulatory experience for others.

Sincerely,

Mark D. Cohen
Deputy Chief, Regulatory Division

Enclosures

DEPARTMENT OF THE ARMY PERMIT

Permittee: California Department of Transportation, District 8 (POC: Scott Quinnell)

Permit Number: SPL-2013-00081-VCC

Issuing Office: Los Angeles District

Note: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: Caltrans proposes to discharge permanent fill into approximately 0.01 acre of wetland and 0.14 acre of non-wetland waters of the U.S. and temporary fill into approximately 0.13 acre of wetland and 2.37 acres of non-wetland waters of the U.S. Therefore, authorization is required pursuant to section 404 of the Clean Water Act (33 U.S.C. 1344; 33 C.F.R. parts 323 and 330), in association with constructing the Interstate 15 Mojave River Reconstruction Project, as shown on the attached drawings.

Specifically, you are authorized to:

1. Discharge permanent fill material into approximately 0.01 acre of wetland and 0.14 acre of non-wetland waters of the U.S. and discharge temporary fill material into approximately 0.13 acre of wetland and 2.37 acres of non-wetland waters of the U.S., in association with widening the I-15 freeway and reconstructing the Stoddard Wells Road, D Street, and E Street Interchanges and constructing a new frontage road west of I-15 connecting E Street to Stoddard Wells Road. Please refer to the attached maps, for locations of permanent impacts to waters of the U.S. Corps-regulated activities include the following:

   - Extend the existing I-15 Mojave River Bridge piers and abutments in order to upgrade the I-15 north and southbound lanes, median, and shoulders to Caltrans' current design standards and widen the bridge to accommodate auxiliary lanes and one lane.
   - Extend or realign existing culverts and drainages in order to accommodate the I-15 improvements, reconstruct Stoddard Wells Road interchange into a diamond interchange, reconstruct D and E Street interchanges, and construct a new frontage road west of I-15 to provide southbound freeway access for E Street via Stoddard Wells Road interchange.

- Construct a new bridge with piers within the Mojave River for the new frontage road that would provide access for E Street via the Stoddard Wells Road interchange.
- Temporarily dewater and construct trestles within the Mojave River for construction and equipment access to the bridges and piers.
- Add temporary equipment and access roads during construction to construct roadway, extend culverts, build bridges, and piers.

Project Location: Mojave River and several unnamed tributaries within the City of Victorville, San Bernardino County, California.

Permit Conditions:

General Conditions:

1. **The time limit for completing the authorized activity ends on _____.** If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification from this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished with the terms and conditions of your permit.

Special Conditions:

1. The Permittee shall abide by the terms and conditions of the Clean Water Act (CWA) section 401 Water Quality Standards Certification.

2. At least thirty (30) days prior to initiating construction in waters of the U.S., the Permittee shall submit to the Corps Regulatory Division a complete set of final detailed grading/construction plans showing all work and structures in waters of the U.S., including dewatering plans. All plan sheets shall be signed, dated, and submitted electronically or on paper no larger than 11x 17 inches. No work in waters of the U.S. is authorized until the Permittee receives, in writing (by letter or e-mail), Corps Regulatory Division approval of the final detailed grading/construction plans. The Permittee shall ensure that the project is built in accordance with the Corps-approved plans.

3. No debris, soil, silt, sand, rubbish, cement or concrete washings thereof, oil or petroleum products or washings thereof, shall be allowed to enter into or placed where it may be washed by rainfall or runoff into the waterway. When project operations are completed, any and all excess construction materials, debris, and or other associated excess project materials shall be removed to an appropriate off-site location outside of any waters of the U.S.

4. The Permittee shall clearly mark the limits of the workspace with flagging or similar means to ensure mechanized equipment does not enter avoided waters of the U.S. areas shown in the attached figures. Adverse impacts to waters of the U.S. beyond the Corps Regulatory Division-approved construction footprint are not authorized. Such impacts could result in permit suspension and revocation, administrative, civil or criminal penalties, and/or substantial, additional, compensatory mitigation requirements.

5. Upon project completion, all temporary fills shall be removed and all temporarily affected wetland and non-wetland waters of the U.S. and adjacent slopes shall be re-contoured to natural streambed conditions.

6. The Permittee has proposed to mitigate for impacts to waters of the U. S. through implementation of the final habitat mitigation and monitoring plan (HMMP): "Habitat Mitigation and Monitoring Plan for the Interstate Mojave River Interchange Reconstruction Project" (dated June 2014, and prepared by AMEC Environment & Infrastructure, Inc.) to enhance 3.88 acres of non-wetland waters of the U.S. According to the final HMMP, responsible parties would be as follows: a) Implementation: California Department of Transportation District 8; b) Long-term management: California Department of Transportation District 8. The Permittee retains ultimate legal responsibility for meeting the requirements of the final HMMP (i.e., this is permittee-responsible mitigation). Detailed mitigation site information is described in the referenced HMMP. Any requirements for long-term management provisions are also described in the referenced HMMP, as well as in special conditions 6 and 7, below.

GIS DATA: Within 30 days following the date of this letter, the Permittee shall provide to the Corps Regulatory Division GIS data (polygons only) depicting the boundaries of all compensatory mitigation sites, as authorized in the final mitigation plan referenced above. All GIS data and associated metadata shall be provided by the Permittee on a digital medium (CD or DVD) or via file transfer protocol (FTP), preferably using the Environmental Systems Research Institute (ESRI) shapefile format. GIS data for mitigation sites shall conform to the data dictionary, as specified in the current Map and Drawing Standards for the Los Angeles District Regulatory Division, and shall include a text file of metadata, including datum, projection, and mapper contact information. Within 45 days following completion of compensatory mitigation construction activities, if any deviations have occurred, the Permittee shall submit as-built GIS data (polygons only) accompanied by a narrative description listing and explaining each deviation. All maps and drawings shall be in compliance with the Final Map and Drawing Standards for the Los Angeles District Regulatory Division dated August 6, 2012 (http://www.spl.usace.army.mil/Portals/17/docs/regulatory/Permit_Process/SPD-RG_map-drawing-standards_final_20120806v3.pdf).

7. At least 90 days prior to initiating construction in waters of the U.S., the Permittee shall submit a draft financial assurance ("financial assurance") to the Corps Regulatory Division for review and approval pertaining to the compensatory mitigation project. The financial assurance may be in the form of a performance bond, letter of credit, escrow account, or other appropriate instrument. The financial institution's credit rating shall be submitted to the Corps Regulatory Division for review to ensure a rating investment grade or higher. In consultation with the Permittee, the amount of the required financial assurance must be determined by the Corps Regulatory Division and will be based on the factors and costs specified in 33 CFR §332.3(n)(2). Prior to initiating construction in waters of the U.S., the Permittee shall post the financial assurance to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with applicable performance standards. An account statement or receipt of deposit shall be provided to the Corps Regulatory Division prior to work within waters of the U.S. The financial assurance shall be released only upon a determination by the Corps Regulatory Division that successful compensatory mitigation has been completed.

8. At least 90 days prior to initiating construction in waters of the U.S., the Permittee shall submit a draft long term management plan (LTMP) for the compensatory mitigation site prepared in accordance with the Corps' Los Angeles District Mitigation Guidelines and Monitoring Requirements, dated April 19, 2004, as amended, and the Mitigation Rule (33 C.F.R. Part 332; 73 FR 19670-19687 (April 10, 2008)). The draft LTMP shall be prepared in accordance with the final HMMP and reviewed by an approved long-term manager of the compensatory mitigation site. No work in waters of the U.S. is authorized until the Permittee receives, in writing (by letter or e-mail), Corps Regulatory Division approval of the LTMP. The Permittee shall provide long term financing (such as a non-wasting endowment) through a mechanism approved by the Corps Regulatory Division.

9. At least 90 days prior to initiating construction in waters of the U.S., the Permittee shall submit a draft Conservation Easement (CE) or other Corps-approved protection tool that has been

reviewed by the long-term manager of the compensatory mitigation site, for review and approval by the Corps Regulatory Division. Prior to completing activities associated with impacts to waters of the U.S. (which the Permittee has estimated as needing approximately 365 days to complete), the Permittee shall record the approved Conservation Easement (CE), or other Corps-approved protection tool, in a form approved by the Corps Regulatory Division, which shall run with the land, obligating the Permittee, its successors, and assigns to protect and maintain the minimum 3.88 acres of non-wetland waters of the U.S. as natural open space in perpetuity (as shown on the enclosed Figure 3). The CE must include a 3rd party easement holder qualified to hold easements pursuant to California Civil Code section 815.3 and Government Code section 65965. The Permittee must provide monies in the form of an endowment (endowment amount to be determined by Property Analysis Record or similar methodology) for the purposes of fulfilling the 3rd party easement holder's responsibilities under the CE. The site protection instrument shall preclude establishment of fuel modification zones, paved public trails, drainage facilities, walls, maintenance access roads and/or future easements, except as provided in the approved site protection instrument. Further, to the extent practicable, any such facilities outside the site protection instrument shall be sited to minimize indirect impacts on the enhanced/preserved waters of the U.S. and buffer habitat. The Permittee shall submit a draft long term management plan and a draft site protection instrument that has been reviewed by the long-term manager of the compensatory mitigation site, for review and approval by the Corps Regulatory Division. The long term management plan shall be incorporated as an attachment to the site protection instrument. The Permittee shall be responsible for long term financing (such as a non-wasting endowment) of the LTMP and conservation easement compliance activities. A draft long term financing mechanism shall be submitted to the Corps Regulatory Division for review concurrent with the draft CE. The Permittee shall receive written approval (by letter or e-mail) from the Corps Regulatory Division of the site protection instrument prior to it being executed and recorded. A recorded copy of the CE or other Corps-approved protection tool shall be furnished by the Permittee to the Corps Regulatory Division within one year after start of work within waters of the U.S.

GIS DATA: Concurrent with the submittal of the draft CE or other Corps-approved protection tool, the Permittee shall provide to the Corps Regulatory Division GIS data (polygons only) depicting the CE boundaries, as authorized by the Corps Regulatory Division. All GIS data and associated metadata shall be provided by the Permittee on a digital medium (CD or DVD) or via file transfer protocol (FTP), preferably using the Environmental Systems Research Institute (ESRI) shapefile format. GIS data for CE sites shall conform to the data dictionary, as specified in the current Map and Drawing Standards for the Los Angeles District Regulatory Division, and shall include a text file of metadata, including datum, projection, and mapper contact information.

10. Within 45 calendar days of completing authorized work in waters of the U.S., the Permittee shall submit to the Corps Regulatory Division a memo including the following:
    A) Date(s) work within waters of the U.S. was initiated and completed;
    B) Summary of compliance status with each special condition of this permit (including any noncompliance that previously occurred or is currently occurring and corrective actions completed or being taken to achieve compliance);

C) Color photographs taken at the project site before and after construction for those aspects directly associated with impacts to waters of the U.S.;
D) One copy of as-built drawings for the entire project (all sheets must be signed, dated, to-scale, and no larger than 8.5 x 11 inches); and
E) Signed Certification of Compliance.

11. This Corps permit does not authorize you to take any federally listed threatened or endangered species, in particular the least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and desert tortoise (*Gopherus agassizii*), or to adversely modify designated critical habitat for any federally listed species, including southwestern willow flycatcher. In order to legally take a listed species, you must have separate authorization under the Endangered Species Act (ESA) (e.g. ESA section 10 permit, or a Biological Opinion (BO) under ESA section 7, with "incidental take" provisions with which you must comply). Pursuant to the U.S. Fish and Wildlife Service (USFWS) correspondence, dated March 6, 2008, including the required avoidance and minimization measures, the Corps Regulatory Division has determined and the USFWS has concurred that your activity is not likely to adversely affect the above federally listed species or to adversely modify designated critical habitat. Your authorization under this Corps Regulatory Division permit is conditional upon your compliance with all of the required avoidance and minimization measures, which are incorporated by reference in this permit. Failure to comply with the required avoidance and minimization measures would constitute non-compliance with your Corps Regulatory Division permit. The Corps Regulatory Division and USFWS are the appropriate authorities to determine compliance with the avoidance and minimization measures and the ESA.

12. Pursuant to 36 C.F.R. section 800.13, in the event of any discoveries during construction of either human remains, archeological deposits, or any other type of historic property, the Permittee shall notify the Corps' Regulatory Division (Veronica Chan at 213-452-3292 or Stephanie Hall at 213-452-3410) and Archaeology staff (Steve Dibble at 213-452-3849 or John Killeen at 213-452-3861) within 24 hours. The Permittee shall immediately suspend all work within 100 feet of any area(s) where potential cultural resources are discovered. The Permittee shall not resume construction in the area surrounding the potential cultural resources until the Corps Regulatory Division re-authorizes project construction, per 36 C.F.R. section 800.13.

Further Information:

1. Congressional Authorities. You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the River and Harbor Act of 1899 (33 U.S.C. 403).

(X) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures

provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measure ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give you favorable consideration to a request for an extension of this time limit.

Your signature below, as Permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

PERMITTEE DATE

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Mark Cohen
Deputy Chief, Regulatory Division

DATE

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

TRANSFEREE DATE

LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

NOTIFICATION OF COMMENCEMENT OF WORK
FOR
DEPARTMENT OF THE ARMY PERMIT

Permit Number: *SPL-2013-00081-VCC*
Name of Permittee: *California Department of Transportation, District 8 (POC: Scott Quinnell)*
Date of Issuance:

Date work in waters of the U.S. will commence: _____
Estimated construction period (in weeks): _____
Name & phone of contractor (if any): _____

Please note that your permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to comply with this permit you may be subject to permit suspension, modification, or revocation.

I hereby certify that I, and the contractor (if applicable), have read and agree to comply with the terms and conditions of the above referenced permit.

_____ _____
Signature of Permittee Date

At least ten (10) days prior to the commencement of the activity authorized by this permit, sign this certification and return it using any ONE of the following three (3) methods:

(1) E-MAIL a statement including all the above information to: Veronica.C.Chan@usace.army.mil
OR
(2) FAX this certification, after signing, to: 213-452-4196
OR
(3) MAIL to the following address:

U.S. Army Corps of Engineers
Regulatory Division
ATTN: CESPL-RG-SPL-2013-00081-VCC
915 Wilshire Boulevard, Suite 930
Los Angeles, CA 90017-3401

LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

NOTIFICATION OF COMPLETION OF WORK AND CERTIFICATION OF COMPLIANCE WITH DEPARTMENT OF THE ARMY PERMIT

Permit Number: *SPL-2013-00081-VCC*
Name of Permittee: *California Department of Transportation, District 8 (POC: Scott Quinnell)*
Date of Issuance:

Date work in waters of the U.S. completed: _____
Construction period (in weeks): _____
Name & phone of contractor (if any): _____

Please note that your permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to comply with this permit you may be subject to permit suspension, modification, or revocation.

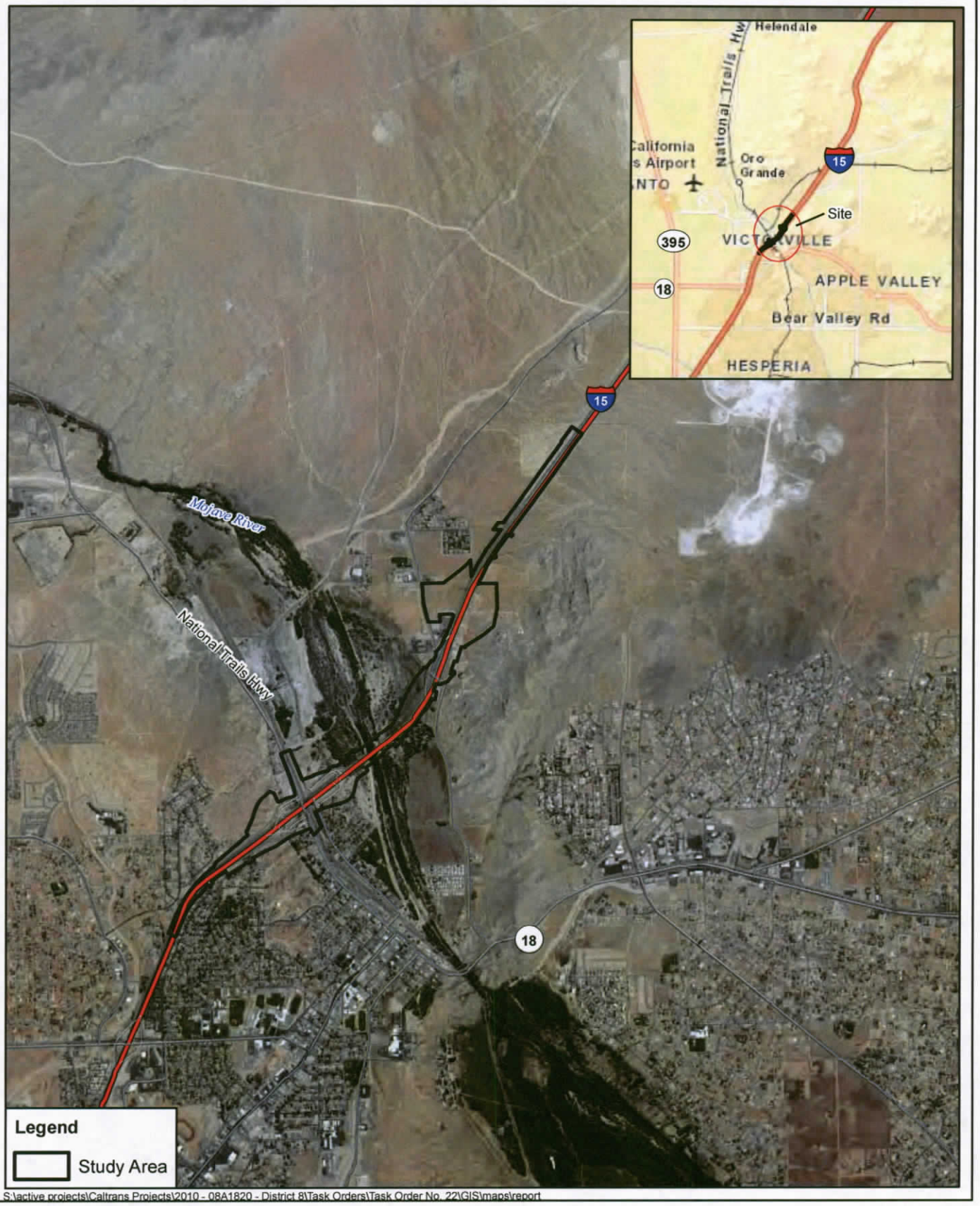
I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of said permit.

_____ _____
Signature of Permittee Date

Upon completion of the activity authorized by this permit, sign this certification and return it using any ONE of the following three (3) methods:

(1) E-MAIL a statement including all the above information to: Veronica.C.Chan@usace.army.mil
OR
(2) FAX this certification, after signing, to: 213-452-4196
OR
(3) MAIL to the following address:

U.S. Army Corps of Engineers
Regulatory Division
ATTN: CESPL-RG-SPL-2013-00081-VCC
915 Wilshire Boulevard, Suite 930
Los Angeles, CA 90017-3401



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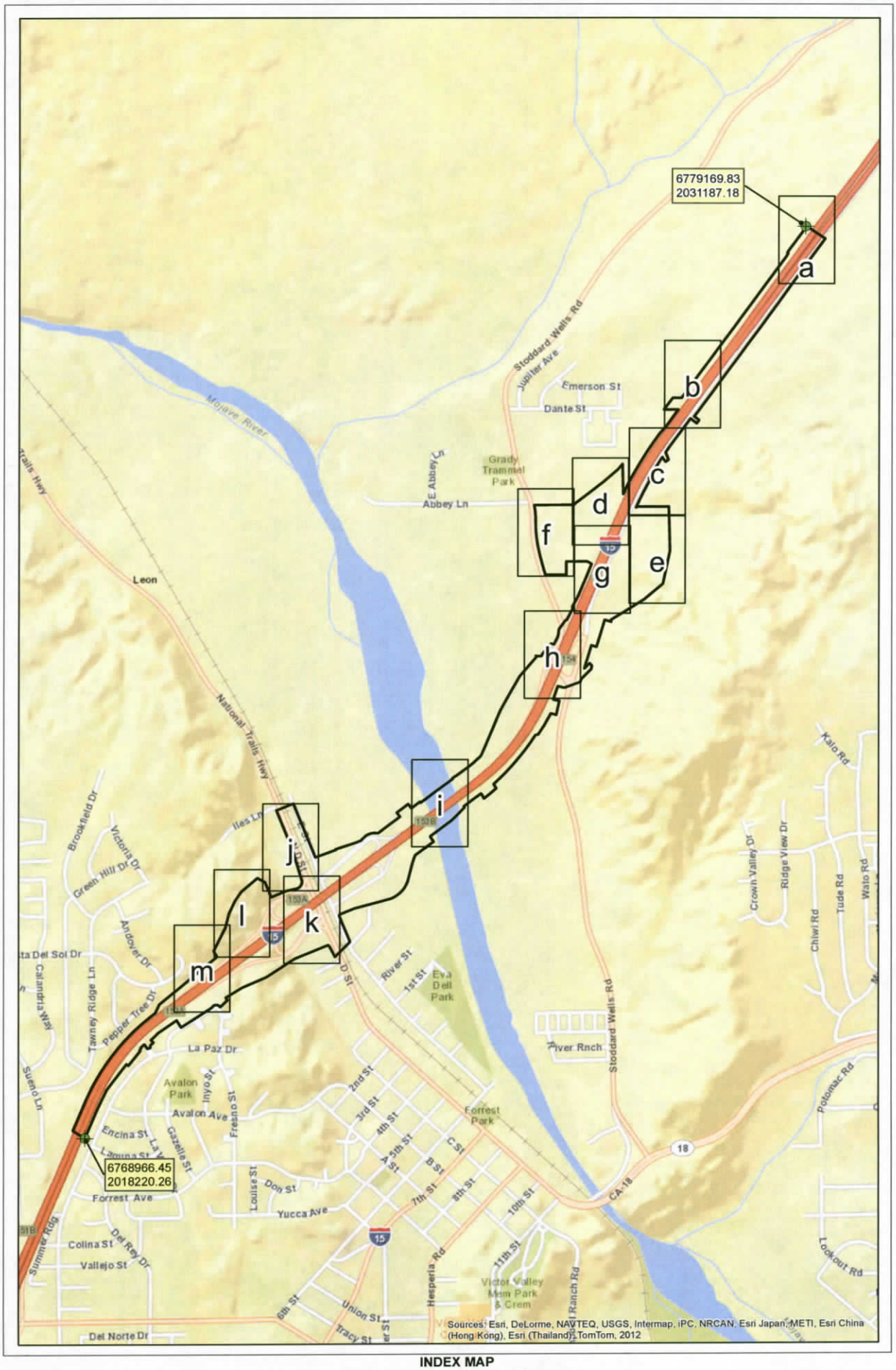
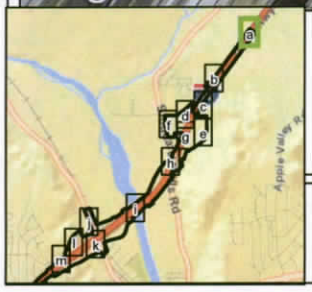
Regional Location
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

FIGURE
1



INDEX MAP
Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation



Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

Map Notes
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0 40 80
Feet
1 inch = 93 feet

FIGURE
1-a

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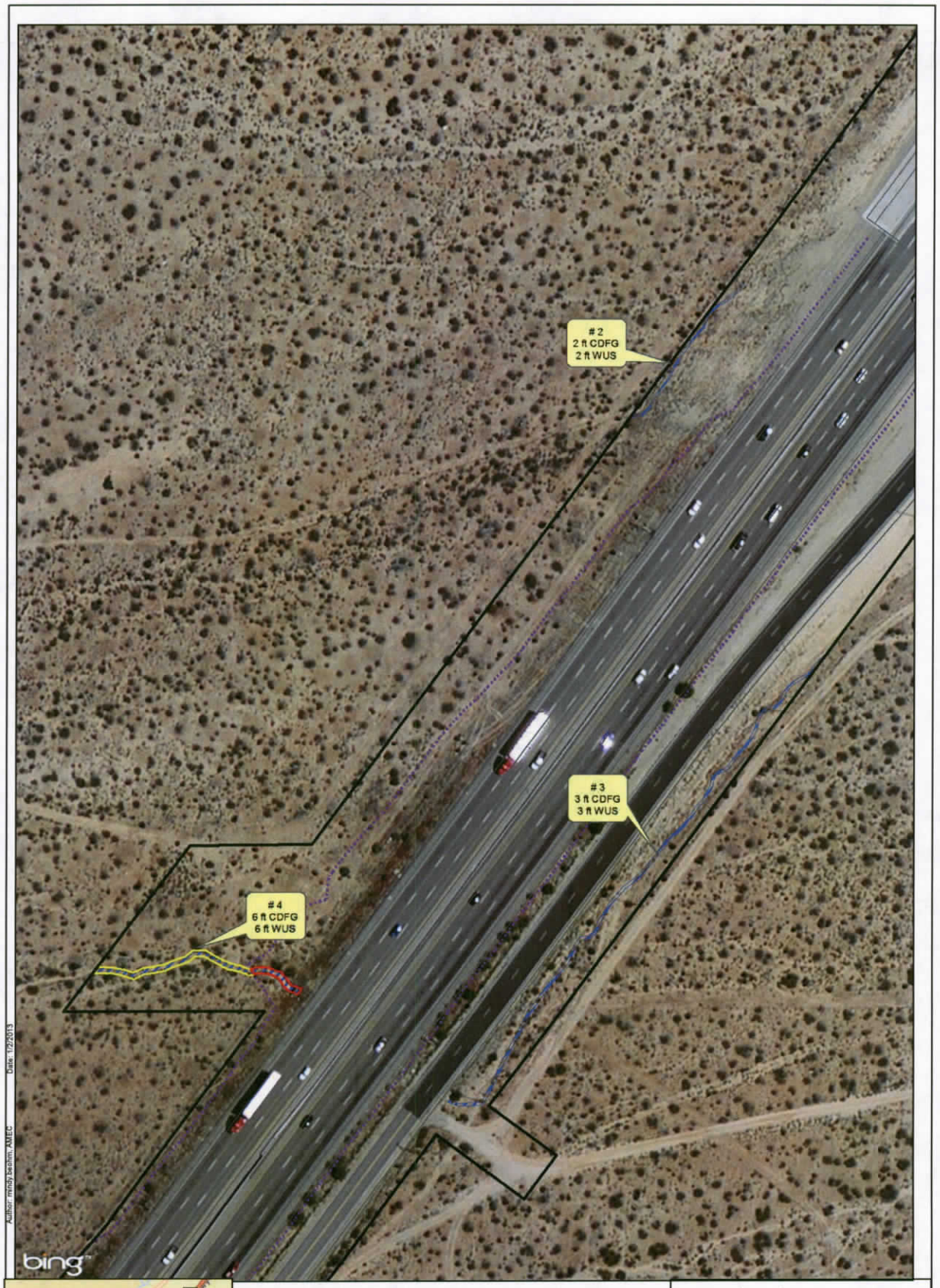
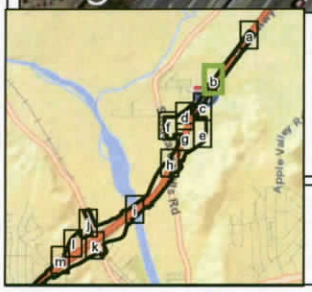
- Permanent Impacts
- Temporary Impacts
- Waters of the US & CDFG Jurisdiction
- USACE Wetlands & CDGF Jurisdication
- CDFG Jurisdiction Only
- Cut & Fill
- Culverts

Author: mindy.bechm, AMEC Date: 1/2/2013





Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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0 40 80
Feet
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FIGURE
1-b

Legend
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- CDFG Jurisdiction Only
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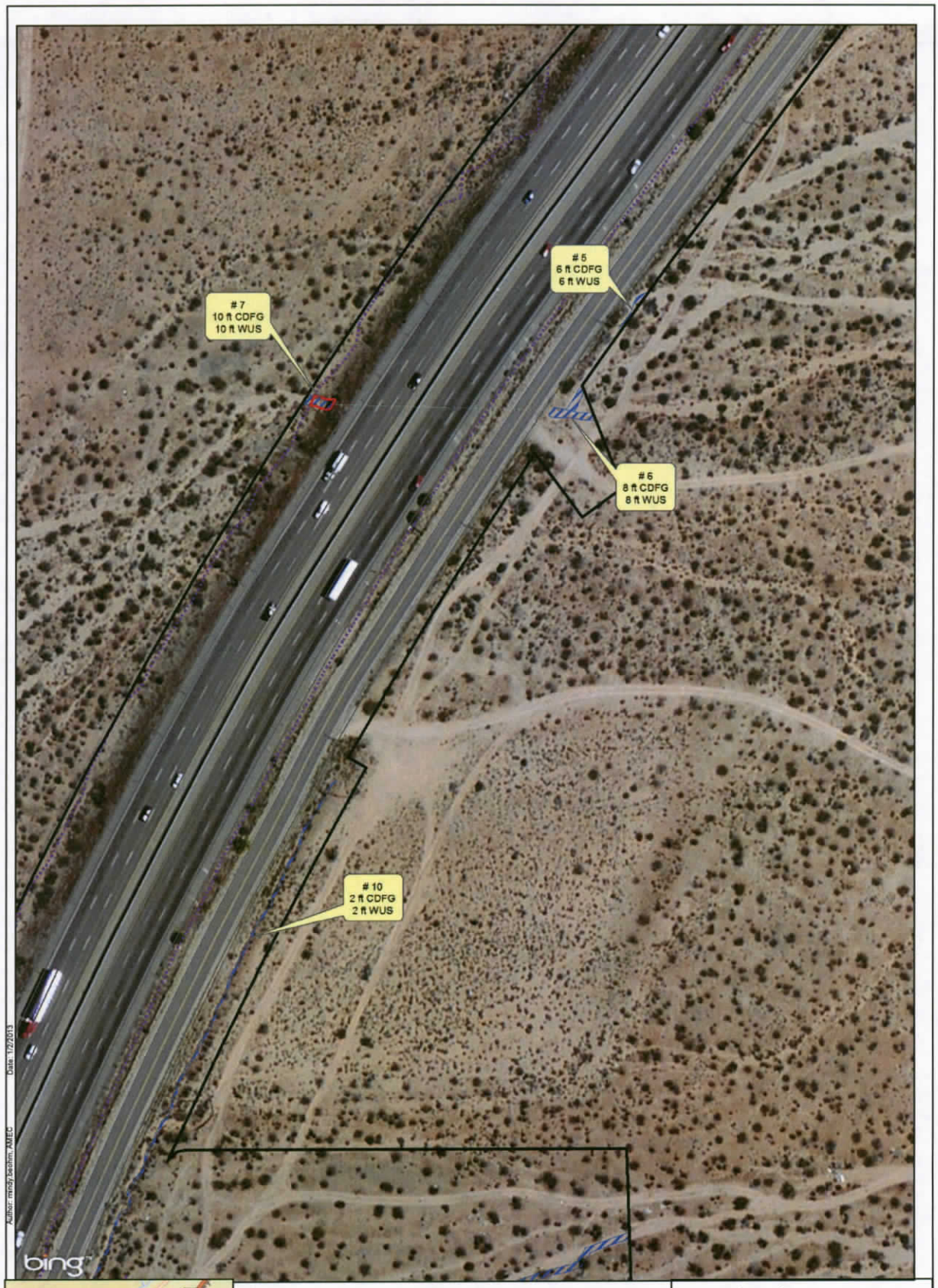
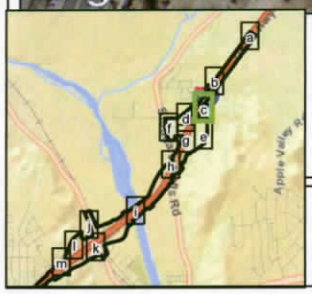
Author: mindy.beohm, AMEC
Date: 1/2/2013



Author: mindy.beohm, AMEC Date: 1/2/2013



Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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Feet
1 inch = 93 feet

FIGURE
1-c

Legend
- Caltrans Right-of-Way
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- Temporary Impacts
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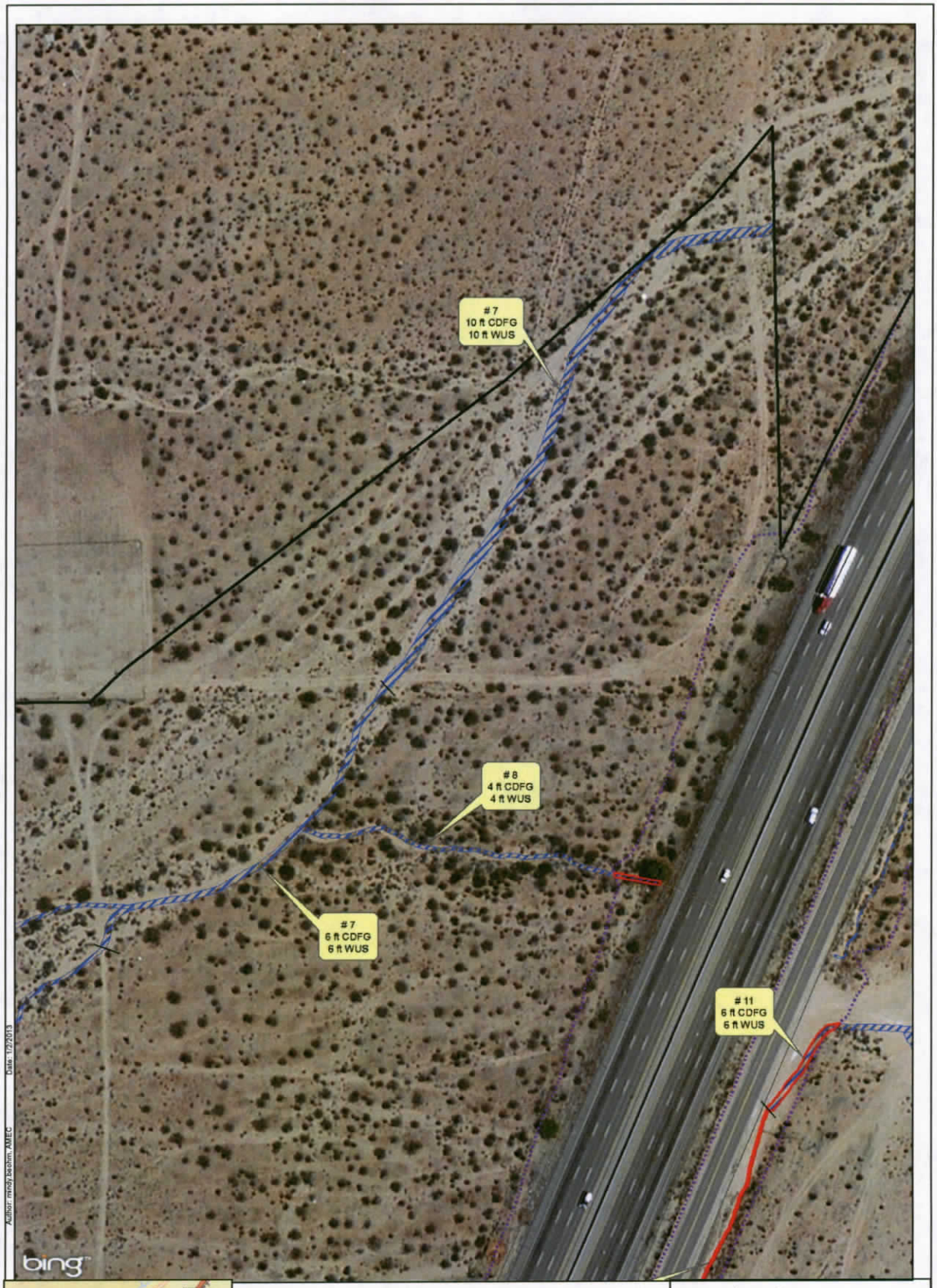

Author: mindy.beohm, AMEC Date: 1/2/2013

Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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Feet
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FIGURE
1-d

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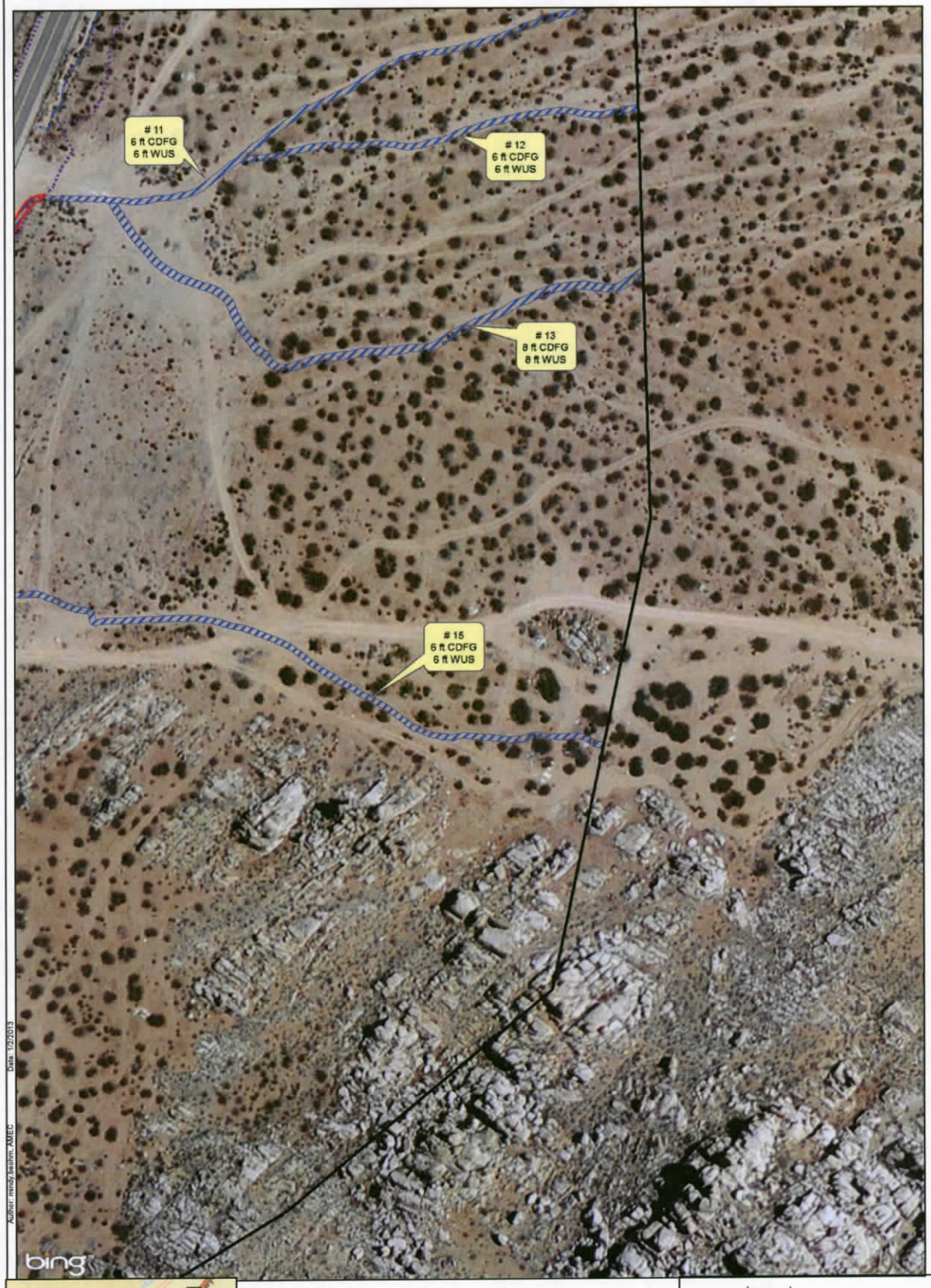
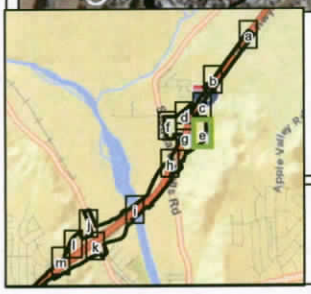


Author: mindy.bechm, AMEC Date: 1/2/2013



Impacts to Jurisdictional Waters
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California Department of Transportation

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0 40 80
Feet
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FIGURE
1-e

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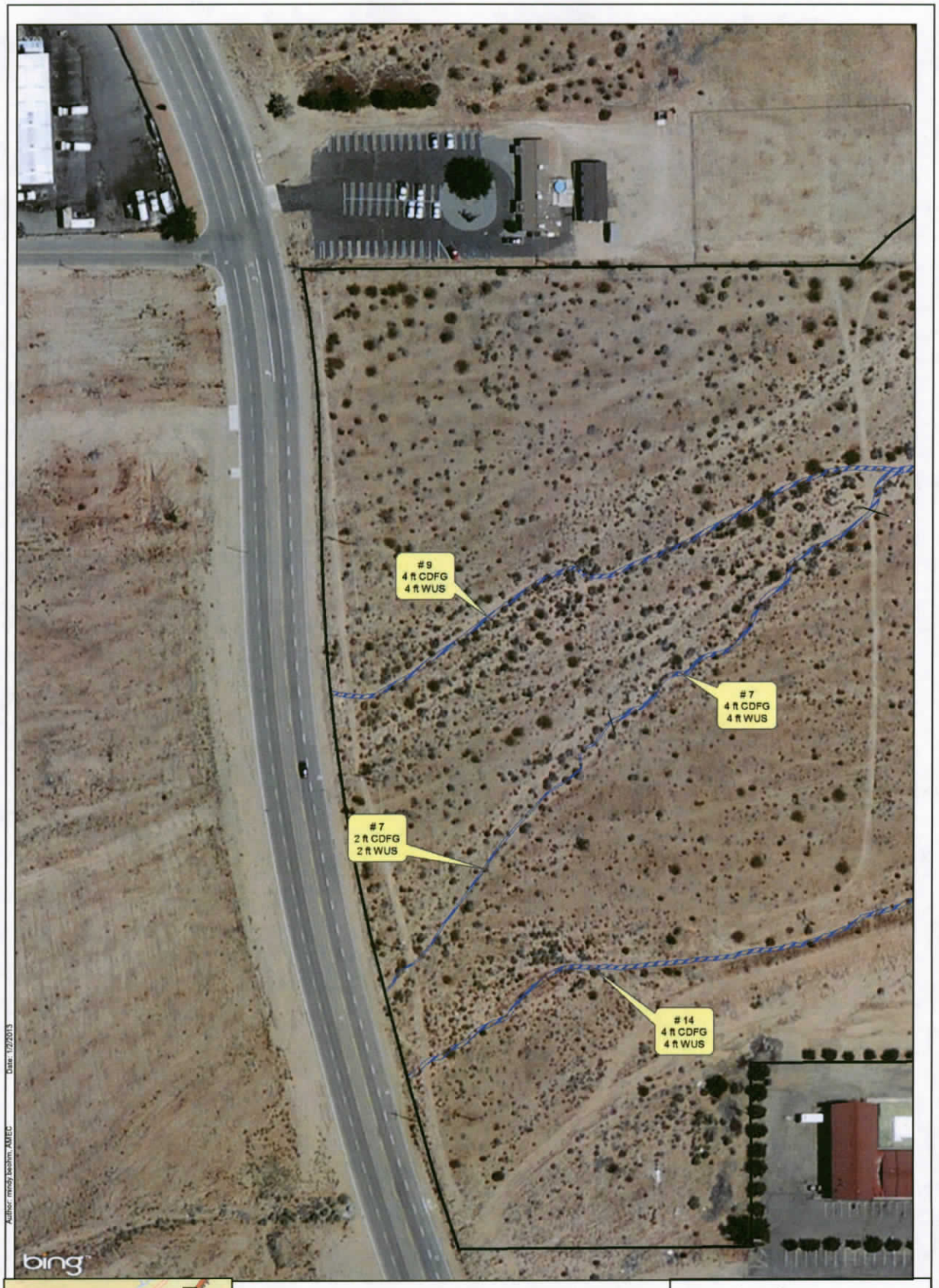

Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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FIGURE
1-f

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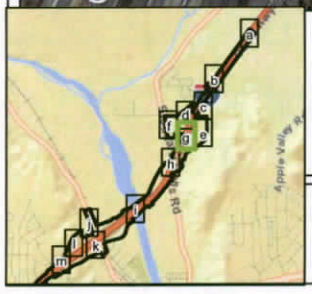
Author: mindy.lanham, AMEC
Date: 1/2/2013



Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
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FIGURE
1-g

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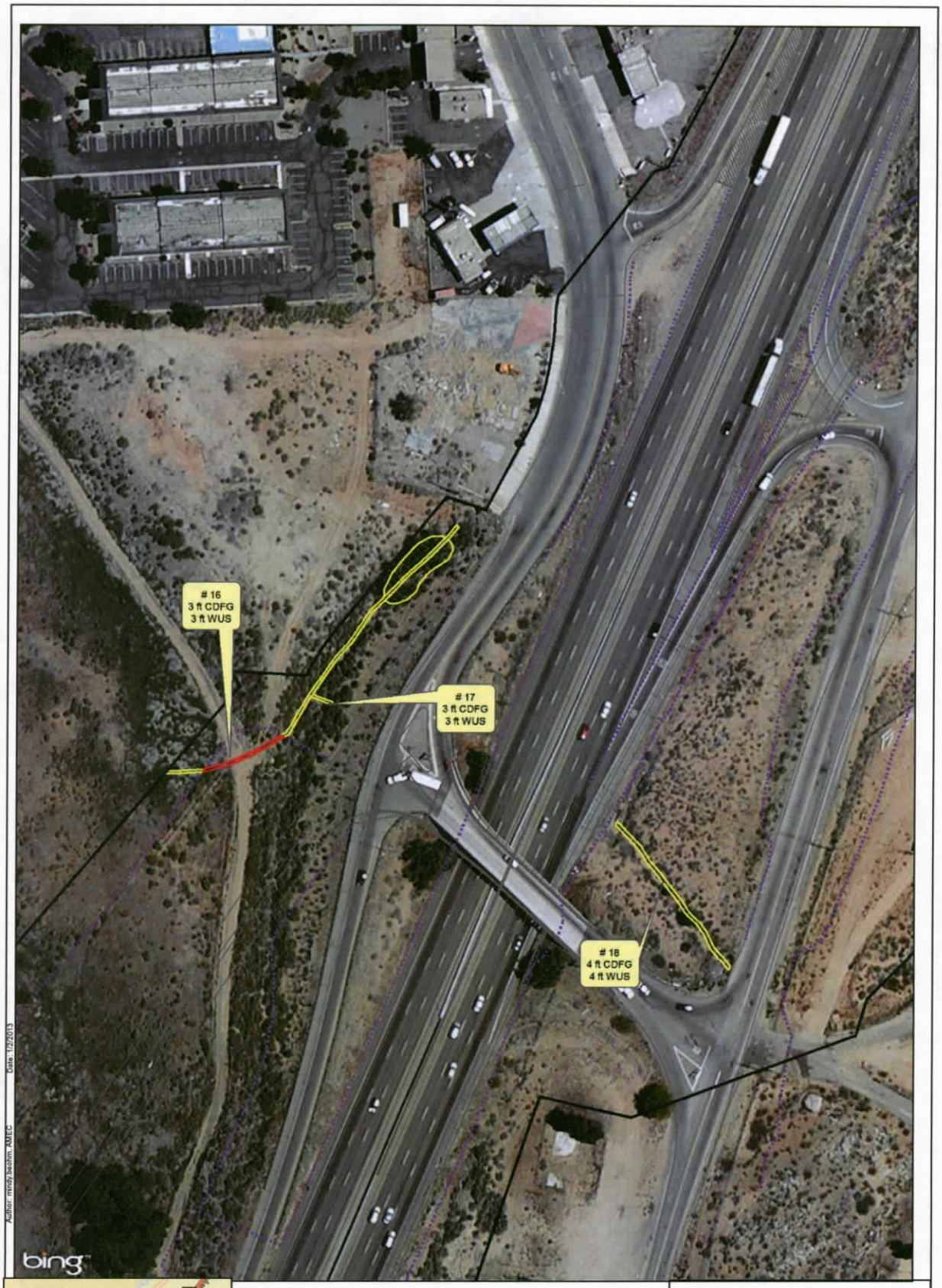
Author: mindy.bachm, AMEC Date: 1/2/2013



Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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FIGURE
1-h

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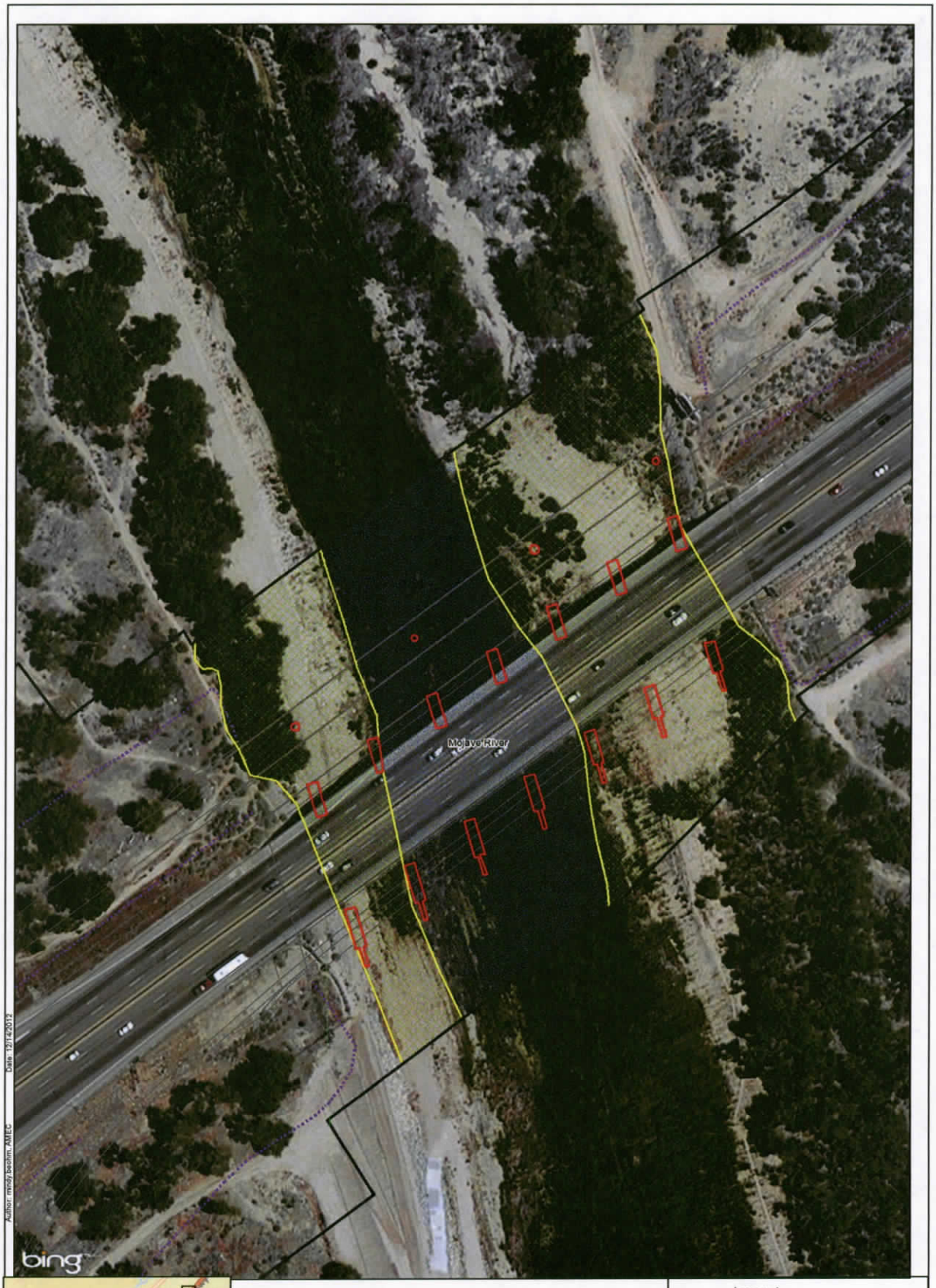
Author: mindy.bacon, AMEC
Date: 1/2/2013



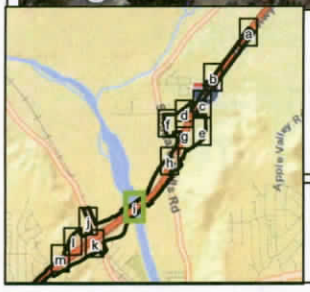


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FIGURE
1-i

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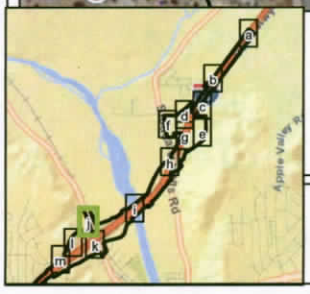
Author: mindy beohm, AMEC
Date: 12/14/2012



Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

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FIGURE
1-j

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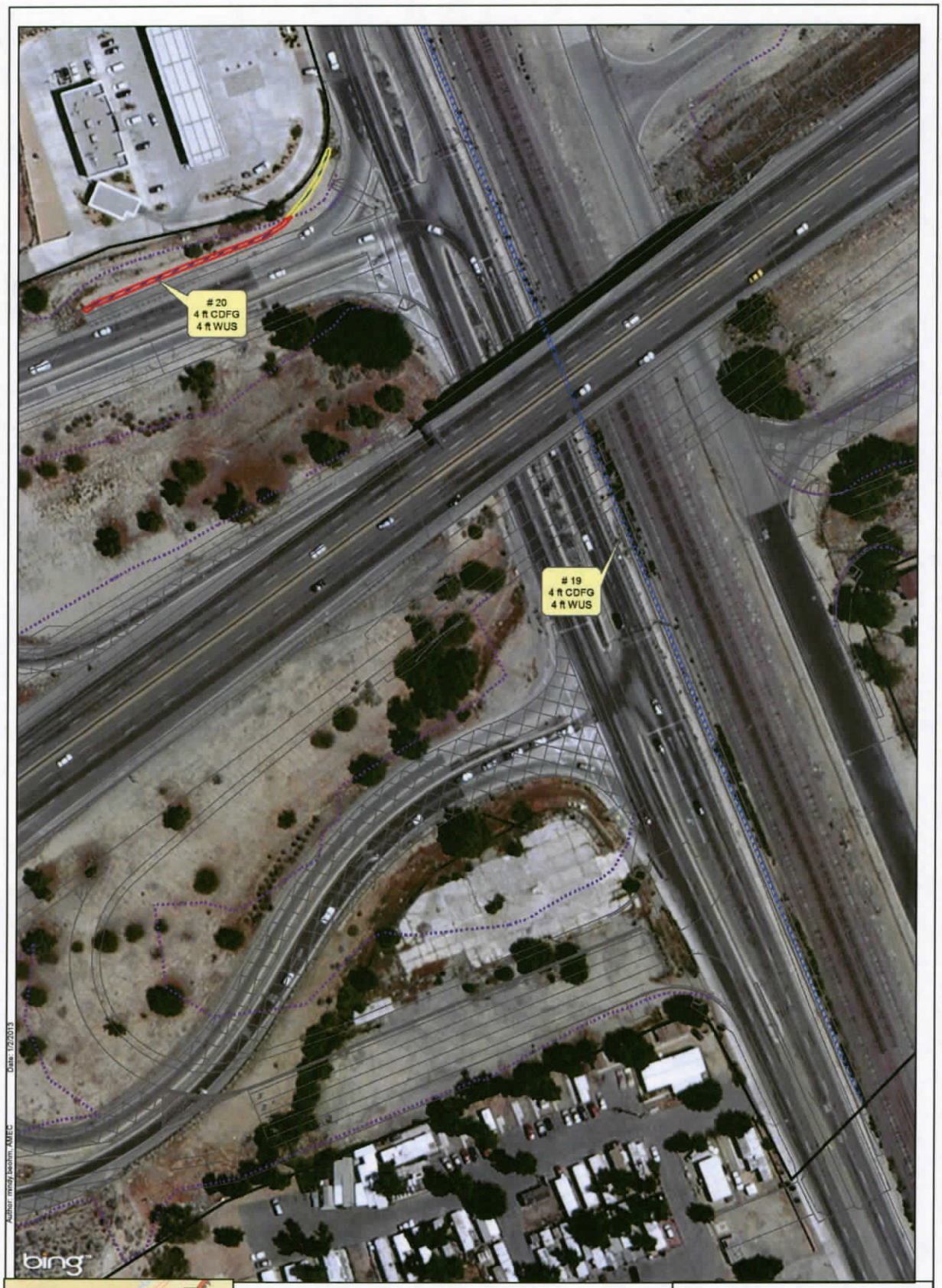
Author: mindy.beohm, AMEC
Date: 1/2/2013



Author: mindy.beahm, AECOM Date: 12/2/2013

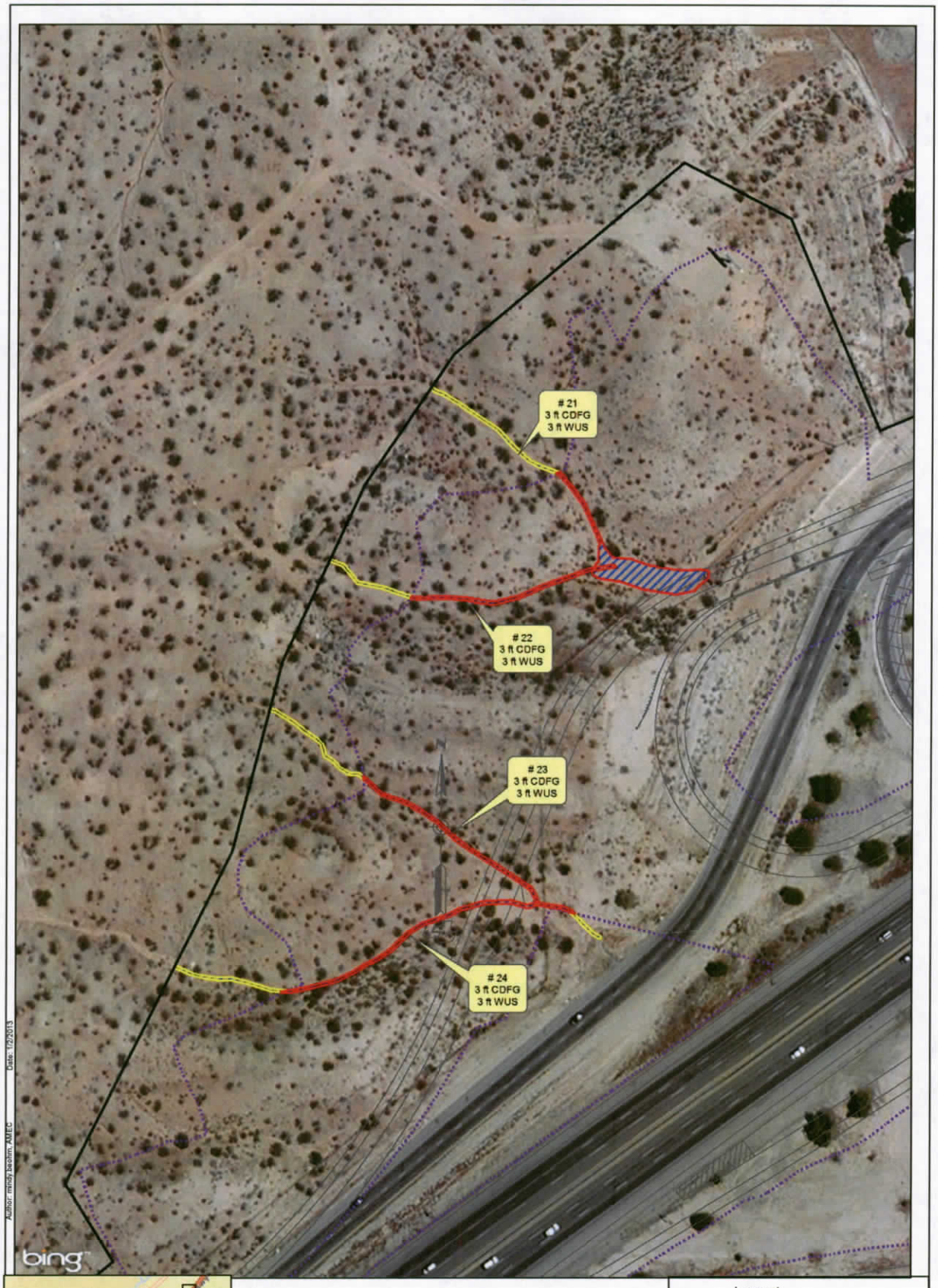
Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

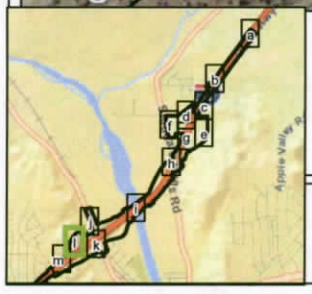
Map Notes
Location:\\RVS-FS1\RV\Share\active projects\
Caltrans Projects\2010 - 08A1820 - District 8\
Task Orders\Task Order No. 30\graphics\mxd,
Survey-Scot Chandler 5/1/12
Layout: D_I_layoutRD for consl V7.DGN
Cut&fill: slopelimitv7file.dgn
Projection: Cal state plan 405ft

0 40 80
Feet
1 inch = 93 feet

FIGURE
1-k

Legend
- Caltrans Right-of-Way
- Permanent Impacts
- Temporary Impacts
- Waters of the US & CDFG Jurisdiction
- USACE Wetlands & CDGF Jurisdication
- CDFG Jurisdiction Only
- Cut & Fill
- Culverts





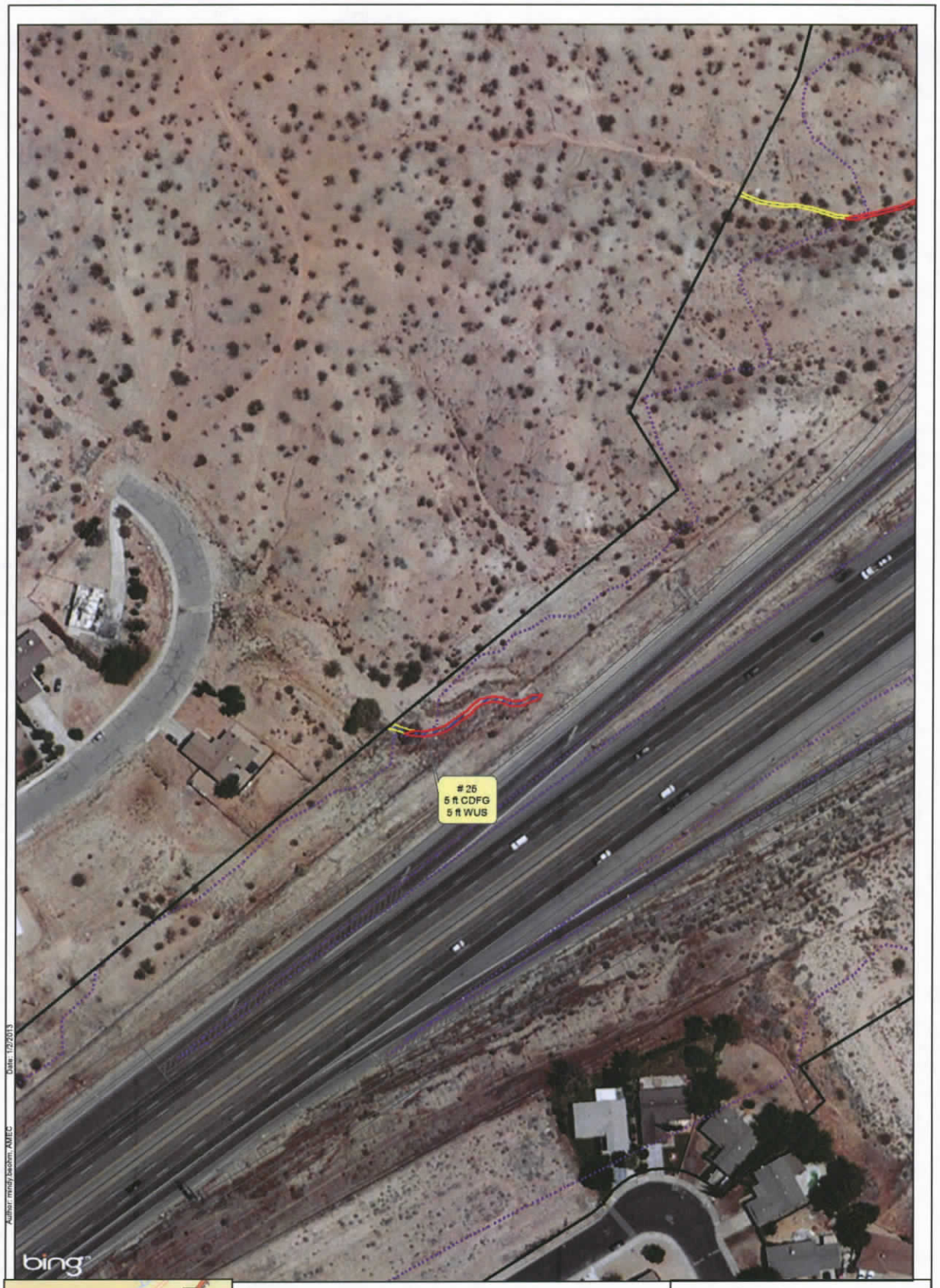
Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

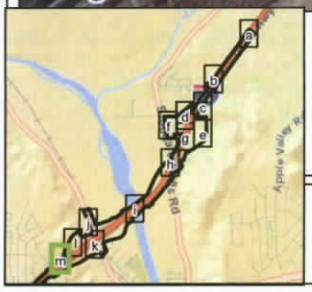
Map Notes
Location:\\RVS-FS1\RVShare\active projects\
Caltrans Projects\2010 - 08A1820 - District 8\
Task Orders\Task Order No. 30\graphics\mxd,
Survey-Scot Chandler 5/1/12
Layout: D_I_layoutRD for consl V7.DGN
Cut&fill: slopelimitv7file.dgn
Projection: Cal state plan 405ft

0 40 80
Feet
1 inch = 93 feet

FIGURE
1-I

Legend
- Caltrans Right-of-Way
- Permanent Impacts
- Temporary Impacts
- Waters of the US & CDFG Jurisdiction
- USACE Wetlands & CDGF Jurisdication
- CDFG Jurisdiction Only
- Cut & Fill
- Culverts





Impacts to Jurisdictional Waters
Interstate 15 Mojave River Interchange Reconstruction Project
California Department of Transportation

Map Notes
Location:\\RVS-FS1\RVShare\active projects\
Caltrans Projects\2010 - 08A1820 - District 8\
Task Orders\Task Order No. 30\graphics\mxd,
Survey-Scot Chandler 5/1/12
Layout: D_I_layoutRD for consl V7.DGN
Cut&fill: slopelimtv7file.dgn
Projection: Cal state plan 405ft

0 40 80
Feet
1 inch = 93 feet

FIGURE
1-m

Legend
- Caltrans Right-of-Way
- Permanent Impacts
- Temporary Impacts
- Waters of the US & CDFG Jurisdiction
- USACE Wetlands & CDGF Jurisdication
- CDFG Jurisdiction Only
- Cut & Fill
- Culverts

Author: mindy.jackson, AMEC Date: 1/2/2013

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

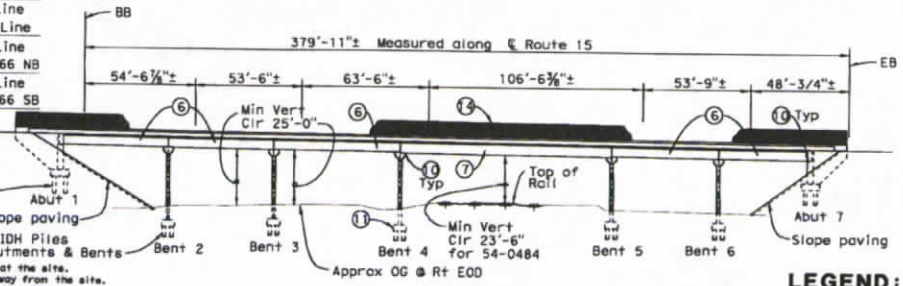
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER RYAN STILTZ No. C65738 Exp. 9/30/13 CIVIL STATE OF CALIFORNIA

To get to the Caltrans web site, go to: http://www.dot.ca.gov

(a) "D4" Line Sta 165+38.09 End =47.33 Lt "A" Line Sta 165+38.09
(b) Sta 5100+31.41 "E3" Line =Sta 168+70.82 "A" Line
(c) Sta 5100+9.78 "RR1" Line =Sta 167+87.95 "A" Line
(d) Sta 5099+86.96 Hwy 66 NB =Sta 166+97.24 "A" Line
(e) Sta 5099+76.13 Hwy 66 SB =Sta 166+47.60 "A" Line



ELEVATION
1"=30'-0"

Vehicular Traffic

1. ___ New alignment. No traffic at the site.
2. ___ Traffic will be detoured away from the site.
3. X Traffic will be carried on the structure.
   Stage construction will/~~will not~~ be required.
4. X Traffic will pass under the structure on Hist Hwy 66 & "E" Street (Name of St. or Hwy.)
   A. ___ No falsework allowed over traffic.
   B. X Falsework opening(s) required:

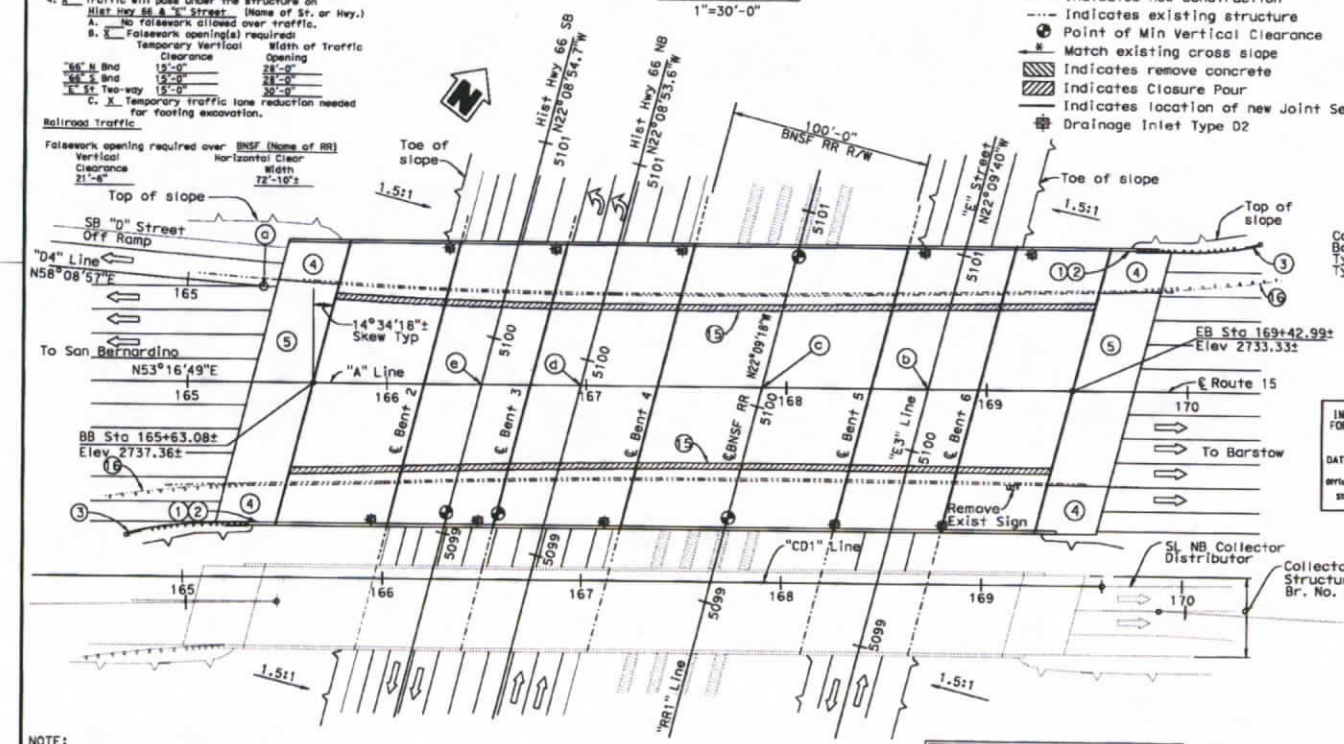
	Temporary Vertical Clearance	Width of Traffic Opening
"66" N Bnd	15'-0"	28'-0"
"66" S Bnd	15'-0"	28'-0"
"E" St Two-way	15'-0"	30'-0"

   C. X Temporary traffic lane reduction needed for footing excavation.

Railroad Traffic

Falsework opening required over BNSF (Name of RR)

Vertical Clearance	Horizontal Clear Width
21'-6"	72'-10"±

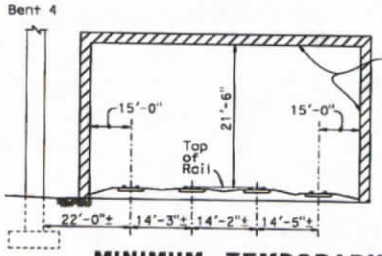


PLAN
1"=30'-0"

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

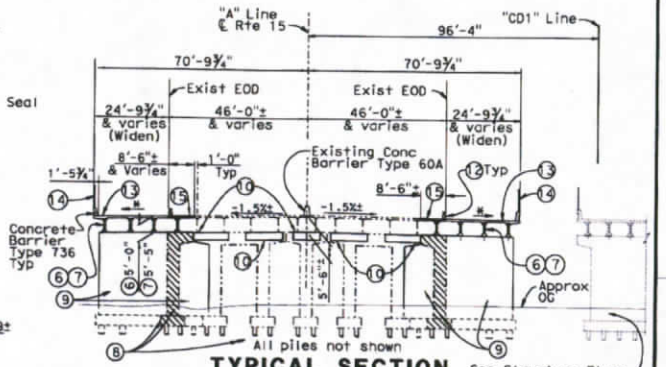
LEGEND:

- —— Indicates new construction
- -·-·- Indicates existing structure
- Point of Min Vertical Clearance
- Match existing cross slope
- Indicates remove concrete
- Indicates Closure Pour
- Indicates location of new Joint Seal
- Drainage Inlet Type D2



MINIMUM TEMPORARY CONSTRUCTION CLEARANCES
(NORMAL TO RAILROAD)
NO SCALE

No construction activities or other obstructions may be placed within these limits, unless getting RR approval



TYPICAL SECTION
1"=20'-0"

See Structure Plans for Br. 54-0484G

INCOMPLETE PLAN FOR DESIGN STUDY PRINTED
DATE: 01-MAR-2013
Office of Structure Design
STATE OF CALIFORNIA

NOTES:

1. Paint "BR. NO. 54-0484"
2. Paint "VICTORVILLE SEPARATION & OVERHEAD"
3. MBGR, see "Roadway Plans"
4. Structure Approach Type N(30S)
5. Structure Approach Type R(30S)
6. Precast Prestressed Conc "I" Girder, Spans 1,2,3,5,6
7. Precast Prestressed Conc Bulb-Tee Girder, Span 4
8. Remove Footing, Column, Bent Cap, Girder and portion of Deck.
9. Pier wall with pile footing
10. Install Catcher Blocks under girders at each Bent and Abutment.
11. For construction of Bent 4 & Bent 5, Shoring Req'd. Refer to BNSF. "Guidelines for Temporay shoring".
12. Remove Existing Type 9 Barrier Rail.
13. Place ¾" Polyester Concrete Overlay on Bridge Deck.
14. Chain Link Railing Type 7 (Mod)
15. 3'-0" Closure Pour
16. Remove existing MBGR, see "Roadway Plans"

GENERAL PLAN

For "General Notes", "Index to Plans", "Standard Plans", "Quantities", and "Pile Data", see "INDEX TO PLANS" Sheet.

DANIEL T. ADAMS DESIGN ENGINEER	DESIGN BY R. Stiltz	CHECKED X	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS BY G. Hallstrom	CHECKED X	LAYOUT BY X	CHECKED X	
	QUANTITIES BY X	CHECKED X	SPECIFICATIONS BY X	PLANS AND SPECS COMPARED X	

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10

CU 08
EA 355561

BRIDGE NO. 54-0484
POST MILE 43.5

VICTORVILLE SEPARATION & OVERHEAD (WIDEN)

GENERAL PLAN

STANDARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 10-16-12 | 7-26-12 | 7-26-12 | 12-11-12 | | 7-26-12 | 7-26-12 | 7-26-12 | 7-26-12 | 7-26-12

SHEET 1 OF

USERNAME => S15254 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 10:22

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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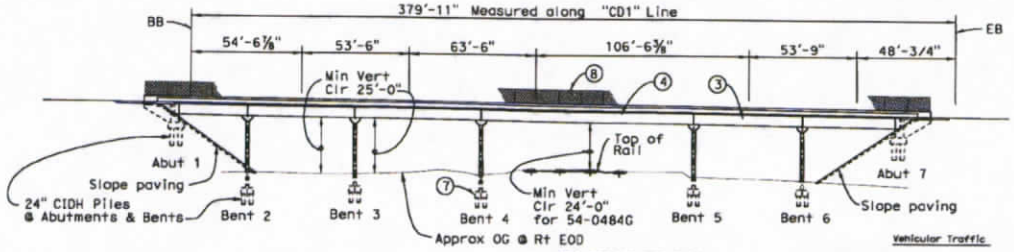
REGISTERED PROFESSIONAL ENGINEER RYAN STILTZ C65738 Exp. 9/30/13 CIVIL STATE OF CALIFORNIA

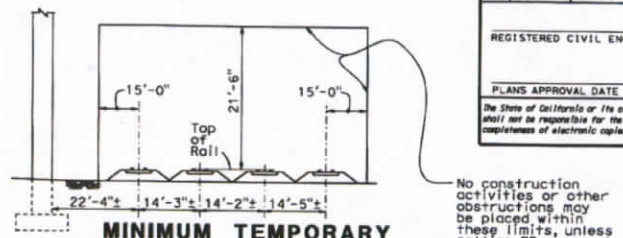
PROFILE GRADE

NO SCALE



ELEVATION

1"=30'-0"



MINIMUM TEMPORARY CONSTRUCTION CLEARANCES

(NORMAL TO RAILROAD)
NO SCALE

INCOMPLETE PLAN FOR DESIGN STUDY PRINTED
DATE: 01-MAR-2013
Office of Structure Design
STATE OF CALIFORNIA

GENERAL PLAN

Vehicular Traffic

1. X New alignment. No traffic at the site.
2. ___ Traffic will be detoured away from the site.
3. ___ Traffic will be carried on the structure. Stage construction will/~~will not~~ be required.
4. X Traffic will pass under the structure on "E" Street (Name of St. or Hwy.)
   A. ___ No falsework allowed over traffic.
   B. X Falsework opening(s) required:

		Temporary Vertical Clearance	Width of Traffic Opening
"66" N	Bnd	15'-0"	28'-0"
"66" S	Bnd	15'-0"	28'-0"
"E" St	Two-way	15'-0"	30'-0"

   C. X Temporary traffic lane reduction needed for footing excavation.

Railroad Traffic

Falsework opening required over BNSF (Name of RR)

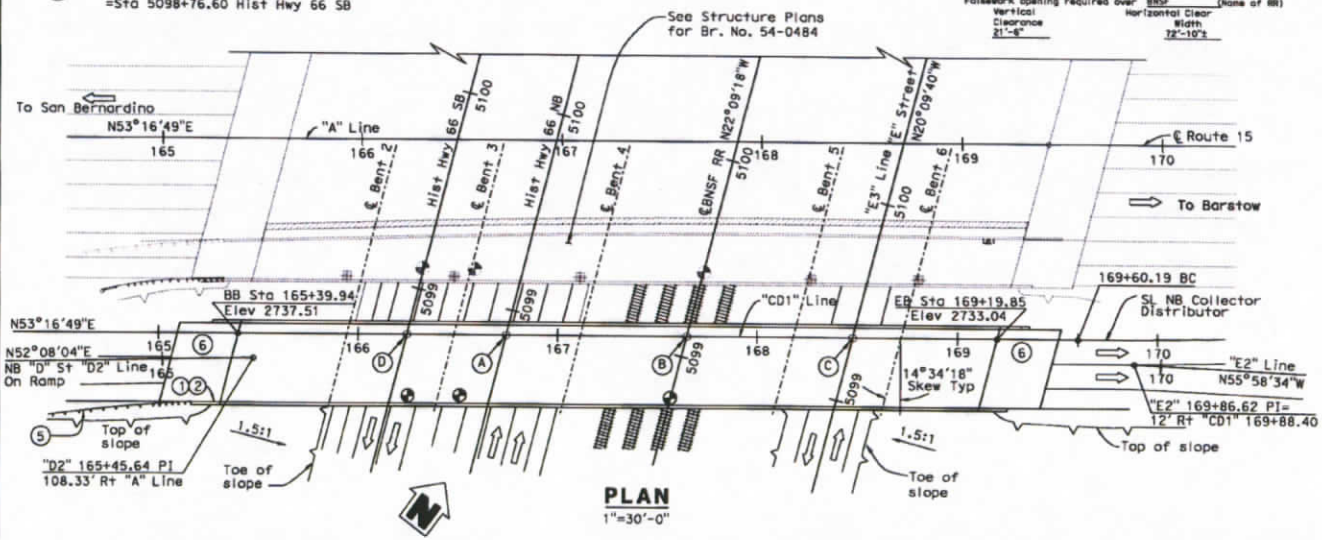
Vertical Clearance	Horizontal Clear Width
21'-6"	72'-10"±

(A) Sta 166+74.10 "CD1" Line
=Sta 5098+87.43 Hist Hwy 66 NB

(B) Sta 167+64.82 "CD1" Line
=Sta 5099+10.25 "RR1" Line

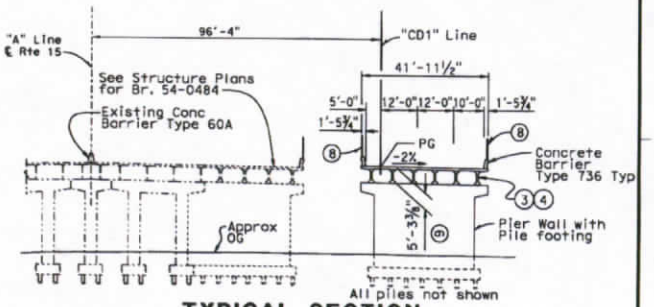
(C) Sta 168+47.71 "CD1" Line
=Sta 5099+31.88 "E3" Line

(D) Sta 166+24.46 "CD1" Line
=Sta 5098+76.60 Hist Hwy 66 SB



PLAN

1"=30'-0"



TYPICAL SECTION

1"=20'-0"

NOTES:

1. Paint "BR. NO. 54-0484G"
2. Paint " VICTORVILLE SEPARATION & OVERHEAD"
3. PC/PS "I" Girder, Spans 1, 2, 3, 5, 6
4. Precast Conc Bulb-Tee Girder, Span 4
5. MBGR, see "ROADWAY PLANS"
6. Structure Approach Type N(30S)
7. For construction of Bent 4 & Bent 5, Shoring Req'd. Bent 4 shoring shall be Type "A" designed for RR Live Loading.
8. Chain Link Railing Type 7 (Mod)
9. 5'-3¾" at Span 4, 5'-0" all others.

For "GENERAL NOTES", "INDEX TO PLANS", "STANDARD PLANS", "QUANTITIES", and "PILE DATA TABLE", see "INDEX TO PLANS" Sheet.

LEGEND:

—— Indicates new construction
-·-·- Indicates existing structure
Point of Min Vertical Clearance

DANIEL T. ADAMS DESIGN ENGINEER	DESIGN BY R. Stiltz	CHECKED A. McPhee	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS BY G. Hallstrom	CHECKED A. McPhee	LAYOUT BY R. Stiltz	CHECKED X	
	QUANTITIES BY X	CHECKED X	SPECIFICATIONS BY X	PLANS AND SPECS COMPARED X	

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 08
EA 355561

BRIDGE NO. 54-0484G
POST MILE 43.5

VICTORVILLE SEPARATION & OVERHEAD

GENERAL PLAN

DIMENSIONS PRINTED BEARING DIFFERENT REVISION DATES

REVISION DATES

SHEET 1 OF

USERNAME => S15354 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 13:22

DIST	COUNTY	ROUTE	POST MILES TOTAL	POST MILES PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15				

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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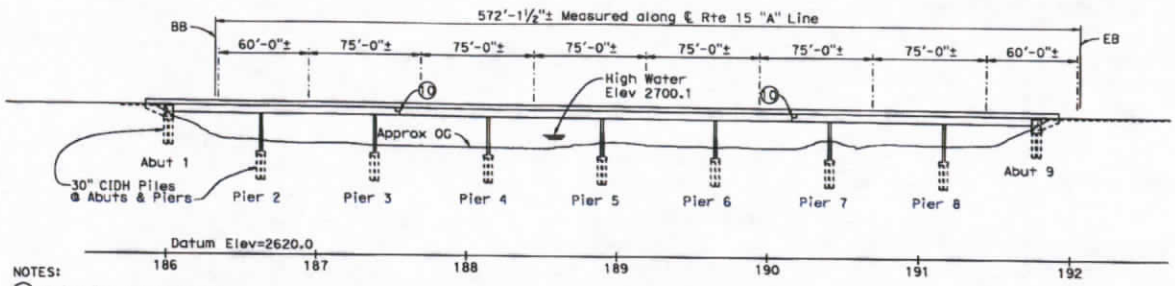
REGISTERED PROFESSIONAL ENGINEER RYAN STILTZ No. C65738 Exp. 9/30/13 CIVIL STATE OF CALIFORNIA



ELEVATION

1"=40'-0"

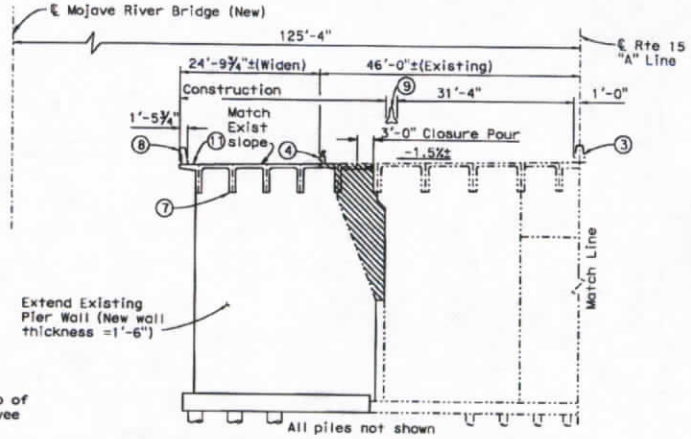
NOTES:

1. Point "BR. NO. 54-0483".
2. Point "MOJAVE RIVER BRIDGE".
3. Exist Conc Barrier, Type 60A.
4. Remove Exist Conc Barrier, Type 9, and overhang.
5. Structure Approach Type N(30S).
6. Structure Approach Type R(30S).
7. CIP/R.C. "T" Girder Bridge.
8. Conc Barrier, Type 736.
9. Temporary Conc Railing, Type K.
10. Pipe Seat Extender earthquake retrofit.
11. Place ¾" Polyester Concrete overlay on bridge deck.
12. Remove existing MBGR, see "Roadway Plans".
13. MBGR, see "Roadway Plans".

(A) Sta 186+58.67, 69.33' Lt "A" Line
(B) Sta 186+01.05, 88.99' Rt "A" Line
(C) Sta 192+30.80, 69.33' Lt "A" Line
(D) Sta 191+77.99, 75.77 Rt "A" Line

LEGEND:

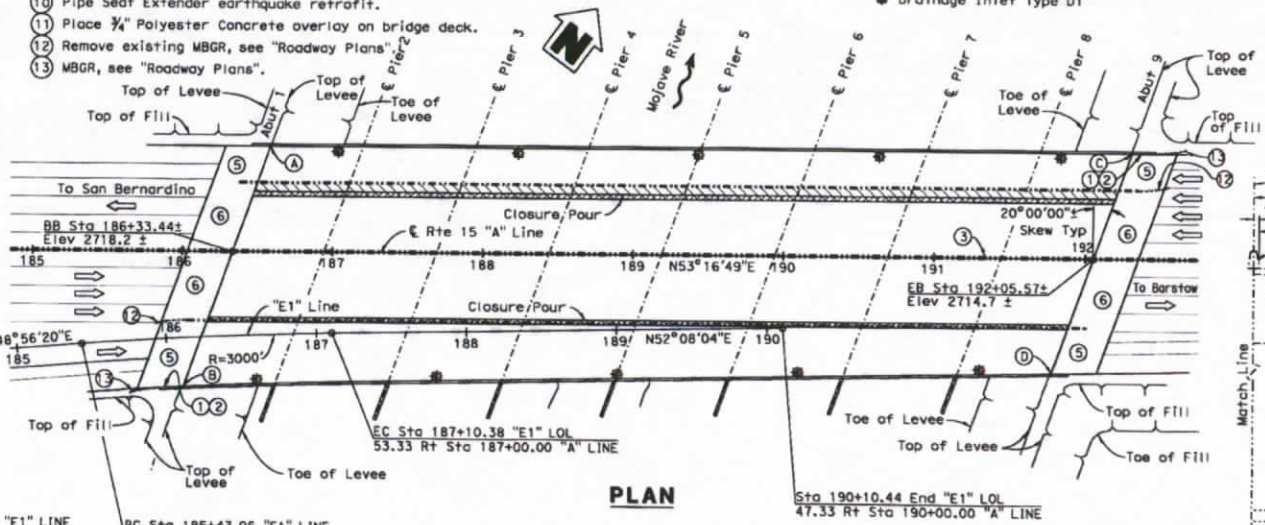
- —— Indicates new construction
- ---- Indicates existing structure
- Indicates concrete removal
- Indicates Closure Pour
- ● Drainage Inlet Type D1



TYPICAL SECTION (LEFT WIDENING)

South Bound I-15

3/32"=1'-0"



PLAN

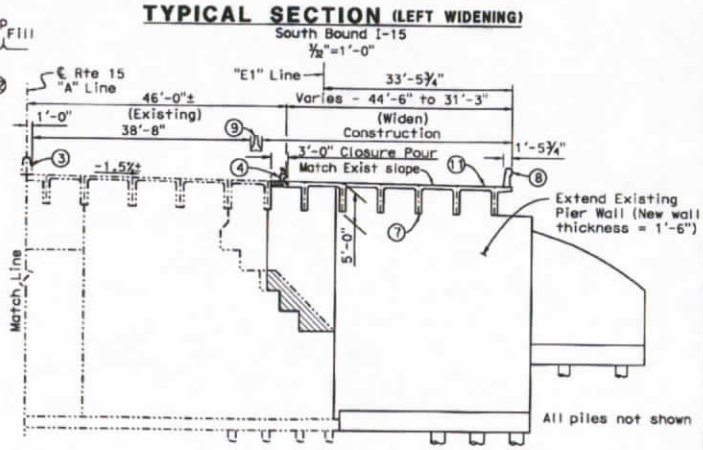
"E1" LINE

R = 3000'
Δ = 3°11'14"
T = 83.68
L = 167.32

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

GENERAL PLAN

For "GENERAL NOTES", "INDEX TO PLANS", "STANDARD PLANS", "QUANTITIES", and "PILE DATA TABLE", see "INDEX TO PLANS" Sheet.



TYPICAL SECTION (RIGHT WIDENING)

North Bound I-15

3/32"=1'-0"

DANIEL T. ADAMS DESIGN ENGINEER	DESIGN	BY R. Stiltz	CHECKED L. Wu	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE	
	DETAILS	BY G. Hallstrom	CHECKED L. Wu	LAYOUT	BY X	CHECKED X
	QUANTITIES	BY X	CHECKED X	SPECIFICATIONS	BY X	PLANS AND SPECS COMPARED X

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10

CU 08
EA 355561

BRIDGE NO. 54-0483
POST MILE 43.93

MOJAVE RIVER BRIDGE (WIDEN)

GENERAL PLAN

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 1 OF

JSC NAME -> 8115554 DATE PLOTTED -> 3-MAR-2013 TIME PLOTTED -> 10:21

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RYAN STILTZ No. C65738 Exp. 9/30/13 CIVIL STATE OF CALIFORNIA

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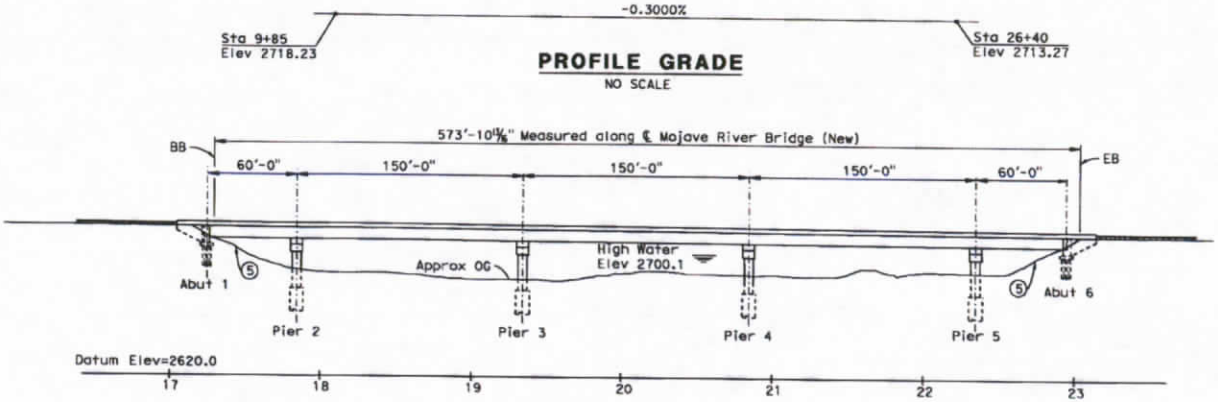
QUANTITIES

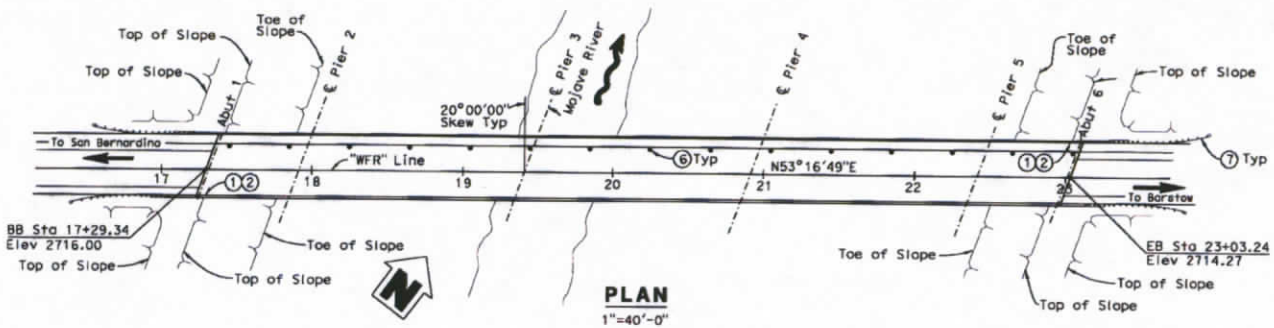


PROFILE GRADE

NO SCALE

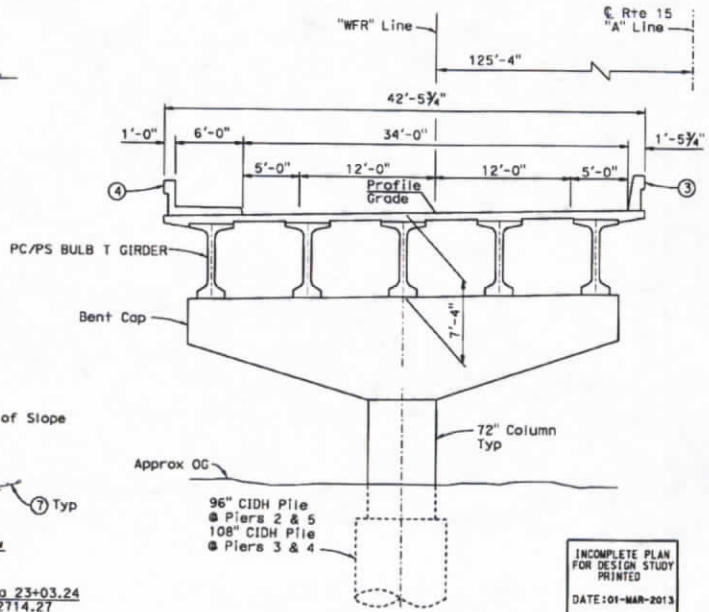
ELEVATION

1"=40'-0"



PLAN

1"=40'-0"



TYPICAL SECTION

3/16"=1'-0"

INCOMPLETE PLAN FOR DESIGN STUDY PRINTED

DATE:01-MAR-2013

Office of Structure Design STATE OF CALIFORNIA

NOTES:

1. Paint "BR. NO. 54C-0661".
2. Paint "MOJAVE RIVER BRIDGE".
3. Conc Barrier, Type 736.
4. Conc Barrier, Type 26.
5. Replace RSP as needed for Abutment construction.
6. Drainage Inlet Type D1
7. MBGR, See "Roadway Plans"

For "GENERAL NOTES", "INDEX TO PLANS", "STANDARD PLANS", and "PILE DATA TABLE", see "INDEX TO PLANS" Sheet.

GENERAL PLAN

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

DANIEL T. ADAMS
DESIGN ENGINEER

	BY	CHECKED
DESIGN	R. Stiltz	X
DETAILS	Y. Tang	X
QUANTITIES	X	X

LOAD & RESISTANCE FACTOR DESIGN — LIVE LOADING: HL93 W/(LOW-BOY) PERMIT DESIGN VEHICLE

LAYOUT BY X CHECKED X

SPECIFICATIONS BY X PLANS AND SPECS COMPARED X

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10

UNIT: 3589
PROJECT NUMBER & PHASE: 0800000621
CONTRACT NO.: 08-355561

BRIDGE NO. 54C-0661
POST MILE 70.7

MOJAVE RIVER BRIDGE (NEW)

GENERAL PLAN

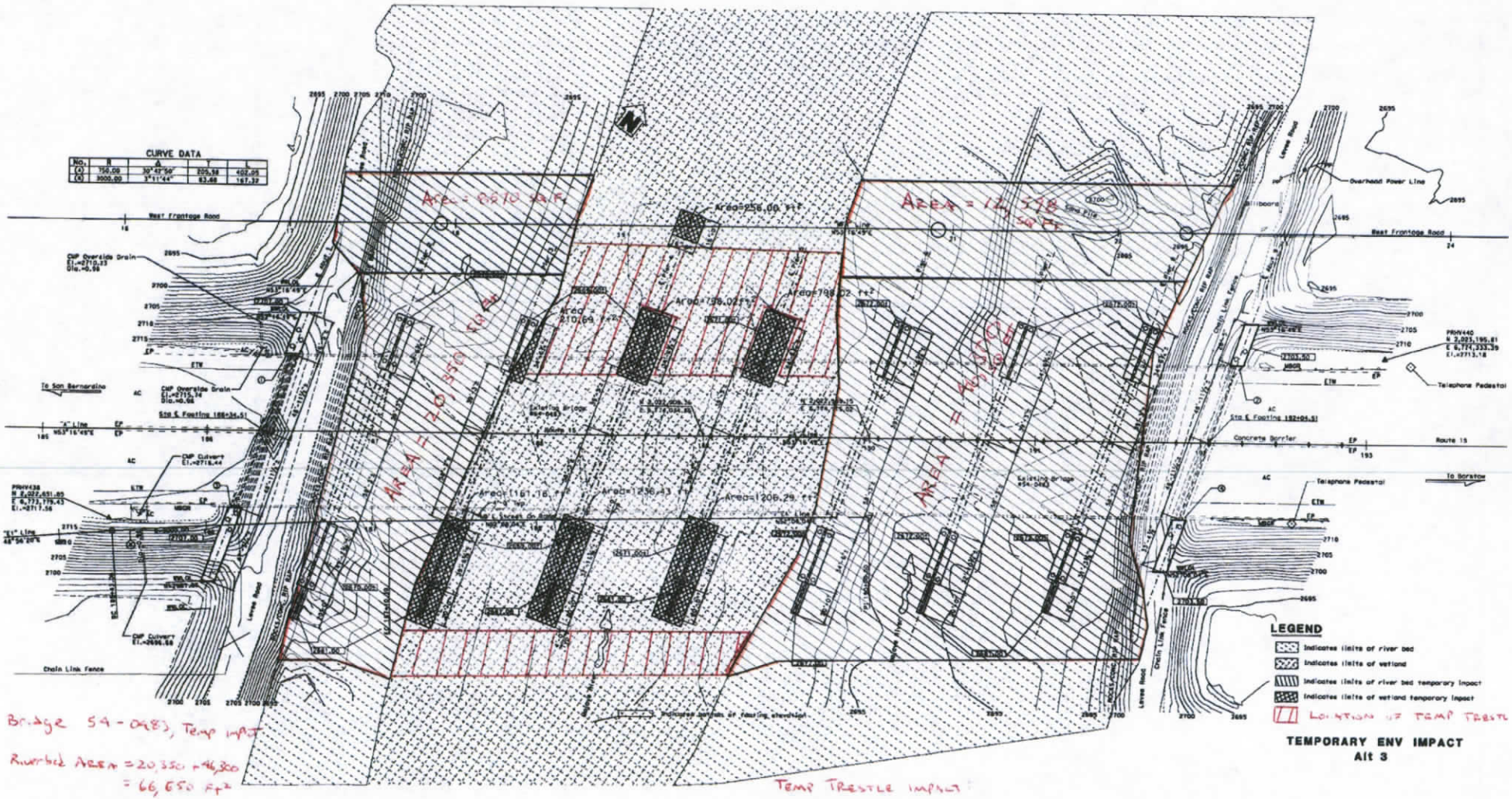
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 12-07-12

SHEET 1 OF X

BRIDGE 54L-0661, TEMP IMPACT
RIVERBED AREA = 8570 FT² + 12,598 FT² = 21,168 FT²
WETLAND AREA = 256 FT²

TEMPORARY ENVIRONMENTAL IMPACT
ALT #3



Bridge 54-0983, Temp impact
Riverbed AREA = 20,350 + 46,300
= 66,650 FT²
WETLAND AREA = 210.7 + 798 + 798 + 1161 + 1236 + 1206
= 5410 FT²

TEMP TRESTLE IMPACT
WETLAND IMPACT: TRESTLE 1 0 ROWS OF PILES × 10 PILES/ROW × 1.5 SQ FT/PILE = 150 FT²
TRESTLE 2: 10 ROWS × 5 PILES/ROW × 1.5 SQ FT/PILE = 75 FT²
225 FT²

~344,300 SQ FT

EXHIBIT "C"

CONTRACTOR REQUIREMENTS

1.01 General:

- **1.01.01** The Contractor must cooperate with **BNSF RAILWAY COMPANY**, hereinafter referred to as "**Railway**" where work is over or under on or adjacent to Railway property and/or right-of-way, hereafter referred to as "Railway Property", during the construction of Interstate Route 15 Overhead Widening through the City of Victorville, California, DOT # 026078U, CPUC # 002-36.00-A, LS 7600, MP 36.0, Cajon Subdivision.

- **1.01.02** The Contractor must execute and deliver to the Railway duplicate copies of the Exhibit "C-1" Agreement, in the form attached hereto, obligating the Contractor to provide and maintain in full force and affect the insurance called for under Section 3 of said Exhibit "C-1". Questions regarding procurement of the Railroad Protective Liability Insurance should be directed to Rosa Martinez at Marsh, USA, 214-303-8519.

- **1.01.03** The Contractor must plan, schedule and conduct all work activities so as not to interfere with the movement of <u>any</u> trains on Railway Property.

- **1.01.04** The Contractor's right to enter Railway's Property is subject to the absolute right of Railway to cause the Contractor's work on Railway's Property to cease if, in the opinion of Railway, Contractor's activities create a hazard to Railway's Property, employees, and/or operations. Railway will have the right to stop construction work on the Project if any of the following events take place: (i) Contractor (or any of its subcontractors) performs the Project work in a manner contrary to the plans and specifications approved by Railway; (ii) Contractor (or any of its subcontractors), in Railway's opinion, prosecutes the Project work in a manner which is hazardous to Railway property, facilities or the safe and expeditious movement of railroad traffic; (iii) the insurance described in the attached <u>Exhibit C-1</u> is canceled during the course of the Project; or (iv) Contractor fails to pay Railway for the Temporary Construction License or the Easement. The work stoppage will continue until all necessary actions are taken by Contractor or its subcontractor to rectify the situation to the satisfaction of Railway's Division Engineer or until additional insurance has been delivered to and accepted by Railway. In the event of a breach of (i) this Agreement, (ii) the Temporary Construction License, or (iii) the Easement, Railway may immediately terminate the Temporary Construction License or the Easement. Any such work stoppage under this provision will not give rise to any liability on the part of Railway. Railway's right to stop the work is in addition to any other rights Railway may have including, but not limited to, actions or suits for damages or lost profits. In the event that Railway desires to stop construction work on the Project, Railway agrees to immediately notify the following individual in writing:

Denny Fong, P.E.
Senior Transportation Engineer
Railroad Agreements Engineer
Division of Right of Way
1120 n Street, MS 37
Sacramento, CA 95814
(916) 654-3070
(606) 654-6378 (fax)
Denny_Fong@dot.ca.gov

- **1.01.05** The Contractor is responsible for determining and complying with all Federal, State and Local Governmental laws and regulations, including, but not limited to environmental laws and regulations (including but not limited to the Resource Conservation and Recovery Act, as amended; the Clean Water Act, the Oil Pollution Act, the Hazardous Materials Transportation Act, CERCLA), and health and safety laws and regulations. The Contractor hereby indemnifies, defends and holds harmless Railway for, from and against all fines or penalties imposed or assessed by Federal, State and Local Governmental Agencies against the Railway which arise out of Contractor's work under this Agreement.

- **1.01.06** The Contractor must notify State (Resident engineer) and the Railway's Manager Public Projects, Melvin Thomas, telephone number 909-386-4472 at least thirty (30) calendar days before commencing any work on Railway Property. Contractor's notification to Railway must refer to Railway's File No. **BF026078U**.

- **1.01.07** For any bridge demolition and/or falsework above any tracks or any excavations located with any part of the excavations located within, whichever is greater, twenty-five (25) feet of the nearest track or intersecting a slope from the plane of the top of rail on a 2 horizontal to 1 vertical slope beginning at eleven (11) feet from centerline of the nearest track, both measured perpendicular to center line of track, the Contractor must furnish the Railway five sets of working drawings showing details of construction affecting Railway Property and tracks. The working drawing must include the proposed method of installation and removal of falsework, shoring or cribbing, not included in the contract plans and two sets of structural calculations of any falsework, shoring or cribbing. For all excavation and shoring submittal plans, the current "BNSF-UPRR Guidelines for Temporary Shoring" must be used for determining the design loading conditions to be used in shoring design, and all calculations and submittals must be in accordance with the current "BNSF-UPRR Guidelines for Temporary Shoring". All submittal drawings and calculations must be stamped by a registered professional engineer licensed to practice in the state the project is located. All calculations must take into consideration railway surcharge loading and must be designed to meet American Railway Engineering and Maintenance-of-Way Association (previously known as American Railway Engineering Association) Coopers E-80 live loading standard. All drawings and calculations must be stamped by a registered professional engineer licensed to practice in the state the project is located. The Contractor must not begin work until notified by the Railway that plans have been approved. The Contractor will be required to use lifting devices such as, cranes and/or winches to place or to remove any falsework over

Railway's tracks. In no case will the Contractor be relieved of responsibility for results obtained by the implementation of said approved plans.

- **1.01.08** Subject to the movement of railways trains, railways will cooperate with the Contractor such that the work may be handled and performed in an efficient manner. **In the 4th quarter of each calendar year, work will not be permitted in Railway's right of way.** The Contractor will have no claim whatsoever for any type of damages or for extra or additional compensation in the event his work is delayed by the Railway.

1.02 Contractor Safety Orientation

- **1.02.01 No employee of the Contractor, its subcontractors, agents or invitees may enter Railway Property without first having completed Railway's Engineering Contractor Safety Orientation, found on the web site www.contractororientation.com. The Contractor must ensure that each of its employees, subcontractors, agents or invitees completes Railway's Engineering Contractor Safety Orientation through internet sessions before any work is performed on the Project. Additionally, the Contractor must ensure that each and every one of its employees, subcontractors, agents or invitees possesses a card certifying completion of the Railway Contractor Safety Orientation before entering Railway Property. The Contractor is responsible for the cost of the Railway Contractor Safety Orientation. The Contractor must renew the Railway Contractor Safety Orientation annually. Further clarification can be found on the web site or from the Railway's Representative.**

1.03 Railway Requirements

- **1.03.01** The Contractor must take protective measures as are necessary to keep railway facilities, including track ballast, free of sand, debris, and other foreign objects and materials resulting from his operations. Any damage to railway facilities resulting from Contractor's operations will be repaired or replaced by Railway and the cost of such repairs or replacement must be paid for by the Contractor.

- **1.03.02** The Contractor must notify the Railway's Division Engineer at 909-386-4054 and provide blasting plans to Railway for review and approval seven (7) calendar days prior to conducting any blasting operations adjacent to or on Railway's Property.

- **1.03.03** The Contractor must abide by the following temporary clearances during construction:

  - 25'-0" Horizontally from centerline of nearest track
  - 22'-6" Vertically above top of rail
  - 27'-0" Vertically above top of rail for electric wires carrying less than 750 volts
  - 28'-0" Vertically above top of rail for electric wires carrying 750 volts to 15,000 volts

- 30'-0" Vertically above top of rail for electric wires carrying 15,000 volts to 20,000 volts
- 34'-0" Vertically above top of rail for electric wires carrying more than 20,000 volts

- **1.03.04** Upon completion of construction, the following clearances shall be maintained:

  - 25' Horizontally from centerline of nearest track
  - 23' 6" Vertically above top of rail

- **1.03.05** Any infringement within State statutory clearances due to the Contractor's operations must be submitted to the Railway and to the **(STATE)** and must not be undertaken until approved in writing by the Railway, and until the **(STATE)** has obtained any necessary authorization from the State Regulatory Authority for the infringement. No extra compensation will be allowed in the event the Contractor's work is delayed pending railway approval, and/or the State Regulatory Authority's approval.

- **1.03.06** In the case of impaired vertical clearance above top of rail, Railway will have the option of installing tell-tales or other protective devices Railway deems necessary for protection of Railway operations. The cost of tell-tales or protective devices will be borne by the Agency.

- **1.03.07** The details of construction affecting the Railway's Property and tracks not included in the contract plans must be submitted to the Railway by **(STATE)** for approval before work is undertaken and this work must not be undertaken until approved by the Railway.

- **1.03.08** At other than public road crossings, the Contractor must not move any equipment or materials across Railway's tracks until permission has been obtained from the Railway. The Contractor must obtain a "Temporary Construction Crossing Agreement" from the Railway prior to moving his equipment or materials across the Railways tracks. The temporary crossing must be gated and locked at all times when not required for use by the Contractor. The temporary crossing for use of the Contractor will be constructed and, at the completion of the project, removed at the expense of the Contractor.

- **1.03.09** Discharge, release or spill on the Railway Property of any hazardous substances, oil, petroleum, constituents, pollutants, contaminants, or any hazardous waste is prohibited and Contractor must immediately notify the Railway's Resource Operations Center at 1(800) 832-5452 of any discharge, release or spills in excess of a reportable quantity. Contractor must not allow Railway Property to become a treatment, storage or transfer facility as those terms are defined in the Resource Conservation and Recovery Act or any state analogue.

- **1.03.10** The Contractor upon completion of the work covered by this contract, must promptly remove from the Railway's Property all of Contractor's tools, equipment, implements and other materials, whether brought upon said property by said Contractor or any Subcontractor, employee or agent of Contractor or of any Subcontractor, and must cause

Railway's Property to be left in a condition acceptable to the Railway's representative.

1.04 Contractor Roadway Worker on Track Safety Program and Safety Action Plan:

- **1.04.01** Each Contractor that will perform work within 25 feet of the centerline of a track must develop and implement a Roadway Worker Protection/On Track Safety Program and work with Railway Project Representative to develop an on track safety strategy as described in the guidelines listed in the on track safety portion of the Safety Orientation. This Program must provide Roadway Worker protection/on track training for all employees of the Contractor, its subcontractors, agents or invitees. This training is reinforced at the job site through job safety briefings. Additionally, each Contractor must develop and implement the Safety Action Plan, as provided for on the web site **www.contractororientation.com**, which will be made available to Railway prior to commencement of any work on Railway Property. During the performance of work, the Contractor must audit its work activities. The Contractor must designate an on-site Project Supervisor who will serve as the contact person for the Railway who will maintain a copy of the Safety Action Plan, safety audits, and Material Safety Datasheets (MSDS), at the job site.

1.05 Railway Flagger Services:

- **1.05.01** The Contractor must notify the Railway's Roadmaster Wayne Morris (909) 386-4730 a minimum of thirty (30) calendar days advance notice when flagging services will be required so that the Roadmaster and MTE can make appropriate arrangements (i.e., bulletin the flagger's position). If flagging services are scheduled in advance by the Contractor and it is subsequently determined by the parties hereto that such services are no longer necessary, the Contractor must give the Roadmaster five (5) working days advance notice so that appropriate arrangements can be made to abolish the position pursuant to union requirements.

- **1.05.02** Unless determined otherwise by Railway's Project Representative, Railway flagger will be required and furnished when Contractor's work activities are located over, under and/or within twenty-five (25) feet measured horizontally from centerline of the nearest track and when cranes or similar equipment positioned beyond 25-feet from the track centerline could foul the track in the event of tip over or other catastrophic occurrence, but not limited thereto for the following conditions:

- **1.05.02a** When, upon inspection by Railway's Representatives, other conditions warrant.

- **1.05.02b** When any excavation is performed below the bottom of tie elevation, if, in the opinion of Railway's Representative, track or other Railway facilities may be subject to movement or settlement.

- **1.05.02c** When work in any way interferes with the safe operation of trains at timetable speeds.

- **1.05.02d** When any hazard is presented to Railway track, communications, signal, electrical, or other facilities either due to persons, material, equipment or blasting in the vicinity.

- **1.05.02e** Special permission must be obtained from the Railway before moving heavy or cumbersome objects or equipment which might result in making the track impassable.

- **1.05.03** Flagging services will be performed by qualified Railway flaggers.

- **1.05.03a** Flagging crew generally consists of one employee. However, additional personnel may be required to protect Railway Property and operations, if deemed necessary by the Railways Representative.

- **1.05.03b** Each time a flagger is called, the minimum period for billing will be the eight (8) hour basic day.

- **1.05.03c** The cost of flagger services provided by the Railway will be borne by **State**. The estimated cost for one (1) flagger is approximately between $800.00-$1,600.00 for an eight (8) hour basic day with time and one-half or double time for overtime, rest days and holidays. The estimated cost for each flagger includes vacation allowance, paid holidays, Railway and unemployment insurance, public liability and property damage insurance, health and welfare benefits, vehicle, transportation, meals, lodging, radio, equipment, supervision and other costs incidental to performing flagging services. Negotiations for Railway labor or collective bargaining agreements and rate changes authorized by appropriate Federal authorities may increase actual or estimated flagging rates. **THE FLAGGING RATE IN EFFECT AT THE TIME OF PERFORMANCE BY THE CONTRACTOR HEREUNDER WILL BE USED TO CALCULATE THE ACTUAL COSTS OF FLAGGING PURSUANT TO THIS PARAGRAPH.**

- **1.05.03d** The average train traffic on this route is 82 freight trains per 24-hour period at a timetable speed 50 MPH and 2 passenger trains at a timetable speed of 60 MPH.

1.06 Contractor General Safety Requirements

- **1.06.01** Work in the proximity of railway track(s) is potentially hazardous where movement of trains and equipment can occur at any time and in any direction. All work performed by contractors within 25 feet of any track must be in compliance with FRA Roadway Worker Protection Regulations.

- **1.06.02** Before beginning any task on Railway Property, a thorough job safety briefing must be conducted with all personnel involved with the task and repeated when the personnel or task changes. If the task is within 25 feet of any track, the job briefing must include the Railway's flagger, as applicable, and include the procedures the Contractor will use to protect its employees, subcontractors, agents or invitees from moving any equipment adjacent to or

across any Railway track(s).

- **1.06.03** Workers must not work within 25 feet of the centerline of any track without an on track safety strategy approved by the Railway's Project Representative. When authority is provided, every contractor employee must know: (1) who the railways flaggers are, and how to contact the flagger, (2) limits of the authority, (3) the method of communication to stop and resume work, and (4) location of the designated places of safety. Persons or equipment entering flag/work limits that were not previously job briefed, must notify the flagger immediately, and be given a job briefing when working within 25 feet of the center line of track.

- **1.06.04** When Contractor employees are required to work on the Railway Property after normal working hours or on weekends, the Railway's representative in charge of the project must be notified. A minimum of two employees must be present at all times.

- **1.06.05** Any employees, agents or invitees of Contractor or its subcontractors under suspicion of being under the influence of drugs or alcohol, or in the possession of same, will be removed from the Railway's Property and subsequently released to the custody of a representative of Contractor management. Future access to the Railway's Property by that employee will be denied.

- **1.06.06** Any damage to Railway Property, or any hazard noticed on passing trains must be reported immediately to the Railway's representative in charge of the project. Any vehicle or machine which may come in contact with track, signal equipment, or structure (bridge) and could result in a train derailment must be reported immediately to the Railway representative in charge of the project and to the Railway's Resource Operations Center at 1(800) 832-5452. Local emergency numbers are to be obtained from the Railway representative in charge of the project prior to the start of any work and must be posted at the job site.

- **1.06.07** For safety reasons, all persons are prohibited from having pocket knives, firearms or other deadly weapons in their possession while working on Railway's Property.

- **1.06.08** All personnel protective equipment (PPE) used on Railway Property must meet applicable OSHA and ANSI specifications. Current Railway personnel protective equipment requirements are listed on the web site, **www.contractororientation.com,** however, a partial list of the requirements include: a) safety glasses with permanently affixed side shields (no yellow lenses); b) hard hats; c) safety shoe with: hardened toes, above-the-ankle lace-up and a defined heel; and d) high visibility retro-reflective work wear. The Railway's representative in charge of the project is to be contacted regarding local specifications for meeting requirements relating to hi-visibility work wear. Hearing protection, fall protection, gloves, and respirators must be worn as required by State and Federal regulations. **(NOTE – Should there be a discrepancy between the information contained on the web site and the information in this paragraph, the web site will govern.)**

- **1.06.09 THE CONTRACTOR MUST NOT PILE OR STORE ANY MATERIALS, MACHINERY OR EQUIPMENT CLOSER THAN 25'-0" TO THE CENTER LINE**

OF THE NEAREST RAILWAY TRACK. MATERIALS, MACHINERY OR EQUIPMENT MUST NOT BE STORED OR LEFT WITHIN 250 FEET OF ANY HIGHWAY/RAIL AT-GRADE CROSSINGS OR TEMPORARY CONSTRUCTION CROSSING, WHERE STORAGE OF THE SAME WILL OBSTRUCT THE VIEW OF A TRAIN APPROACHING THE CROSSING. PRIOR TO BEGINNING WORK, THE CONTRACTOR MUST ESTABLISH A STORAGE AREA WITH CONCURRENCE OF THE RAILWAY'S REPRESENTATIVE.

- **1.06.10** Machines or vehicles must not be left unattended with the engine running. Parked machines or equipment must be in gear with brakes set and if equipped with blade, pan or bucket, they must be lowered to the ground. All machinery and equipment left unattended on Railway's Property must be left inoperable and secured against movement. (See internet Engineering Contractor Safety Orientation program for more detailed specifications)

- **1.06.11** Workers must not create and leave any conditions at the work site that would interfere with water drainage. Any work performed over water must meet all Federal, State and Local regulations.

- **1.06.12** All power line wires must be considered dangerous and of high voltage unless informed to the contrary by proper authority. For all power lines the minimum clearance between the lines and any part of the equipment or load must be; 200 KV or below - 15 feet; 200 to 350 KV - 20 feet; 350 to 500 KV - 25 feet; 500 to 750 KV - 35 feet; and 750 to 1000 KV - 45 feet. If capacity of the line is not known, a minimum clearance of 45 feet must be maintained. A person must be designated to observe clearance of the equipment and give a timely warning for all operations where it is difficult for an operator to maintain the desired clearance by visual means.

1.07 Excavation:

- **1.07.01** Before excavating, the Contractor must determine whether any underground pipe lines, electric wires, or cables, including fiber optic cable systems are present and located within the Project work area. The Contractor must determine whether excavation on Railway's Property could cause damage to buried cables resulting in delay to Railway traffic and disruption of service to users. Delays and disruptions to service may cause business interruptions involving loss of revenue and profits. Before commencing excavation, the Contractor must contact **BNSF's Field Engineering Representative (909) 386-4079.** All underground and overhead wires will be considered HIGH VOLTAGE and dangerous until verified with the company having ownership of the line. **It is the Contractor's responsibility to notify any other companies that have underground utilities in the area and arrange for the location of all underground utilities before excavating.**

- **1.07.02** The Contractor must cease all work and notify the Railway immediately before continuing excavation in the area if obstructions are encountered which do not appear on drawings. If the obstruction is a utility and the owner of the utility can be identified, then the Contractor must also notify the owner immediately. If there is any doubt about the location

of underground cables or lines of any kind, no work must be performed until the exact location has been determined. There will be no exceptions to these instructions.

- **1.07.03** All excavations must be conducted in compliance with applicable OSHA regulations and, regardless of depth, must be shored where there is any danger to tracks, structures or personnel.

- **1.07.04** Any excavations, holes or trenches on the Railway's Property must be covered, guarded and/or protected when not being worked on. When leaving work site areas at night and over weekends, the areas must be secured and left in a condition that will ensure that Railway employees and other personnel who may be working or passing through the area are protected from all hazards. All excavations must be back filled as soon as possible.

1.08 Hazardous Waste, Substances and Material Reporting:

- **1.08.01** If Contractor discovers any hazardous waste, hazardous substance, petroleum or other deleterious material, including but not limited to any non-containerized commodity or material, on or adjacent to Railway's Property, in or near any surface water, swamp, wetlands or waterways, while performing any work under this Agreement, Contractor must immediately: (a) notify the Railway's Resource Operations Center at 1(800) 832-5452, of such discovery: (b) take safeguards necessary to protect its employees, subcontractors, agents and/or third parties: and (c) exercise due care with respect to the release, including the taking of any appropriate measure to minimize the impact of such release.

1.09 Personal Injury Reporting

- **1.09.01** The Railway is required to report certain injuries as a part of compliance with Federal Railroad Administration (FRA) reporting requirements. Any personal injury sustained by an employee of the Contractor, subcontractor or Contractor's invitees while on the Railway's Property must be reported immediately (by phone mail if unable to contact in person) to the Railway's representative in charge of the project. The Non-Employee Personal Injury Data Collection Form contained herein is to be completed and sent by Fax to the Railway at 1(817) 352-7595 and to the Railway's Project Representative no later than the close of shift on the date of the injury.

BNSF RAILWAY

NON-EMPLOYEE PERSONAL INJURY DATA COLLECTION

(If injuries are in connection with rail equipment accident/incident, highway rail grade crossing accident or automobile accident, ensure that appropriate information is obtained, forms completed and that data entry personnel are aware that injuries relate to that specific event.)

Injured Person Type:

- ☐ Passenger on train (C)
- ☐ Non-employee (N) *(i.e., emp of another railroad, or, non-BNSF emp involved in vehicle accident, including company vehicles)*
- ☐ Contractor/safety sensitive (F)
- ☐ Contractor/non-safety sensitive (G)
- ☐ Volunteer/safety sensitive (H)
- ☐ Volunteer/other non-safety sensitive (I)
- ☐ Non-trespasser (D) - to include highway users involved in highway rail grade crossing accidents who did not go around or through gates
- ☐ Trespasser (E) - to include highway users involved in highway rail grade crossing accidents who went around or through gates
- ☐ Non-trespasser (J) - Off railroad property

If train involved, Train ID: _____

Transmit attached information to Accident/Incident Reporting Center by:
Fax 1-817-352-7595 or by Phone 1-800-697-6736 **or email to: Accident-Reporting.Center@BNSF.com**

Officer Providing Information:

_____ _____ _____
(Name) (Employee No.) (Phone #)

REPORT PREPARED TO COMPLY WITH FEDERAL ACCIDENT REPORTING REQUIREMENTS AND PROTECTED FROM DISCLOSURE PURSUANT TO 49 U.S.C. 20903 AND 83 U.S.C. 490

NON-EMPLOYEE PERSONAL INJURY DATA COLLECTION

INFORMATION REQUIRED TO BE COLLECTED PURSUANT TO FEDERAL REGULATION. IT SHOULD BE USED FOR COMPLIANCE WITH FEDERAL REGULATIONS ONLY AND IT IS NOT INTENDED TO PRESUME ACCEPTANCE OF RESPONSIBILITY OR LIABILITY.

1. Accident City/St: _____ 2. Date: _____ Time: _____

County: _____ 3. Temperature: _____ 4. Weather: _____
(if non BNSF location)

Mile Post / Line Segment: _____

5. Driver's License No (and state) or other ID: _____ **SSN (required)**: _____

6. Name (last, first, mi): _____

7. Address: _____ City: _____ St: _____ Zip: _____

8. Date of Birth: _____ and/or Age: _____ Gender: _____
(if available)

Phone Number: _____ Employer: _____

9. Injury: _____ 10. Body Part: _____
(i.e., Laceration, etc.) (i.e., Hand, etc.)

11. Description of Accident (To include location, action, result, etc.): _____

_____

_____

_____

12. Treatment:

- ☐ First Aid Only _____
- ☐ Required Medical Treatment _____
- ☐ Other Medical Treatment _____

13. Dr. Name: _____ Date: _____

14. Dr. Address:

Street: _____ City: _____ St: _____ Zip: _____

15. Hospital Name: _____

16. Hospital Address:

Street: _____ City: _____ St: _____ Zip: _____

17. Diagnosis: _____

REPORT PREPARED TO COMPLY WITH FEDERAL ACCIDENT REPORTING REQUIREMENTS
PROTECTED FROM DISCLOSURE PURSUANT TO 49 U.S.C. 20903 AND 83 U.S.C. 490

EXHIBIT "C-1"

Agreement Between
BNSF RAILWAY COMPANY
and the
CONTRACTOR

BNSF RAILWAY COMPANY
Attention: Manager Public Projects

Railway File:* *BF026078U
Agency Project: I-15 Overhead Widening through the City of Victorville, CA

Gentlemen:

The undersigned (hereinafter called, the "Contractor"), has entered into a contract (the "Contract") dated _____, 201___, with State of California, Department of Transportation (STATE) for the performance of certain work in connection with the following project: **I-15 Overhead Widening through the City of Victorville, CA.** Performance of such work will necessarily require Contractor to enter **BNSF RAILWAY COMPANY** ("Railway") right of way and property ("Railway Property"). The Contract provides that no work will be commenced within Railway Property until the Contractor employed in connection with said work for STATE (i) executes and delivers to Railway an Agreement in the form hereof, and (ii) provides insurance of the coverage and limits specified in such Agreement and Section 3 herein. If this Agreement is executed by a party who is not the Owner, General Partner, President or Vice President of Contractor, Contractor must furnish evidence to Railway certifying that the signatory is empowered to execute this Agreement on behalf of Contractor.

Accordingly, in consideration of Railway granting permission to Contractor to enter upon Railway Property and as an inducement for such entry, Contractor, effective on the date of the Contract, has agreed and does hereby agree with Railway as follows:

Section 1. RELEASE OF LIABILITY AND INDEMNITY

Contractor hereby waives, releases, indemnifies, defends and holds harmless Railway for all judgments, awards, claims, demands, and expenses (including attorneys' fees), for injury or death to all persons, including Railway's and Contractor's officers and employees, and for loss and damage to property belonging to any person, arising in any manner from Contractor's or any of Contractor's subcontractors' acts or omissions or any work performed on or about Railway's property or right-of-way. **THE LIABILITY ASSUMED BY CONTRACTOR WILL NOT BE AFFECTED BY THE FACT, IF IT IS A FACT, THAT THE DESTRUCTION, DAMAGE, DEATH, OR INJURY WAS OCCASIONED BY OR CONTRIBUTED TO BY THE NEGLIGENCE OF RAILWAY, ITS AGENTS, SERVANTS, EMPLOYEES OR OTHERWISE, EXCEPT**

TO THE EXTENT THAT SUCH CLAIMS ARE PROXIMATELY CAUSED BY THE WILLFUL MISCONDUCT OR SOLE NEGLIGENCE OF RAILWAY.

THE INDEMNIFICATION OBLIGATION ASSUMED BY CONTRACTOR INCLUDES ANY CLAIMS, SUITS OR JUDGMENTS BROUGHT AGAINST RAILWAY UNDER THE FEDERAL EMPLOYEE'S LIABILITY ACT, INCLUDING CLAIMS FOR STRICT LIABILITY UNDER THE SAFETY APPLIANCE ACT OR THE LOCOMOTIVE INSPECTION ACT, WHENEVER SO CLAIMED.

Contractor further agrees, at its expense, in the name and on behalf of Railway, that it will adjust and settle all claims made against Railway, and will, at Railway's discretion, appear and defend any suits or actions of law or in equity brought against Railway on any claim or cause of action arising or growing out of or in any manner connected with any liability assumed by Contractor under this Agreement for which Railway is liable or is alleged to be liable. Railway will give notice to Contractor, in writing, of the receipt or dependency of such claims and thereupon Contractor must proceed to adjust and handle to a conclusion such claims, and in the event of a suit being brought against Railway, Railway may forward summons and complaint or other process in connection therewith to Contractor, and Contractor, at Railway's discretion, must defend, adjust, or settle such suits and protect, indemnify, and save harmless Railway from and against all damages, judgments, decrees, attorney's fees, costs, and expenses growing out of or resulting from or incident to any such claims or suits.

In addition to any other provision of this Agreement, in the event that all or any portion of this Article shall be deemed to be inapplicable for any reason, including without limitation as a result of a decision of an applicable court, legislative enactment or regulatory order, the parties agree that this Article shall be interpreted as requiring Contractor to indemnify Railway to the fullest extent permitted by applicable law. **THROUGH THIS AGREEMENT THE PARTIES EXPRESSLY INTEND FOR CONTRACTOR TO INDEMNIFY RAILWAY FOR RAILWAY'S ACTS OF NEGLIGENCE.**

It is mutually understood and agreed that the assumption of liabilities and indemnification provided for in this Agreement survive any termination of this Agreement.

Section 2. TERM

This Agreement is effective from the date of the Contract until (i) the completion of the project set forth herein, and (ii) full and complete payment to Railway of any and all sums or other amounts owing and due hereunder.

Section 3. INSURANCE

Contractor shall, at its sole cost and expense, procure and maintain during the life of this Agreement the following insurance coverage:

A. Commercial General Liability insurance. This insurance shall contain broad form contractual liability with a combined single limit of a minimum of $2,000,000 each

occurrence and an aggregate limit of at least $6,000,000 but in no event less than the amount otherwise carried by the Contractor. Coverage must be purchased on a post 2004 ISO occurrence form or equivalent and include coverage for, but not limit to the following:

- Bodily Injury and Property Damage
- Personal Injury and Advertising Injury
- Fire legal liability
- Products and completed operations

This policy shall also contain the following endorsements, which shall be indicated on the certificate of insurance:

- The definition of insured contract shall be amended to remove any exclusion or other limitation for any work being done within 50 feet of railroad property.
- Waver of subrogation in favor of and acceptable to Railway.
- Additional insured endorsement in favor of and acceptable to Railway.
- Separation of insureds.
- The policy shall be primary and non-contributing with respect to any insurance carried by Railway.

It is agreed that the workers' compensation and employers' liability related exclusions in the Commercial General Liability insurance policy(s) required herein are intended to apply to employees of the policy holder and shall not apply to ***Railway*** employees.

No other endorsements limiting coverage as respects obligations under this_Agreement may be included on the policy with regard to the work being performed under this agreement.

B. Business Automobile Insurance. This insurance shall contain a combined single limit of at least $1,000,000 per occurrence, and include coverage for, but not limited to the following:

- Bodily injury and property damage
- Any and all vehicles owned, used or hired

The policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

- Waiver of subrogation in favor of and acceptable to Railway.
- Additional insured endorsement in favor of and acceptable to Railway.
- Separation of insureds.
- The policy shall be primary and non-contributing with respect to any insurance carried by Railway.

C. Workers Compensation and Employers Liability insurance including coverage for, but not limited to:

- Contractor's statutory liability under the worker's compensation laws of the state(s) in which the work is to be performed. If optional under State law, the insurance must cover all employees anyway.
- Employers' Liability (Part B) with limits of at least $500,000 each accident, $500,000 by disease policy limit, $500,000 by disease each employee.

This policy shall also contain the following endorsements or language, which shall be indicated on the certificate of insurance:

- Waiver of subrogation in favor of and acceptable to Railway.

D. Railroad Protective Liability insurance naming only the ***Railway*** as the Insured with coverage of at least $2,000,000 per occurrence and $6,000,000 in the aggregate. The policy Must be issued on a standard ISO form CG 00 35 12 04 and include the following:

- Endorsed to include the Pollution Exclusion Amendment
- Endorsed to include the Limited Seepage and Pollution Endorsement.
- Endorsed to remove any exclusion for punitive damages.
- No other endorsements restricting coverage may be added.
- The original policy must be provided to the ***Railway*** prior to performing any work or services under this Agreement
- Definition of "Physical Damage to Property" shall be endorsed to read: "means direct and accidental loss of or damage to all property owned by any named insured and all property in any named insured' care, custody, and control arising out of the acts or omissions of the contractor named on the Declarations.

In lieu of providing a Railroad Protective Liability Policy, Licensee may participate (if available) in Railway's Blanket Railroad Protective Liability Insurance Policy.

Other Requirements:

Where allowable by law, all policies (applying to coverage listed above) shall contain no exclusion for punitive damages.

Contractor agrees to waive its right of recovery against ***Railway*** for all claims and suits against ***Railway***. In addition, its insurers, through the terms of the policy or policy endorsement, waive their right of subrogation against ***Railway*** for all claims and suits. Contractor further waives its right of recovery, and its insurers also waive their right of subrogation against ***Railway*** for loss of its owned or leased property or property under Contractor's care, custody, or control.

Allocated Loss Expense shall be in addition to all policy limits for coverages referenced above.

Contractor is not allowed to self-insure without the prior written consent of ***Railway.*** If granted by ***Railway***, self-insured retention or other financial responsibility for claims shall be covered directly by Contractor in lieu of insurance. Any and all ***Railway*** liabilities that

would otherwise, in accordance with the provisions of this ***Agreement***, be covered by Contractor's insurance will be covered as if Contractor elected not to include a deductible, self-insured retention or other financial responsibility for claims.

Prior to commencing the Work, Contractor shall furnish to ***Railway*** an acceptable certificate(s) of insurance from an authorized representative evidencing the required coverage(s), endorsements, and amendments. The certificate should be directed to the following addresses:

BNSF Railway Company
c/o CertFocus
P.O. Box 140528
Kansas City, MO 64114
Toll Free: 877-576-2378
Fax number: 817-840-7487
Email: BNSF@certfocus.com
www.certfocus.com

Contractor shall notify ***Railway*** in writing at least 30 days prior to any cancellation, non-renewal, substitution, or material alteration.

Any insurance policy must be written by a reputable insurance company acceptable to ***Railway*** or with a current Best's Guide Rating of A- and Class VII or better, and authorized to do business in the state(s) in which the service is to be provide.

If coverage is purchased on a "claims made" basis, Contractor hereby agrees to maintain coverage in force for a minimum of three years after expiration, cancellation or termination of this contract. Annually, Contractor agrees to provide evidence of such coverage as required hereunder.

Contractor represents that this ***Agreement*** has been thoroughly reviewed by Contractor's insurance agent(s)/broker(s), who have been instructed by Contractor to procure the insurance coverage required by this ***Agreement***.

Not more frequently than once every five years, ***Railway*** may reasonably modify the required insurance coverage to reflect then-current risk management practices in the railroad industry and underwriting practices in the insurance industry.

If any portion of the operation is to be subcontracted by Contractor, Contractor shall require that the subcontractor shall provide and maintain the insurance coverage(s) set forth herein, naming ***Railway*** as an additional insured, and shall require that the subcontractor shall release, defend, and indemnify ***Railway*** to the same extent and under the same terms and conditions as Contractor is required to release, defend, and indemnify ***Railway*** herein.

Failure to provide evidence as required by this section shall entitle, but not require, ***Railway*** to terminate this ***Agreement*** immediately. Acceptance of a certificate that does not comply with this section shall not operate as a waiver of Contractor's obligations hereunder.

The fact that insurance (including, without limitation, self-insurance) is obtained by Contractor shall not be deemed to release or diminish the liability of Contractor including, without limitation, liability under the indemnity provisions of this ***Agreement***. Damages recoverable by ***Railway*** shall not be limited by the amount of the required insurance coverage.

In the event of a claim or lawsuit involving ***Railway*** arising out of this agreement, Contractor will make available any required policy covering such claim or lawsuit.

These insurance provisions are intended to be a separate and distinct obligation on the part of the Contractor. Therefore, these provisions shall be enforceable and Contractor shall be bound thereby regardless of whether or not indemnity provisions are determined to be enforceable in the jurisdiction in which the work covered hereunder is performed.

For purposes of this section, ***Railway*** means "Burlington Northern Santa Fe LLC", "BNSF RAILWAY COMPANY" and the subsidiaries, successors, assigns and affiliates of each.

Section 4. EXHIBIT "C" CONTRACTOR REQUIREMENTS

The Contractor must observe and comply with all provisions, obligations, requirements and limitations contained in the Contract, and the Contractor Requirements set forth on Exhibit "C" attached to the Contract and this Agreement, , including, but not be limited to, payment of all costs incurred for any damages to Railway roadbed, tracks, and/or appurtenances thereto, resulting from use, occupancy, or presence of its employees, representatives, or agents or subcontractors on or about the construction site.

Section 5. TRAIN DELAY

Contractor is responsible for and hereby indemnifies and holds harmless Railway (including its affiliated railway companies, and its tenants) for, from and against all damages arising from any unscheduled delay to a freight or passenger train which affects Railway's ability to fully utilize its equipment and to meet customer service and contract obligations. Contractor will be billed, as further provided below, for the economic losses arising from loss of use of equipment, contractual loss of incentive pay and bonuses and contractual penalties resulting from train delays, whether caused by Contractor, or subcontractors, or by the Railway performing work under this Agreement. Railway agrees that it will not perform any act to unnecessarily cause train delay.

For loss of use of equipment, Contractor will be billed the current freight train hour rate per train as determined from Railway's records. Any disruption to train traffic may cause delays to multiple trains at the same time for the same period.

Additionally, the parties acknowledge that passenger, U.S. mail trains and certain other grain, intermodal, coal and freight trains operate under incentive/penalty contracts between Railway and its customer(s). Under these arrangements, if Railway does not meet its contract service commitments, Railway may suffer loss of performance or incentive pay and/or be subject to penalty payments. Contractor is responsible for any train performance and incentive penalties or other contractual economic losses actually incurred by Railway which are attributable to a train delay caused by Contractor or its subcontractors.

The contractual relationship between Railway and its customers is proprietary and confidential. In the event of a train delay covered by this Agreement, Railway will share information relevant to any train delay to the extent consistent with Railway confidentiality obligations. Damages for train delay are currently $382.20 per hour per incident. **THE RATE THEN IN EFFECT AT THE TIME OF PERFORMANCE BY THE CONTRACTOR HEREUNDER WILL BE USED TO CALCULATE THE ACTUAL COSTS OF TRAIN DELAY PURSUANT TO THIS AGREEMENT.**

Contractor and its subcontractors must give Railway's representative (Greg Rousseau 909-386-4079) four (4) weeks advance notice of the times and dates for proposed work windows. Railway and Contractor will establish mutually agreeable work windows for the project. Railway has the right at any time to revise or change the work windows due to train operations or service obligations. Railway will not be responsible for any additional costs or expenses resulting from a change in work windows. Additional costs or expenses resulting from a change in work windows shall be accounted for in Contractor's expenses for the project.

Contractor and subcontractors must plan, schedule, coordinate and conduct all Contractor's work so as to not cause any delays to any trains.

Kindly acknowledge receipt of this letter by signing and returning to the Railway two original copies of this letter, which, upon execution by Railway, will constitute an Agreement between us.

_____	
Contractor	**BNSF Railway Company**
By: _____	By: _____
Printed Name: _____	Name: _____
Title: _____	Manager Public Projects
Contact Person: _____	Accepted and effective this _____day of 201___.
Address: _____	
City: _____	
State: _____ Zip: _____	
Fax: _____	
Phone: _____	
E-mail: _____	

GEOTECHNICAL DESIGN REPORT

FOR THE PROPOSED WIDENING OF INTERSTATE 15 IN SAN BERNARDINO COUNTY

FROM MOJAVE DRIVE IN VICTORVILLE TO HIGHWAY 58 IN BARSTOW

08-SBd-15-KP 67.4/113.6
(PM 41.9 - 70.3)
08-355500
08-355520

Prepared for:

District 08
Project Development

By:

California Department of Transportation
ENGINEERING SERVICE CENTER
Division of Structural Foundations
Office of Roadway Geotechnical Engineering - South

February, 2000

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Prepared for:

District 08
Project Development

By:

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California Department of Transportation
ENGINEERING SERVICE CENTER
Division of Structural Foundations
Office of Roadway Geotechnical Engineering - South

February 29, 2000

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1.0 Introduction

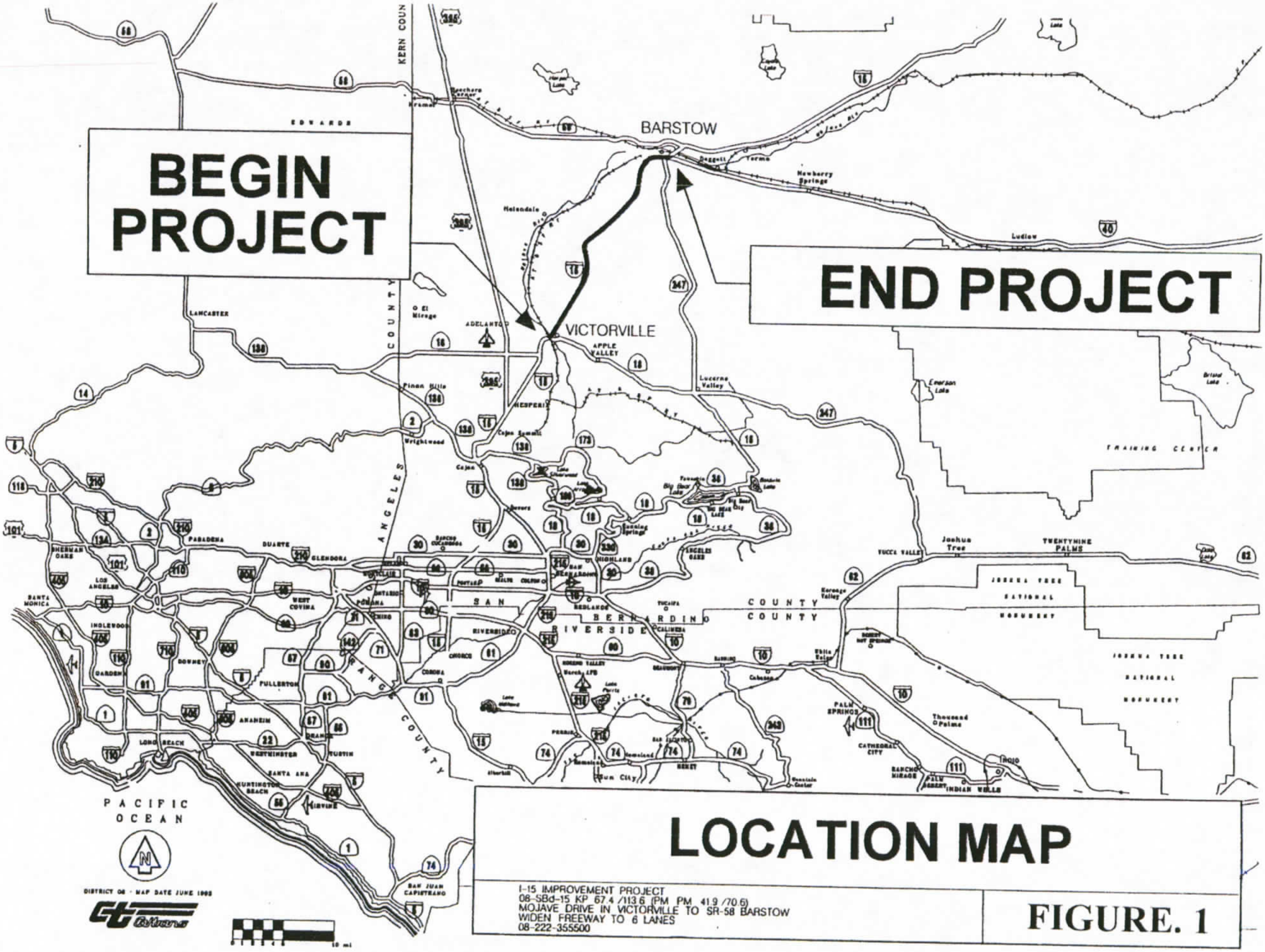
This Geotechnical Design Report (GDR) presents the findings of a geotechnical investigation performed by the Office of Roadway Geotechnical Engineering - South (RGES) of the Division of Structural Foundations for the proposed widening of Interstate -15, (See Location Map, Figure 1). The approved Project Study Report dated August 13, 1991, recommends the outside widening of Interstate 15 from 4 to 6 lanes between the City of Victorville and the City of Barstow and the addition of a 1.6 kilometer long, southbound truck climbing lane just north of Victorville. This GDR was requested by District 8 Project Development to provide support to the County of San Bernardino engineering staff who is responsible for project development. The limits of this study include approximately 45 kilometers (28.5 miles) of existing roadway between Stations 30+00, which is 300 meters north of Mojave Drive in Victorville, and Station 487+00, which is 800 meters north of the Highway 58 connector near Barstow.

This GDR provides geotechnical design and construction recommendations for Retaining Walls, Soundwalls, cut slopes and embankments. Foundations for overhead signs and structures or retaining walls within 150 meters of existing bridges were out of the scope of this investigation, thus were not addressed in this GDR. Investigative techniques and exploration methodology used include review of published literature, site reconnaissance, geologic mapping, seismic refraction, subsurface exploration, Laboratory testing, and engineering analysis.

2.0 Existing Facilities and Proposed Improvements

The approximate 45 kilometers of existing Interstate 15 between Victorville and Barstow consists of 4 lanes, 2 northbound (N/B) and 2 southbound (S/B), including 14 bridges. The existing lanes are 3.6 meters wide with a shoulder width that varies from approximately 0.5 to 3.0 meters. Concrete barriers have been installed in the median throughout the entire segment, except where median guardrails are in place. Approximately 8 kilometers of paved, 2 lane frontage roads, on both sides of the highway, skirt the existing Interstate. Existing cuts and fills have slope ratios between 1:1 and 1:2 (V:H). Currently only one soundwall, located between Stations 34+00 and 38+50, exists within the project limits. With the exception of a retaining wall adjacent to the above mentioned soundwall, all existing retaining walls within the project limits are those associated with bridge structures. Drainage collectors within the project limits consist mostly of drop inlets along the median, overside drains along the outside shoulders, 6 wash/river bridges and more than 120 cross culverts. The Mojave River flows under I-15 between Stations 57+40 and 58+40. The Union Pacific Railroad crosses over I-15 at Station 143+50 and under the roadway at Station 51+00 adjacent to "D" Street. Four Los Angeles Department of Water and Power (LADWP) high voltage tension lines cross over I-15 between KP 84.0 (PM 52.2) and KP 84.5 (PM 52.3).

Proposed northbound and southbound widening will include removing the existing outside shoulders and constructing two, 3.6 meter-wide, outside lanes with 3.0 meter-wide shoulders, rumble strip and AC dike. Finished embankments will have a 1:2 (V:H) or flatter slope ratio, and finished cut slopes will be 1:1.5 (V:H) or flatter and rounded. Thirteen of the 14 bridges located within the project limits will be widened or replaced, including one railroad bridge. All of the cross culverts within the project limits will be extended at the inlet and outlet.



LOCATION MAP

I-15 IMPROVEMENT PROJECT
08-SBd-15 KP 67.4 /113.6 (PM PM 41.9 /70.6)
MOJAVE DRIVE IN VICTORVILLE TO SR-58 BARSTOW
WIDEN FREEWAY TO 6 LANES
08-222-355500

FIGURE. 1

Several Retaining walls, soundwalls, embankment and cut slopes are proposed as part of the improvements to accomadate the roadwaay widening. A list of improvements showing locations, maximum heights and foundation type for each of the proposed improvement are shown in Table 1. Table 1 does not include proposed cuts or fills that have maximum vertical heights less then 5 meters.

Table 1 - Summary of Proposed Improvements

Proposed Improvement	Location Sta. To Sta.	Maximum Height (m)	Remarks
Soundwall #40	(NB I15) 38+46 to 41+17	4	CIDH piles foundation
Soundwall #50	(NB offramp) 49+19 to 50+31	4	CIDH piles foundation in embankment fill
Soundwall #60	(NB I15) 59+00 to 62+40	4	CIDH piles foundation in embankment fill
Soundwall on Retaining Wall #31	(SB I15) 30+60 to 32+80	4	Adjacent to apartment complex Requires overexcavation and recompaction Standard Plan XS 3-51
Soundwall on Retaining Wall #37	(SB I15) 34+00 to 41+00	4	Standard Plan XS 3-51
Retaining Wall #42	(NB I15) 38+60 to 46+95	7.3	Type 1, Standard Plan B3-1
Retaining Wall #440	(NB I15) 439+24 to 441+25	1.4	Type 6A, Standard Plan B3-11
Retaining Wall #450	(NB I15) 447+16 to 452+85	2.4	Type 1, Standard Plan B3-1
Retaining Wall #105	(SB I15) 103+00 to 108+00	3.5	Type 1, Standard Plan B3-1, Adjacent to air strip
Retaining Wall #123	(SB I15) 122+87 to 122+97	3	Type 1, Standard Plan B3-1, Adjacent to high voltage tower
Embankment fill	(NB offramp) 47+00 to 50+60	7	1:2 (V:H) slope ratio
Embankment fill	(NB I15) 55+20 to 57+00	7	1:2 (V:H) slope ratio
Embankment fill	(NB I15) 220+50 to 223+00	7	1:2 (V:H) ratio
Embankment fill	(SB I15) 217+50 to 223+00	12	1:2 (V:H) slope ratio
Embankment fill	(SB I15) 294+00 to 296+00	6	1:2 (V:H) slope ratio
Embankment fill	(SB I15) 339+50 to 345+00	7	1:2 (V:H) slope ratio
Cut slope	(NB I15) 140+20 to 147+00	11	Rail road over crossing, gravely Sand, 1:2
Cut slope	(NB I15) 212+80 to 214+00	6	Blasting may be required 1:1.5 (V:H) ratio
Cut slope	(NB I15) 218+00 to 220+30	12	Rock slope, 1:1.5 (V:H) ratio
Cut slope	(NB I15) 330+00 to332+00	12	Silty Sand slope, 1:2 (V:H) ratio
Cut slope	(NB I15) 413+60 to 216+60	13	Sandy Gravel, 1:2 (V:H) ratio
Cut slope	(NB I15) 467+00 to 474+00	13	Clayey Sand, 1:2 (V:H) ratio
Cut slope	(SB I15) 140+20 to 147+00	11	Rail road over crossing, Gravely Sand
Cut slope	(SB onramp) 46+20 to 50+00	24	Gravely Sand, 1:2 (V:H) ratio
Cut slope	(SB I15) 164+00 to 166+40	10	Blasting may be required, 1:2 (V:H) ratio
Cut slope	(SB I15) 212+00 to 215+00	12	Blasting may be required, 1:2 (V:H) ratio
Cut slope	(SB I15) 223+00 to 226+40	21	Blasting may be required, 1:2 (V:H) ratio
Cut slope	(SB I15) 468+00 to 474+00	18	Clayey Sand, 1:2 (V:H) slope ratio
Frontage road, new alignment	(NB) 65+70 to 116	10	Cuts and fills, 1:2 (V:H) slope ratio
Cut slope	(NB frontage)111+0 to 113+0	10	Blasting may be required 1:1.5 (V:H) ratio
Rock cut	(NB frontage)70+0 to72+0	6	Blasting may be required 1:1.5 (V:H) ratio

3.0 Pertinent Reports and Investigations

The pertinent geotechnical information reviewed for this report is as follows.

- "Draft Project Report Victorville to Barstow I-15 Outside Widening", Jim Balcome, San Bernardino County Freeway Study Team, April 1999
- "Floodplain Analysis Interstate 15 Widening Between Mojave Drive in Victorville To SR-58 In Barstow", Jim Balcome, San Bernardino Freeway County Study, Team December 1998
- "Geotechnical Study I-15 Widening Victorville to Barstow", Jim Balcome, San Bernardino County Freeway Study Team", October 1998
- "Materials Report for Proposed Construction on State Highway 31 in San Bernardino County Between 0.3 Mi. South of AT&SFRR and SCL Barstow," Caltrans, June 1956
- "Foundation Investigation Soundwall NO. 800 Mojave Drive to "D" Street", Faramarz Gerami , Office of Transportation Laboratory, December 1989
- "Materials Report for Southbound Truck Climbing Lane", Bruce Kean, Department Of Transportation, May 1998

4.0 Physical Setting

4.1 Climate

The climate within the project limits is fairly typical for elevated desert environments with less than 150 mm of rain falling between December and April and an occasional summer shower (38 mm fell in an hour and a half during our seismic refraction survey in August of 1998). The temperature covers a range from a minimum of -11^0C to a maximum of 47^0C. Temperature variations of 28^0C within a 24-hour period are not uncommon during the summer months. Occasional snowfalls on the higher elevation portions of the highway during the winter months may produce freeze/thaw conditions.

4.2 Topography and Drainage

The general topography in the project vicinity consists of rocky ridges projecting above alluvial fans in a desert environment. Ridges are aligned north to northwest with mountain peaks ranging in elevation from 1500 m at Stoddard Mountain to about 650 m at the Mojave River in Barstow. Highway elevations range from 1000 m just north of Dale Evans Parkway to about 725 m at Lenwood Road.

The Mojave River is the principal drainage of the region flowing partially underground from Victorville, making an accurate path as it flows to the north to Barstow. The Mojave River is the most porous river channel in the U.S. (CDMG, Bull. 170, Vol. 2). The five major drainage basins in

the project vicinity are ephemeral washes that flow into the Mojave River. These washes can produce heavy flows during periods of rain, such as: Bell Mountain Wash, Powerline Wash, Wild Wash, and the largest basin area, Drift/Lenwood Washes. The washes in the extreme northern portion of the project flow northward, the central and north central washes flow northwest, and the southern washes flow southwest (See Drainage Location Map, Figure 2).

4.3 Man-Made and Natural Features of Engineering and Construction Significance

The natural and manmade features which were observed during our field investigations are discussed below.

- Retaining Wall #42 is proposed in the cut slope along N/B I-15 between Stations 38+40 and 47+00. The top of the cut slope has a bench that varies in width between 3 m and 10 m and will support soundwall #40 from Stations 38+46 to 41+17. Residential structures, which exist adjacent to the RIGHT OF WAY fence, may be impacted during construction of the walls and adequate slope protection, including shoring, will be necessary in this area during construction.

- The proposed alignment of the northbound frontage road, east of the proposed Stoddard Wells Overcrossing will require the demolition of several structures including the existing restaurant known as Peggy Sue's and a large outcrop of unusual monolithic granitic rocks between stations 69+00 and 72+00.

- Retaining Wall #105 is proposed between Stations 101+00 and 108+00 and will encroach upon a storm water detention basin and a private airport runway. Final design of a proposed detention basin will determine what construction techniques are necessary to construct retaining wall #105.

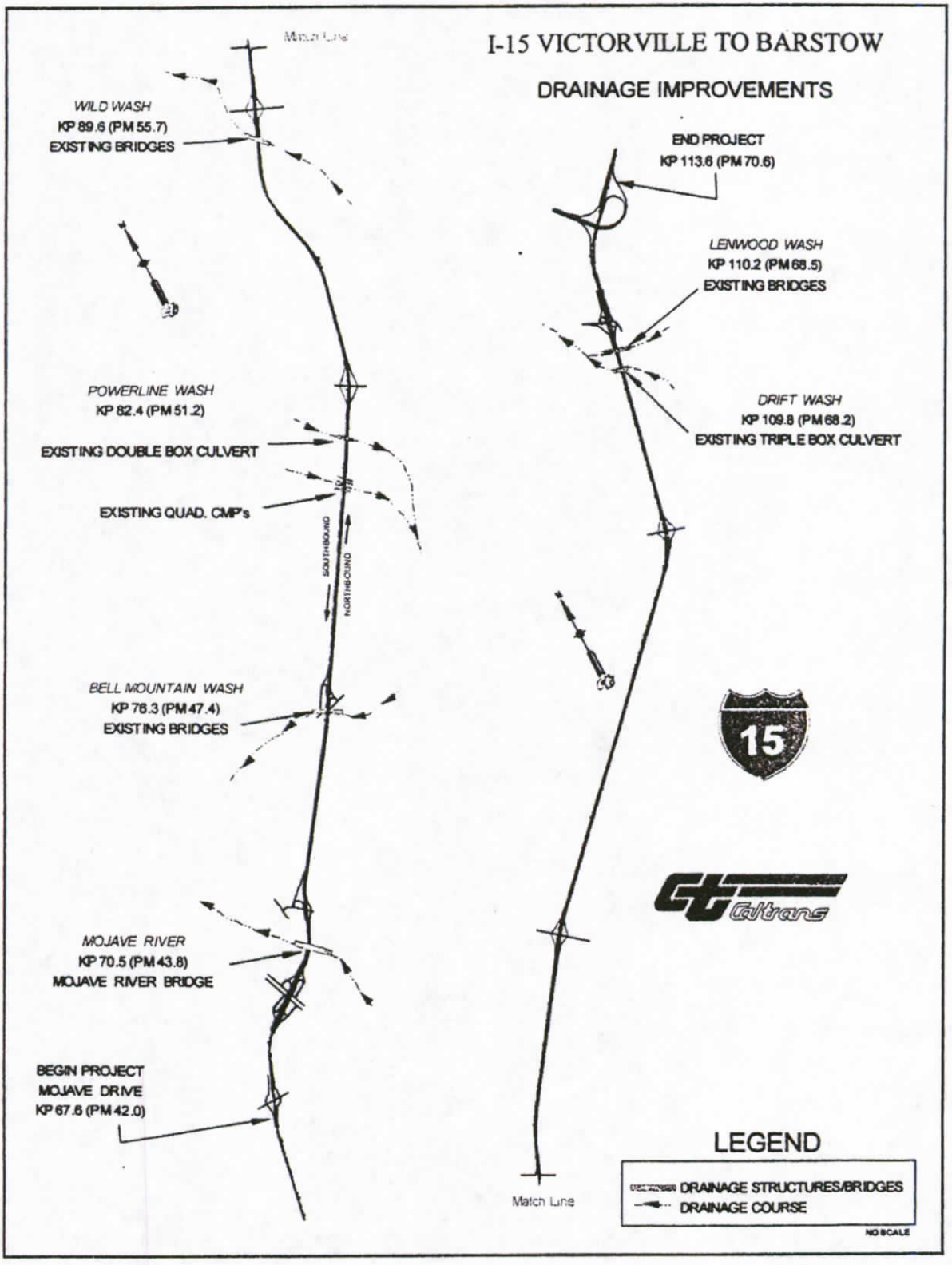
- Retaining Wall #123 is proposed between Stations 122+50 and 123+00 to protect a high voltage tower, which crosses the highway.

- Between Stations 353+55 and 373+85, there is a unique outcrop of granitic rocks within 3 meters of the existing embankment toe. At least two, oversized rocks (approximately 2.5 m in diameter) are within the proposed embankment fill area and will need to be removed. The weathered, wedge shaped rocks could be moved out of the way using a crane. Blasting of the rocks would disrupt traffic and may destroy their esthetic value.

- A series of natural detention basins exist on the east side of the highway from Station 373+55 to Outlet Center Drive at Station 405+00. These shallow basins are rectangular shaped, 40 m wide from the edge of embankment to the RIGHT OF WAY and ranging from 80 to 300 m long with an average length of 140 m. To retain their current dimensions, they will have to be relocated beyond the RIGHT OF WAY.

- Between Stations 439+20 and 441+20, Retaining Wall #440 is planned to preserve RIGHT OF WAY for an archeological site known as the "Circle Rocks", District Environmental and or Archeology will have recommendations for construction in this area.

08-355500
08-SBd-15-KP 67.4/113.6



Drainage Location Map

Figure 2

4.4 Regional Geology and Seismicity

Regionally, the Mojave Desert Geomorphic Province can be sectioned into the East Mojave subprovince and the West Mojave subprovince as defined by the northerly flowing Mojave River. This GDR includes the area located on the west side of the East Mojave subprovince.

From the southern project limit in Victorville, flat, sandy alluvium is dissected by the Mojave River. Some river gravels and clayey silts are layered in the alluvium. The project highway climbs out of the river basin around mountains and traverses alluvial valley.

Prominent features seen on the right (eastside of the highway) are blocky granite hills, then a limestone quarry. Limestone and quartzite terrane were deposited in this region before any other exposed rock in this region. The highway passes through a cut in intensely folded limestone at Bell Mountain Wash. Just past this cut, the volcanic Bell Mountain can be seen on the east rising up out of the desert floor. The volcanic rock extruded over the limestone and both were intruded and uplifted by the granite. Most of the volcanic rock and some of the limestone eroded away leaving a pointed peak, or plug, high above the surrounding Sidewinder Valley.

Several large cuts at the top of the highway grade expose the granite and volcanic rocks. These rocks are very fractured because of the seismically active Helendale Fault which passes through this area, and it forms the deep valley below called Turtle Valley. A granite rock quarry can be seen adjacent to the east side of the highway just north of Wild Wash.

The highway crosses a highland plateau traversing the toes of alluvial fans deposited from the highest peak in the area, Stoddard Mountain. Isolated outcrops of granite, volcanic plugs and flow-banded metavolcanic rocks dot the landscape. At the north end of this plateau, the highway passes through some older, well-dissected (well-eroded) alluvial fans and rare intrusive volcanic rocks.

The highway descends into the Lenwood and Drift Washes which converge at the highway producing the largest water flow in the area, besides the Mojave River, during rainy periods. North of these washes the highway passes through a large cut in another well-dissected alluvial fan material of interbedded sand and some clay. It is an upper limb of a syncline that is partially cemented on the north side. This cementation forms from carbonate-rich infiltration along the seismically-active Lenwood Fault that has bisected the limb, leaving it elevated above the surrounding topography. The terrain to the north side of the Lenwood Fault is flat to gently sloping to the Mojave River on the northwest side of Highway 58.

5.0 Geotechnical Investigation

The geotechnical investigation performed included: performing field reconnaissance, exploration of the subsurface soils, geophysical studies, geological mapping and Laboratory testing. A brief discussion of the procedures performed during our geotechnical investigation is presented below. Findings of the geotechnical investigation are presented in Section 7.0, Geotechnical Conditions.

5.1 Field Reconnaissance

Our initial field reconnaissance included visually inspecting the existing roadway, shoulders and locations of proposed frontage roads for obvious signs of geotechnical distress and to obtain preliminary design parameters.

During the first site visit on April 20, 1999, RGES staff drove I-15 between Victorville and Barstow, stopping to inspect each of the proposed wall locations and several of the large proposed cut and fill locations. Photographs and notes were taken at each site including estimating the slope geometry and visual identification of the exposed soils. Five sites were identified that required geophysical studies in order to determine the rippability of the bedrock. On September 7, 1999, RGES was notified that one additional cut slope between Stations 467+00 and 474+00 was added to the project limits of this GDR. The additional slope was inspected by RGES staff on September 8, 1999.

5.2 Subsurface Investigation

On three separate occasions members of the RGES staff visited the project area in order to log the existing surface and sub-surface soil conditions and to obtain soil samples for Laboratory testing. The subsurface exploration phase of this project utilized a B-47 trailer mounted drill rig, a CME 75 Drill Rig, and a standard, rubber tired, backhoe. Sampling in cohesionless soil was performed with the Standard Penetration Test (SPT) every 1.5 meters. Blow counts from the SPT were recorded in the Log of Test Boring sheets (LTBs). Soil samples collected from the 2 inch-diameter SPT spoon sampler were packaged in zip-lock bags and bulk bag samples were collected from auger cuttings. Samples for testing were delivered to the District 7 Laboratory or to the Sacramento Laboratory. Table 2 summarizes pertinent information from the borings. Laboratory test results and the Log of Test Borings are provided in the Appendix.

On September 8, 1999, a backhoe operated by District 8 Maintenance excavated 6 test pit trenches to approximately 0.3 meters below the existing shoulder grade along the proposed Lay Out Line (LOL) of proposed Retaining Wall #42. The trenches were excavated to allow visual identification of the subsurface soil conditions of the slope and to evaluate the possibility of constructing a soil nail retaining wall. Four bags of soil were obtained from the trenches and delivered to the Sacramento Laboratory for testing. A summary of borings and trenching information is show in Table 2. A photograph and sketch of each trench is provided in Appendix 13.3.

Table 2 - Summary of Borings and Trenching

Boring	Station (m)	Offset (m)	Offset L/R	Elevation (m)	Depth (m)	Drill Rig	Drilling Method	Date Drilled
SW1	34+95	23	LEFT	882.5	8.1	Mobile Drill B-47	Mud Rotary	5/26/99
SW2	37+00	23	"	883.0	8.1	"	"	"
SW3	38+50	25	"	884.0	8.1	"	"	"
SW4	39+60	33	RIGHT	"	8.1	"	"	9/9/99
SW5w	40+80	22	LEFT	876.0	9.6	"	"	5/26/99
RW1A	42+20	33	RIGHT	874.0	8.0	"	"	9/9/99
RW1	43+00	15	RIGHT	864.0	9.8	CME 75	Hollow Stem Auger	11/18/99
RW2	44+00	16	RIGHT	859	8.3	"	"	"
RW4	46+00	33	RIGHT	849.5	8.3	"	"	"
RW5	103+00	25	LEFT	882.2	9.6	Mobile Drill B-47	Mud Rotary	5/25/99
RW6w	104+40	25	"	880.5	9.6	"	"	5/27/99
RW7A	30+85	20	LEFT	883.6	12.7	CME 75	Hollow Stem Auger	11/17/99
RW7B	31+90	20	LEFT	883.5	11.2	CME 75	Hollow Stem Auger	11/17/99
RW8	105+50	25	"	882.2	8.1	Mobile Drill B-47	Mud Rotary	5/25/99
RW9	107+00	25	"	884.0	9.6	"	"	5/25/99
RW10	122+70	25	"	904.0	8.1	"	"	"
RW11	440+00	25	RIGHT	742.0	7.6	"	"	9/8/99
RW12	449+00	15	"	727.5	9.6	"	Hollow Stem Auger	9/17/99
RW13	450+00	15	"	727.0	9.6	"	Hollow Stem Auger	"
RW14	450+95	15	"	726.5	8.1	"	Hollow Stem Auger	"
RW15	451+90	15	"	726.0	8.1	"	Hollow Stem Auger	"
CS1	470+50	50	"	766.2	8.1	"	Mud Rotary	9/9/99
CS2	471+40	55	"	769.2	8.1	"	"	"
TR1	39+00	18	RIGHT	886.0	3	Backhoe	Backhoe	9/8/99
TR2	40+00	18	"	877.0	3	"	"	"
TR3	42+00	18	"	860.0	3	"	"	"
TR4	43+80	18	"	863.5	3	"	"	"
TR5	45+00	18	"	855.0	3	"	"	"
TR6	46+50	18	"	847.0	3	"	"	"

5.3 Laboratory Testing

Laboratory tests performed on the collected samples included: Mechanical Analysis (California Test Method 202), Moisture Content (CTM 226), Plasticity Indexing (CTM 204) and Corrosion (CTM 643). Gradation plots and corrosion test results are presented in the Appendix.

5.4 In-Situ testing

In-situ testing for this report included Geophysical Studies performed at proposed cut slopes and Standard Penetration Tests (SPT) which were performed at all boring locations.

5.4.1 Geophysical Studies

Seismic refraction surveys were performed at 5 locations and are included in the Appendix. The seismic refraction surveys were performed to determine approximate rippability and depth to unweathered bedrock.

5.4.2 Instrumentation

Geotechnical instrumentation was not installed during this investigation. Two groundwater observation wells were installed in May, 1999, at borings SW5w and RW6w, due to the wet sand zones, which were encountered during drilling.

5.5 Geologic Mapping

Geologic field reconnaissance was conducted in order to map surface exposures of faults, shears, joints, fractures, springs, formational contacts, strikes and dips and other data to help characterize the bedrock and earth material in the project vicinity. The primary geologic map source used for reconnaissance mapping was the California Division of Mines and Geology, Geology Map of the San Bernardino Quadrangle, 1986, with a scale of 1:250,000. This scale was appropriate for the sparse outcrop of bedrock found that would affect the project. See Geologic Map, Figure 2a. Supporting data was gleaned from Diblee's USGS Professional Paper 522, Arial Geology of the Western Mojave Desert, California.

6.0 Geotechnical Conditions

6.1 Site Geology

The study area encompasses a wide range of rock types and ages of rock, from sedimentary to volcanic and granite ranging in ages from the Late Paleozoic, Mesozoic to recent Quaternary ages. (See Geologic Map, Figure 2a)

6.1.1 Lithology

Undifferentiated Paleozoic limestone, marble, and hornfelsic limestone that has been folded, faulted and metamorphosed outcrop along the frontage road at Stations 46+60 to 49+00 and the highway at Stations 111+60 to 133+50. The limestone is in contact with granite and peridotite with local faulting oriented north/south. The folding and hornfels metamorphosing has opalized and hardened this material so that it will require some blasting to rip it (See Rippability Study in Appendix). The next oldest rock type is Mesozoic Triassic to Jurassic Sidewinder Series metavolcanic extrusive rocks. This rocktype is found in the southern portion of the project. It consists of flow-banded andesite and dacite plugs with lesser volcanic rocks. A large cut at Stations 223+30 to 226+20 exposes this rock. It is highly fractured with some weathering from hydrothermal alteration along the Helendale Fault. This hydrothermal alteration has left sericite and quartz in the fractures of the dacite. This material has been mined for non-metallic filler material (Bull. 170).

Upper Jurassic-Lower Cretaceous granitic rock, quartz monzonite, intruded and uplifted the limestone and volcanic rock. Exposures of this rock can be seen on the right side of the highway going north from Victorville. Monolithic outcrops highlight the moderate to intense weathering and rectangular jointing. Quartz monzonite has intruded the limestone at Stations 111+60 to 133+50 along with peridotite, an associated ultramafic intrusive. At Stations 210+80 to 215+00, a cut slope exposes fractured quartz monzonite in the Helendale Fault and contacts the metavolcanic rock on the

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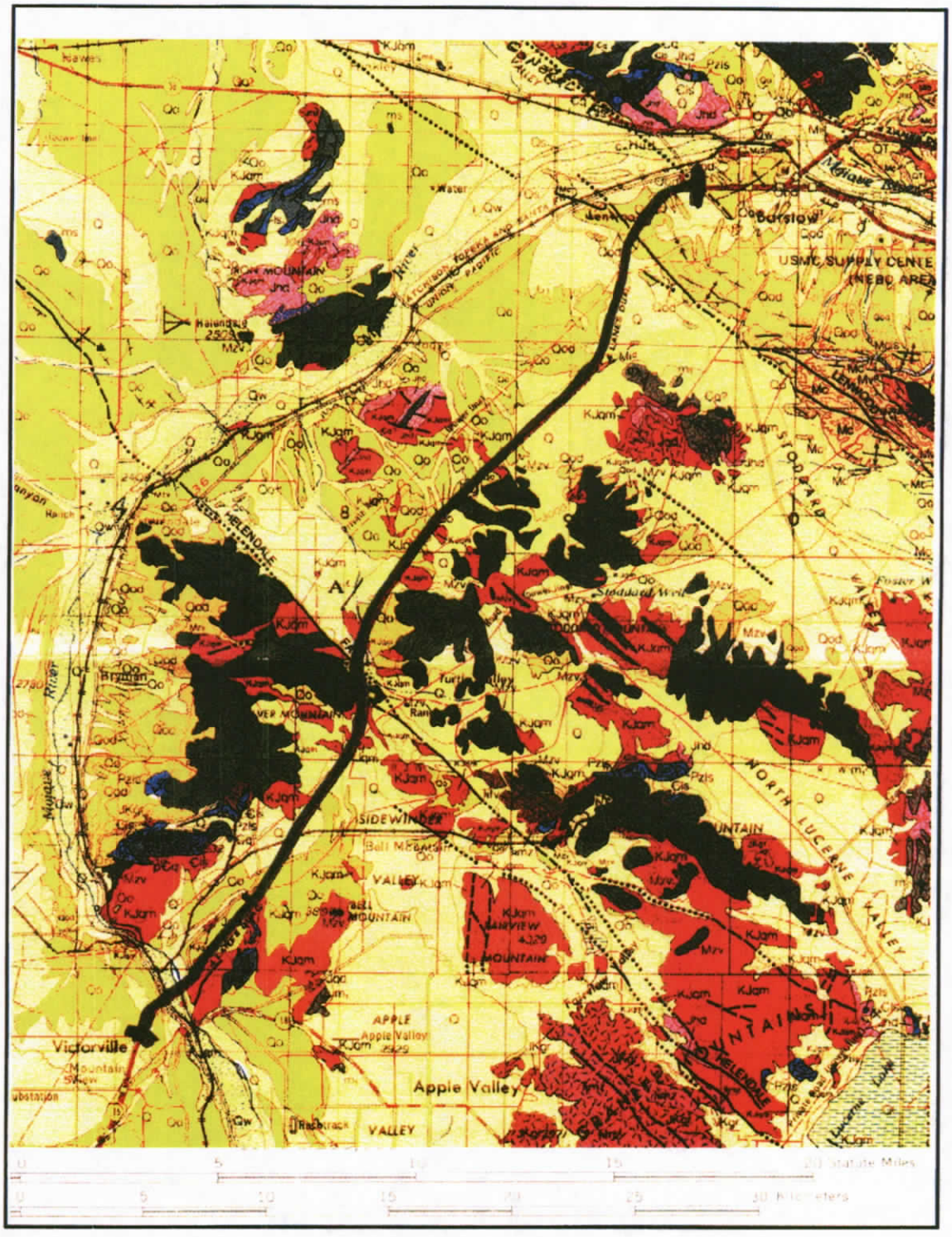


Geologic Map

Figure 2a

ABBREVIATED EXPLANATION

Approximate stratigraphic relationships only; see Geologic Map Explanation for more accurate age determinations and unit descriptions.

Q — **Alluvium** *(Undifferentiated)*

Qw — **Wash deposits** *(Alluvial deposits of modern washes)*

Qo — Older alluvium *(Undifferentiated)*

Qod — Well dissected alluvial fans

Mi — Miocene shallow intrusive rocks
(a-andesitic; d-dacitic and rhyolitic; b-basaltic)

KJqm — Cretaceous or Jurassic quartz monzonite; Quartz Monzonite of Pleasant View Ridge

Mzv — Mesozoic metavolcanic rocks

ms ∑ ls — **Metasedimentary rocks of uncertain age**
(Quartzite, phyllite, and schist)
ls - limestone and marble

MAP SYMBOLS

Contact
Observed or approximately located, queried where gradational or inferred.

Fault
Solid where well located, dashed where approximately located or inferred; queried where continuation or existance is uncertain; dotted where concealed by younger rocks. Arrows show relative or apparent direction of movement. U, upthrown side and D, downthrown side (relative or apparent).

Thrust fault - barbs on the upper plate. Generally dips less than 45°, but locally may have been subsequently steepened. Dashed where approximately located or inferred; dotted where concealed by younger rocks; queried where continuation or existance is uncertain.

Anticlinal fold
Dashed where inferred, dotted where concealed by younger rocks.

Synclinal fold
Dashed where inferred; dotted where concealed by younger rocks.

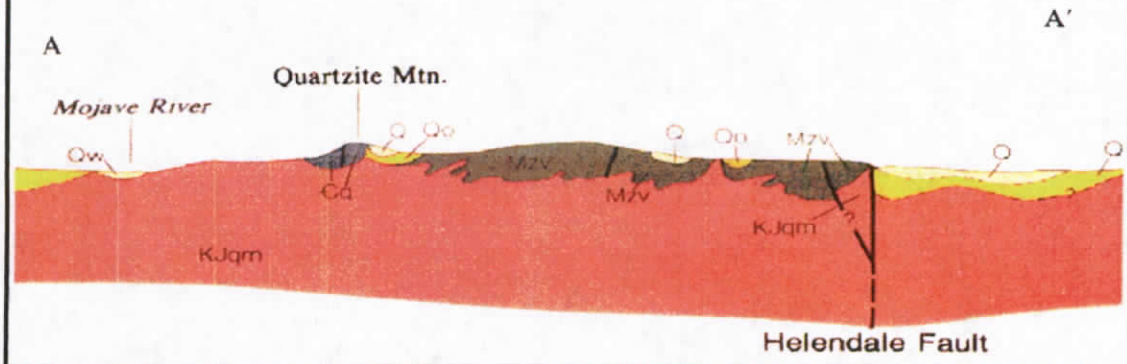
Overturned fold
Dashed where inferred, dotted where concealed by younger rocks.

Strike and dip of beds
General strike and dip of stratified rocks.

Most conspicuous foliation strike and dip

Joints
Selected areas of prominently jointed plutonic rocks

Dikes



Geologic Legend

Figure 2b

north side of the slope. Another cut slope, at Stations 164+70 to 166+40, exposes a fine grained, light colored granite called tonolite with fracturing, and some mineralization present in the fractures.

One surface cut along the highway on the east side of Outlet Center Drive, Sta. 410+50, exposes an outcrop of Miocene volcanic intrusive rock. This is a shallowly emplaced dacite or rhyolite. Cutting of material on the east side of this overcrossing may contact this material.

On the west side of Outlet Center Drive, there is an outcrop of a well-dissected alluvial fan formation. It is composed of dense sands and interbedded clays with a shallow dip angle. Some clays may be found next to the bridge and highway cut at Stations 414+00 to 416+50, however, these stiff to hard clays are thin and sandy and should not cause a settlement or expansion problem. At Stations 467+00 to 474+00, the highway passes through this formation as a large cut slope. In the Early Tertiary, Oligocene to Miocene and again in the Early Quaternary, Pleistocene period, this area was a lowland, but not a lake bed, that received coarse sands from the highlands. The clay was deposited between the Miocene and the Pleistocene. Erosion has sculptured these pediments to their current shapes.

6.1.2 Structure

The project area can be characterized by having three structural blocks which are each composed of granitic basement rock and are separated by the Helendale and Lenwood faults. The southern block and the northern block have been eroded deeply by the Mojave River. The central block is a high plateau along which the highway travels as the Mojave River swings to the west around this plateau.

Jointing in the basement rock is wide spaced and regular. Some mineralization and hydrothermal weathering is present along faults. Folding of the limestone beds occurred during emplacement of the granite bedrock and volcanic rocks that were, probably, the fluid portion of the magmatic body during formation.

The Helendale and Lenwood Faults are recently active (Holocene) faults up to 1 km wide each, in places. These active faults strike northwest and are capable of large earthquakes. See Section 7.4 for more details on these faults.

Bedding is visible in only a few places. Trenching from Mojave Drive to "D" Street exposed horizontal bedding in sands and gravels with a basal siltstone just above highway level. The limestone outcrop just south of North Stoddard Wells Road on both N/B and S/B I-15 is intensely folded and the fault, which was associated with the contact of the granite and limestone, was orientated N10°E with a dip of 70°E as measured with a Brunton Compass. The dissected alluvial fan beds by Outlet Center Drive had erratic bedding, but the same material north of Lenwood Drive had a measured orientation of a strike of N50°W and a dip of 15°SW.

6.1.3 Natural Slope Stability

All natural slopes in the project area have performed well and no landslides or small slipouts were identified or reported by this office. The flat-lying bedding nature of the alluvial sands gives the slopes strength and leaves them only susceptible to erosion as discussed below.

6.1.4 Ground Motions

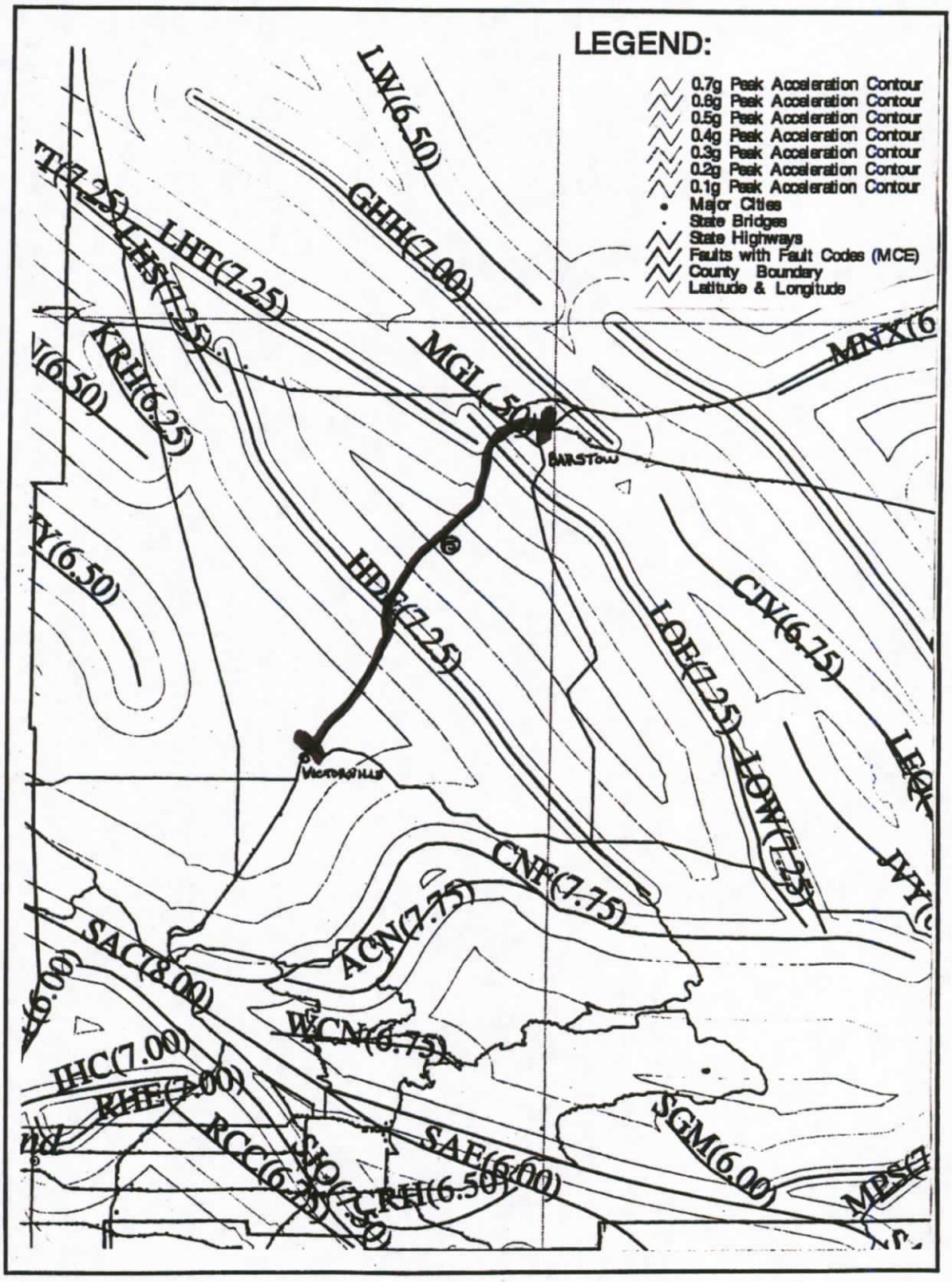
Ground motions are expected to be severe if a large earthquake occurs on the Helendale or Lenwood Faults. According to Caltrans (Mualchin, 1995, 1996), maximum bedrock acceleration for Lenwood Fault (Barstow) is expected to be 0.6g (See Fault Location Map, Figure 3). On the Mercali Intensity Scale, maximum shaking intensity is expected to be IX to X. Additional active faults located near the City of Barstow include the Mount General, Barstow, Pisgan, Hildalgo, Mesquite Lake, Calico, and portions of the Johnson Valley faults. South of the Lenwood Fault to Hodge Road acceleration is expected to diminish to 0.35g. Maximum intensity is expected to diminish to III, depending on the location relative to the active faults. In the City of Victorville area, active faults are the Helendale, North Frontal, Landers, San Andreas, San Jacinto, and Cucamonga faults. Maximum acceleration for the Helendale Fault area is expected to be 0.6g, also, with an intensity of IX to X. The intensity in the City of Victorville is III with and acceleration of 0.35g. Slip rates on most of these faults are less than 1mm per year.

During the Landers Earthquake in 1992, M7.3, 90 km away, ground shaking intensity was estimated in Barstow by the Mercali scale between VI and VII. On October 16, 1999, a M7.1 earthquake struck at 75 km east of Barstow (See Figure 4, Recent Earthquake Locations). Although damage was light in Barstow and Victorville, the earthquake woke people as far away as Ventura County. In Barstow, Mercali intensity measured VI and in Victorville it measured V. An apparent maximum offset of 3.8 to 4.7 meters was identified and measured with a 40-km long surface rupture (USGS). Peak acceleration in Barstow reached 13.5 (%g) at 9 cm/sec. Peak acceleration may be higher in certain areas due to local geologic conditions, directivity of the seismic waves, change in fault geometry or higher earthquake magnitude than the one listed on Mualchin's map.

In addition to the earthquake hazards listed above, the project area is bordered by potential volcanic hazards to the north and east (Bull. 198). Volcanic rocks less than 100 km away are only 400 years old. Volcanic hot spots exist below the surface within 50 km distance. Ground shaking from these sources are possible. It should be noted that the Hector Mine Earthquake was centered below a recent volcanic center (Pisgah Crater) at a shallow depth of 6 km. This volcanic flow is only 2000 years old and the recent earthquake could be an indication of a renewed upsurge of magma.

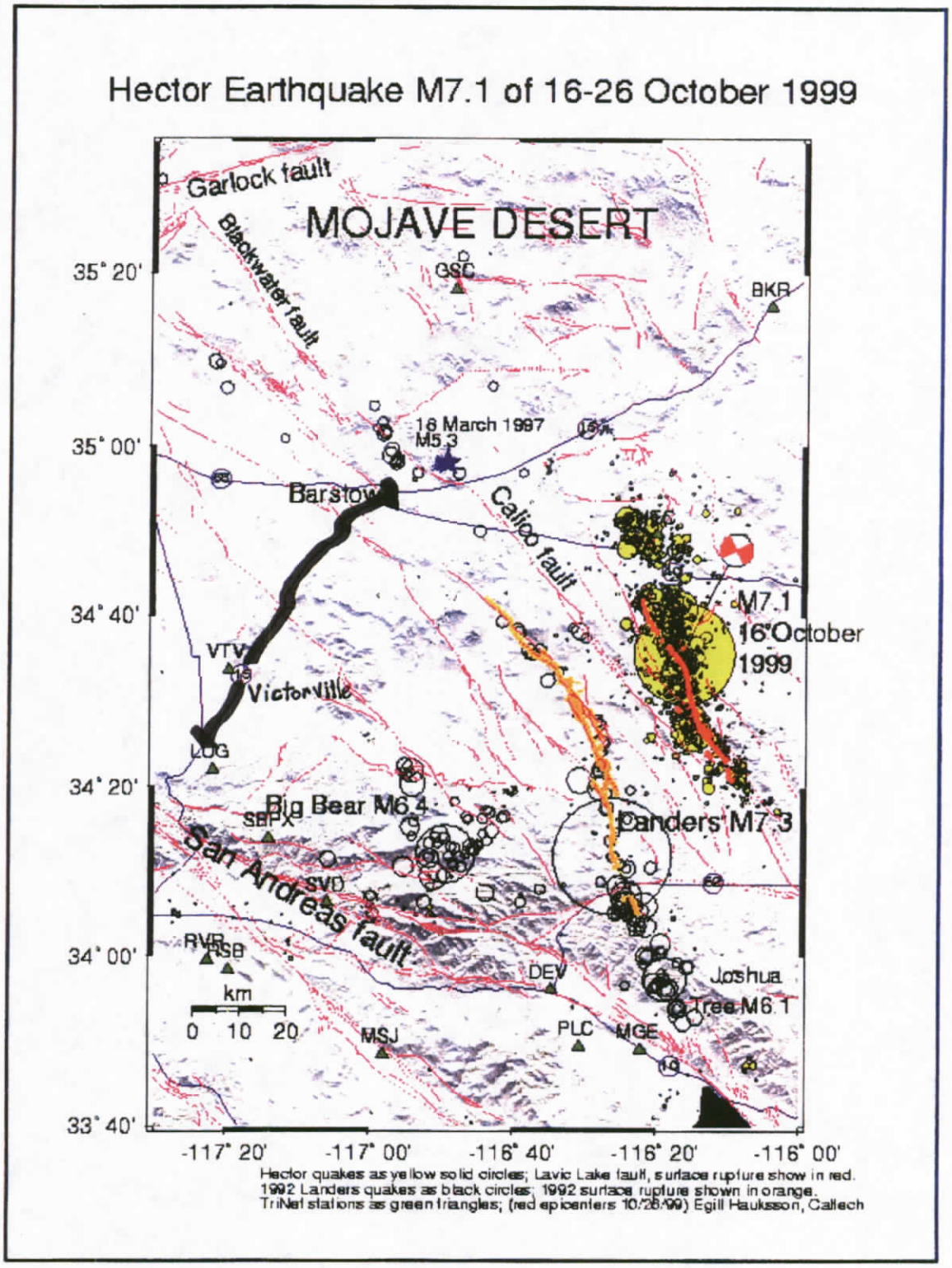
6.1.5 Project Site Seismicity

The Helendale Fault is a 90 km long, right-lateral strike-slip fault which has some vertical component to its slip. It is capable of a Maximum Credible Earthquake (MCE) of 7.25. The Lenwood Fault, also a right-lateral strike-slip fault capable of an MCE of 7.25, may have had 3-10 cm of secondary surface displacement during the Landers Earthquake (M7.3) of 1992 (Hudnut, 1993). Over 7 m of surface displacement was recorded for the Landers Earthquake fault segment. This earthquake is a good model for a similar event on the Helendale or Lenwood faults as they are capable of a 7.3 magnitude earthquake.



Fault Location Map

Figure 3



Recent Earthquake Locations

Figure 4

6.2 Subsurface Soil Conditions

The alignment of I-15 passes through a series of shallow cuts and fills as it traverses a deep alluvial basin. The general soil profile of the project includes mostly alluvial silty sands and gravels with some cobbles which vary from a shallow depth to over 50 meters deep. Finer grained soils exist around the Mojave River, wash basins, and dissected alluvial fans on the north side of the project. Results of our Geotechnical Investigation revealed that the majority of soils within the study limits is composed of silty sand with gravel although some local non-plastic to slightly plastic silts and clays exist in thin layers.

6.3 Water

6.3.1 Surface Water

Surface waters within the project limits are in the form of ephemeral streams that drain to the Mojave River. Surface waters can be found along the Mojave River but can flow underground in some places. The Mojave River and Drift/Lenwood washes are considered flood plain areas. Existing detention basins adjacent to the highway south of North Stoddard Wells Road and south of Outlet Center Drive drain quickly after heavy rains.

6.3.1.1 Scour

Scour will be an issue only during high intensity precipitation and will affect hydraulic structures such as bridges, culverts and detention basins. Discussion of bridge scour is out of the scope of this report and was not covered by this report. Sustained high flows have not occurred in the past, although short duration, high intensity precipitation as experienced during the 1997/98 rainy season should be expected occasionally. Scour is not anticipated to affect the elements of this GDR, including proposed walls, cuts and fills.

6.3.1.2 Erosion

Existing cut, fill and natural slopes were observed for degree of erosion as an indicator of the erosion performance of the geologic materials to be encountered and used on this project. The cut slopes along the existing alignment exhibit some surficial erosion.

At Station 120+00 four, 1 meter-diameter Corrugated Metal Pipe (CMP) culverts were plugged up to 80% with material ranging in size from fine silts to 0.22 meter diameter cobbles. The adjacent Asphalt Concrete drain foundational material was also completely eroded away. When measured with a Brunton Compass, the slope of the culverts was estimated to be approximately 1 degree downstream.

Many of the cut slopes are unvegetated, with surficial soils consisting of moderately dense silty sands, and thus are subject to erosion. Between Stations 46+00 to 50+00 S/B I-15, several high cuts in moderately dense gravelly sands require protection from erosion of the proposed cut face. Between Stations 462+00 to 474+00, surface water runoff has overtopped a 1:2 (V:H) cut slope eroding several deep gullies (the deepest is approximately 3 meters in depth). The slope material is composed predominately of dense sands and stiff clays. District Design proposes to install a brow ditch along the top bench of the cut. If the brow ditch is designed large enough to contain heavy

runoff flows, it should reduce the problem of erosion on the slope. District Landscaping should be consulted for implementation of a landscaping system on this and other project slopes.

6.3.2 Ground Water

Groundwater elevations in the project area are generally greater than 8 meters below the ground surface except, close to the Mojave River basin where the groundwater depth is between 3 meters to over 50 meters. Groundwater was not present in the groundwater monitoring wells at borings SW5 and RW6 on September 17, 1999, just after a light rain.

7.0 Geotechnical Analysis and Design

The following is a brief description of how the soil strength parameters, slope geometry and foundations were determined for each of the proposed improvements covered by this GDR. Similar improvements, such as the Soundwalls, Retaining Walls, cuts and fills are grouped together into the following four sub-sections. Each sub-section includes a table of pertinent information, a location map, a discussion of how the site-specific soil strength parameters were determined and concludes with slope stability and bearing capacity analysis results.

7.1 Soundwalls

This GDR includes 5 proposed Soundwalls, three of which will be founded on pile caps with CIDH piles and 2 of which will be founded on Retaining Walls. The Soundwalls to be founded on Retaining Wall are covered in Section 7.2, Retaining Walls. All Soundwalls are located between Stations 30+50 and 50 +00 just north of Victorville. Table 3 summarizes pertinent information regarding the Soundwalls. The methodology used for design of Caltrans standard Soundwall On Piles that pertain to this GDR includes, selecting soil strength parameters and unit weight, defining the proposed slope and wall geometry, then selecting CIDH pile properties and spacing from the Pile Data charts on the Soundwalls on Pile Cap Standard Plan Sheet in the Caltrans Standard Bridge Detail Sheets, dated March 1995, Reference #1. Finally, the soil parameters and slope geometry are used to determine the factor of safety for the proposed structure.

Table 3 - Pertinent Information - Soundwalls On Piles

Wall Number	Location Sta. to Sta.	Pile Design Data	Proposed Wall Height (meters)	Remarks
#40	Northbound 38+40 / 41+00	G1 with H=12' Type SP450	4.0	On slope bench
#50	Northbound 48+70 / 50+50	G2 with H=12' Type SP450	4.0	On embankment fill
#60	Northbound 59+00 / 62+60	G2 with H=12' Type SP450	4.0	On embankment fill

G-1 - Proposed finished ground line is **level** on both sides of wall.
G-2 - Proposed finished ground line is **level** on one side of wall and **sloped** on the opposite side.

7.1.1 Proposed Soundwall #40

The cross sections, which were provided to this office, indicated a level ground surface on both sides of proposed Soundwall #40. The SPT data from Station 40+75 averaged 70 blows per foot. Soil samples from the site were classified as dense to very dense sand with trace gravel. From these in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal friction to be 35°, zero(0) cohesion and a moist unit weight of 20 kN/m^3. These soil parameters, along with the proposed finished grade along the wall, indicate a G1, SP450 Ground Condition as identified in Reference #1.

7.1.2 Proposed Soundwalls #50 and #60

The cross sections, which were provided to this office, indicated a level ground surface on the freeway side of proposed Soundwalls #50 and #60, and a sloped embankment fill on the opposite side. Soundwalls #50 and #60 will be founded on a proposed embankment fill, therefore, soil samples were not obtained from either site. For design purposes this office assumes that the embankment fill will be placed at 90% relative compaction. Assuming that the on-site soils (silt and sand mixes) will be used in embankment construction; soil parameters include an angle of internal friction of 35°, zero(0) cohesion and a moist unit weight of 20 kN/m^3. These soil parameters, along with the proposed finished grade along the wall, indicate a G2, SP450 Ground Condition as identified in Reference #1.

7.2 Retaining Walls

The widening project includes 7 proposed earth retaining walls, 2 of which support Soundwalls. This section describes the methodology used for design of the Retaining Walls, including the selection of soil strength parameters, the proposed slope and wall geometry, and analyzing the assumed soil parameters and wall dimensions for failure resulting from sliding, overturning and soil bearing capacity. Global slope stability was also analyzed by inputting the assumed soil strength parameters and the slope geometry into the XSTABLE computer software. A horizontal coefficient of 0.15g was used for the pseudo-static analysis. All analysis assumed a surcharge load of 11.5 kPa (per Std. Plan B3-8) from the adjacent roadway and no groundwater. Plots of the XSTABL analysis results are presented in Appendix 13.7. The section closes with a presentation of calculated Factor of Safety (FOS) obtained from the slope stability and bearing capacity analysis. Table 4 summarizes pertinent information regarding the each of the proposed Retaining Walls.

7.2.1 Soundwall on Retaining Wall #31

The cross sections, which were provided to this office, indicated a level finished grade on the freeway side of proposed Retaining Wall #31, and a sloped finished grade on the opposite side. The SPT data from Stations 30+85 and 31+90, averaged 7 blows per foot from the proposed footing elevation to a depth of 8 meters below the footing elevation. Soil samples from the site were classified as loose, silty fine sand.

7.2.1.1 Selection of Soil Strength and Design Parameters

The existing soil conditions will not provide the minimum soil strength parameters as indicated in Reference 1, for a Soundwall on a Retaining Wall (Standard Plan XS 3-51) founded on a spread footing. Alternative wall options that were investigated by this office included, Mechanically Stabilized Embankments, (MSE), placing the retaining wall on a pile foundation, providing a special design for the wall or modifying the existing foundation materials. This office selected to modify the existing foundation material and used a Soundwall on Retaining Wall design. In order to use standard wall design, this office recommends that the existing soils be overexcavated and recompacted to 95% relative compaction in order to achieve the design soil parameters of an internal angle of friction 34 degrees, a moist unit weight of 21 kN/m^3 and cohesion of 500 kPa.

7.2.1.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Soundwall on Retaining Wall with a design height of 4 meters, the foundation soils were determined to have an allowable bearing capacity of 516 kPa with a FOS of 3. The XSTABL static and pseudo-static analysis of the slope for post construction, yielded a FOS of 1.66 and 1.16 respectfully. These Factors of Safety satisfy Caltrans requirements.

Table 4 - Pertinent Information - Retaining Walls

Wall NO.	Wall Type	Location Sta. to Sta.	Wall Height (m)	Remarks
31	Soundwall on Retaining Wall	Southbound 30+60 / 32+80	4.0 to 2.8	Foundation soils must be over excavated and recompacted. Adjacent to apartment complex.
37	Soundwall on Retaining Wall	Southbound 37+00 / 41+00	4.0 to 0.8	Retains cut from 34+00 to 39+00 Retains fill from 39+00 to 41+00
42	Type 1	Northbound 38+60 / 46+95	7.9 to 1.7	Retains 18 meter tall cut.
105	Type 1 or MSE	Southbound 100+00 / 106+00	Not known as this time	Adjacent to stormwater detention basin and airport runway
123	Type 1	SB 122+87 / 122+97	3.0	Protecting electrical high voltage tower.
440	Type 6A	Northbound 439+24 / 441+25	1.4 to 1.0	Protecting environmentally sensitive "Circle Rocks" RIGHT OF WAY
450	Type 1	Northbound 447+16 / 452+85	2.4	Will be adjacent to culvert

7.2.2 Soundwall on Retaining Wall #37

The cross sections, which were provided to this office, indicate a level finished grade on both sides of proposed Retaining Wall #37. Between station 35+00 and 39+00 the proposed wall will retain fill, between stations 39+00 and 40+20 the wall will retain a cut slope and back fill. The SPT data from Stations 34+95 and 38+50, averaged 37 blows per foot, uncorrected for overburden near the proposed footing elevation. Soil samples from the site were classified as dense to medium dense sand to silty sand with a perched ground water zone.

7.2.2.1 Selection of Soil Strength and Design Parameters

From these in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal friction to be 35°, a moist unit weight of 20 kN/m^3 and zero cohesion. These soil parameters meet the requirements for the use of the Soundwall on Retaining Wall design sheets as identified in Reference #1.

7.2.2.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Soundwall on Retaining Wall with a design height of 4 meters, the foundation material were determined to have an allowable bearing capacity of 520 kPa with a FOS of 3. The XSTABL static and pseudo-static analysis of the slope for post construction of the Retaining Wall, yielded a FOS of 1.95 and 1.31 respectfully. These Factors of Safety satisfy Caltrans requirements.

7.2.3 Retaining Wall #42

Based on information from the District, the preliminary design height of Retaining Wall #42 varies from approximately 2 to 8 meters and is 900 meters in length. The proposed wall location is at the base of a 1:2(V:H) cut slope which varies in height from 5 to 20 meters above the existing roadway. Soundwall #40, 3 meter in height, is proposed to be constructed on the slope bench along the Right of Way prior to construction of Retaining Wall #42. Graded lots and residential houses occupy the area adjacent to Right of Way. As requested by District, this office analyzed both a Type 1 Retaining Wall and a Soil Nail Wall along the proposed LOL of Retaining Wall #42. The Soil Nail Wall option was discarded during the subsurface investigation when loose granular sands were discovered within the slope. Therefore a Type 1 Retaining Wall was selected for Retaining Wall #42.

7.2.3.1 Selection of Soil Strength and Design Parameters

The cross sections, which were provided to this office, indicated a level finished grade on the freeway side of proposed Retaining Wall #42, and a 1:2(V:H) sloped finished grade on the opposite side, indicating a Case II Loading Condition, as identified in Reference 1. The SPT data from Stations 38+00 and 42+00, averaged 41 blows per foot near the footing elevation. Soil samples from the site were classified as medium dense silty sand to loose large grained clean sand. Trench logs, along with the Logs of Test Boring from the subsurface investigation for the existing adjacent soundwall, were used to estimate a friction angle of 36^0, a moist unit weight of 20 kN/m^3 and zero cohesion for the slope.

7.2.3.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Type 1 Retaining Wall with a design height of 3 meters, the foundation material was determined to have an allowable bearing capacity of 378 kPa with a FOS of 3. The XSTABL static and pseudo-static analysis of the slope for post construction of the Type 1 Retaining Wall, yielded a FOS of 1.88 and 1.21 respectfully. Between stations 42+50 and 44+50 a design height of 7.3 m produced static and pseudo-static global stability FOS of 1.56 and 1.2 respectfully, including a 5 kPa line load from the proposed Soundwall #40 above the slope. An allowable bearing capacity of 411 kPa with an FOS of 3 was also calculated. These factors of safety satisfy Caltrans requirements.

7.2.4 Retaining Wall #105

The layout sheets of the existing conditions along the LOL of proposed retaining Wall #105 indicate approximately 10 meter horizontally and 3.5 meters vertically of fill will be retained by the proposed wall. A stormwater detention basin has been proposed adjacent to the LOL of Retaining Wall #105 and storm water culverts will need to be extended through the face of the wall. The soil conditions and proposed wall geometry suggests a Mechanically Stabilized Earth Wall (MSE) may provide a cost saving as compared to a Type 1 Retaining Wall, although, because cross sections of the proposed wall were not supplied, design was incomplete. Final design and recommendation will depend on the proposed final grade, wall geometry and location of the Right of Way. This office will provide foundation recommendations for Retaining Wall #105 after receiving the proposed wall geometry from District Design.

7.2.4.1 Selection of Soil Strength and Design Parameters

SPT data obtained from boreholes along the proposed Retaining Wall #105 alignment averaged 75 blows per foot at the proposed footing elevation. Soil samples from the site were classified as silty sands with gravel. From these in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal fiction to be 34° a moist unit weight of 19 kN/m^3 and zero cohesion.

7.2.5 Retaining Wall #123

The proposed location of Retaining Wall #123 is approximately 5.5 meter east of the Southern California Edison (SCE) power transmission tower along the southbound shoulder of I-15 between Stations 122+87 and 122+97. Wall #123 will provide for the needed space to accommodate the proposed widening, while protecting the tower foundation. It is our understanding that the tower on the northbound side of I-15 will be protected by a Concrete Barrier and will not require a Retaining Wall.

7.2.5.1 Selection of Soil Strength and Design Parameters

The cross-sections, which were provided to this office, showed a level finished grade on both sides of proposed Type 1, Retaining Wall #123, indicating a Case III Loading Condition. SPT data obtained from the site averaged 70 blows per foot and refusal. Soil samples from the site were classified as silty sands with gravel.

From in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal friction to be 36° a moist unit weight of 20 kN/m^3 and zero cohesion for the foundation material.

7.2.5.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Type 1 Retaining Wall with a design height of 3 meters, the foundation material were determined to have an allowable bearing capacity of 500 kPa with a FOS of 3. The XSTABL static and pseudo-static analysis of the slope for post construction of the Type 1 Retaining Wall, yielded a FOS of 2.18 and 1.61 respectfully. These factors of safety satisfy Caltrans requirements.

7.2.6 Retaining Wall #440

Retaining Wall #440 is proposed to be located along the Caltrans Right of Way on northbound I-15 between Stations 439+24 and 441+25 with a maximum height of 1.4 meters. A Type 6A Retaining Wall is proposed for the site in order to minimize disruption of the environmentally sensitive surface adjacent to the Caltrans Right of Way.

7.2.6.1 Selection of Soil Strength and Design Parameters

The cross sections, which were provided to this office, indicated a level ground surface on both sides of the proposed Retaining Wall #440. A Type 6A Retaining Wall with design height of 1.4 m was selected for design analysis. SPT data obtained from the boreholes along the proposed alignment indicated an average blow count of greater then 100 blows per foot and refusal at the footing elevation. Soil samples from the site were classified as cobbles and gravels with sand.

From in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal friction to be 36°, and a moist unit weight of 20 kn/m^3 and zero cohesion. These soil parameters, along with the proposed finished grade along the wall, indicate a Loading Case I condition as identified on Standard Plan B-3-8 of Reference #2, Caltrans Standard Plans, July 1999.

7.2.6.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Type 6A Retaining Wall with a design height of 1.4 meters, the foundation materials were determined to have an allowable bearing capacity of 400 kPa with a FOS of 3. Based on a friction angle of 36 degrees and zero cohesion. The XSTABL static and pseudo-static analysis of the slope for post construction of the Type 6A Retaining Wall, yielded a FOS of 1.5 and 1.1 respectfully. These factors of safety satisfy Caltrans requirements.

7.2.7 Retaining Wall #450

The provided cross sections of the proposed Wall #450 show a level finished grade on both sides of the LOL, indicating a Case III loading condition. The extent of the required fill will be approximately 10 meter horizontally and 2.5 meters vertically from the existing embankment slope. Although a MSE wall was considered for this site, a Type 1 wall was selected for design due to the fact that the cost saving between an MSE wall and a Type 1 wall with a height of 2.5 meters are minimal.

7.2.7.1 Selection of Soil Strength and Design Parameters

SPT data obtained from boreholes along the proposed wall alignment indicated an average blow count of 75 blows per foot near the footing elevation. Soil samples from the site were classified as silty sands with gravel. From in-situ and Laboratory test results, and our experience in the area, we conservatively estimated the angle of internal friction to be 34° a moist unit weight of 20 kN/m^3 and zero cohesion for the existing foundation material.

7.2.7.2 Wall Design and Analysis

Using the above soil parameters, and footing dimensions for a Type 1 Retaining Wall with a design height of 1.4 meters, the foundation materials were determined to have an allowable bearing capacity of 378 kPa with a FOS of 3. Based on a friction angle of 36 degrees and zero cohesion. The XSTABL static and pseudo-static analysis of the slope for post construction of the Type 6A Retaining Wall, yielded a FOS of 1.5 and 1.1 respectfully. These factors of safety satisfy Caltrans requirements.

7.3 Cuts and Fills

Assuming that on-site, cohesionless excavated material will be used for embankment construction in conformance with Section 19 of the Standard Specifications; the following soil strength parameters should be available in the embankment fills: an angle of internal friction of 34 degrees a moist unit weight of 20 kN/m^3 and zero cohesion. Using the above soil strength parameters, a maximum slope height of 20 meters and a 1:2 (V:H) slope ratio; the XSTABL software calculated Factors of Safety for global stability to be greater than 1.5 under static conditions, and greater then 1.1 for pseudo-static condition using a 0.15g coefficient of horizontal acceleration. Historically, the existing cuts within the project area, including 1:1.5 (V:H) rock cuts and 1:2 (V:H) soil cuts and embankments, have proven to be globally stable. The XSTABL software also calculated a global stability FOS of 1.2 for the proposed, temporary 1:1 (V:H) back cut proposed for the footing excavation of Retaining Wall #40.

8.0 RECOMMENDATIONS

8.1 Soundwalls

This office recommends that Soundwalls which are not supported on a retaining wall be founded on Cast-In-Drilled–Hole (CIDH) piles per Caltrans Bridge Standard Detail Sheets. Recommendations for Soundwalls on Retaining Walls are presented in Section 8.2 Retaining Walls.

8.1.1 Soundwall #40

This office recommend using G2: Pile Data for design of Masonry Wall on Pile Cap, Per Standard Drawing file No. XS 3-59.3. A wall with a design height of 3.66 m, (12 feet) and G-2 ground conditions, calls for CIDH piles with a design depth of 3.81 m, diameter of 0.36 m and pile spacing of 4.88 m.

8.1.2 Soundwall #50 and #60

This office recommend using Case 2: Pile Data for design of Masonry Wall on Barrier, Per Standard Drawing file No. XS 3-57.3. Pile dimensions and spacing is dependent on the barrier embedment length (HE), which is to be determined by the District based on the required shoulder widening and resultant final slope geometry.

8.2 Retaining Walls

Standard Plan Retaining Walls are recommended for the 7 proposed Retaining Walls of the I-15 widening project. Standard Plan design sheets from Reference #1, Caltrans Bridge Standard Detail Sheets, shall be used to design Retaining Walls which support a soundwall. Standard design sheets from Reference #2, Caltrans Standard Plans, shall be used to design Type 1 and Type 6A Retaining Walls which do not support a soundwall.

8.2.1 Retaining Wall #31

Caltrans Standard Soundwall on Retaining Wall with spread footings is recommended. Existing foundation material shall be removed and recompacted to 95% relative compaction as determined per CTM 216. The extent of overexcavation and recompaction shall extend horizontally 1 meter from the face of the footing heel and footing toe, and to a depth of 2 meters, measured vertically from the bottom of the footing.

8.2.2 Retaining Wall #37

Caltrans Standard Soundwall on Retaining Wall with spread footing is recommended for Retaining Wall #37.

8.2.3 Retaining Wall #42

A Type 1 Retaining Wall is recommended for Retaining Wall #42. Between stations 43+00 and 44+50 an embedment depth of 1 meter, measured vertically from the top of the footing to the finished grade, is required. A minimum wall height of 7.3 meters is recommended between Stations 43+00 and 44+50. In order to provide slope stability during construction, this office recommends temporary shoring be installed on the slope bench, between the proposed Retaining Wall #42 and the proposed Soundwall #40, prior to excavation of the Retaining Wall footing. The contractor shall be responsible for design and installation of shoring, per the Standard Specifications. The contractor shall submit a detailed shoring plan in conformance with Sections 5.102, 5.102a and 19-1.02 of the Standard Specifications.

8.2.4 Retaining Wall #105

Preliminary design recommendation is for a Standard Caltrans MSE wall. Final design and recommendation will depend on the proposed final grade, wall geometry and location of the Right of Way.

8.2.5 Retaining Wall #123

A Type 6A Retaining Wall is recommended.

8.2.6 Retaining Wall #440

A Type 1 Retaining Wall is recommended.

8.2.7 Retaining Wall #450

A Type 1 Retaining Wall is recommended.

8.3 Cuts and Fills

We recommend cut slopes, constructed to a slope ratio of 1:2 (V:H) in soil, and the 6 proposed rock slope cuts be constructed at 1:1.5 (V:H). See the Remarks column in Table 1 for the proposed cut and fill locations. We recommend that embankment slopes be constructed to a slope ratio of 1:2 (V:H) with Slope Rounding per Standard Plan A62A. We recommend that erosion protection for the cut and embankment slopes be designed by District Landscaping.

We recommend a brow ditch for the cut slope at Stations 468+80 and 474+40. The large proposed cuts, between Stations 127+60 and 137+50 on southbound I-15, may have loose zones or cobble zones which could ravel and should have a Ritchie Criteria catchment ditch of at least 3 m, or a protective fence along the length of the slope at the toe.

8.3.1 Rock Cuts

We recommend cuts in rock should be finished at a slope ratio of 1:1.5 (V:H). We recommend a catchment area (Ritchie Criteria) between the toe of the cut slope and the edge of the road at a minimum of 3 m or a protective fence adjacent to the toe of the slope. The catchment area should be sloped towards the toe of the slope, and down at 5% from the horizontal. Positive drainage should be provided along the ditch to prevent accumulation of water at the toe of the slope.

A blasting consultant should plan blasting operations and perspective contractors should be limited to those licensed and experienced in ripping, blasting, and excavating rock materials such as those found at the seismic refraction sites (in Appendix). A blasting specification and bid item(s) should be included in the contract although prospective contractors may have a more cost effective method of splitting and removing large rock knobs. Draft blasting specifications are included in the Geophysical Appendix. Blasting operations should be limited to controlled blasting and production blasting should not be allowed on this project.

Approximately 10% to 30% of the material will require blasting to facilitate ripping. Pre-Splitting is the preferred method for the excavation of the slopes. The drill shafts should be closely spaced (typically 10 to 20 times the hole diameter) and parallel to the final break line.

A Caltrans engineering geologist should examine the blasted slopes to identify any areas which need scaling or additional work.

8.3.2 Embankments

Embankments should be constructed in accordance with Section 19 of the Standard Specifications. We recommend that all embankment slopes be designed with a slope ratio of 1:2 (V:H). The maximum height of the embankment slopes shall be 10 meters. Assuming fill material will come from cohesionless cut material from within the project limits, settlement will occur during construction. Cut bedrock, used as fill, should conform to gradation, and size specifications as stated in Section 19 of the Standard Specification. Oversized material, which does not meet the

requirements of the Section 19 shall be disposed of outside of the Highway Right of Way, per section 7-1.13 or as directed by the Engineer.

9.0 CONSTRUCTIBILITY

9.1 Soundwalls

In areas where Soundwalls are proposed, embankment material should be placed and compacted per section 19 of the Standard Specifications. Per Section 19-6.01, "Rocks, Broken concrete, or other materials, which are larger than 0.1-m in greatest dimension shall not be placed in embankment areas where piles are to be placed or driven. Only non-corrosive soils were encountered within the project limits, therefore no special recommendations are provided regarding concrete corrositivity. The contractor will be responsible for the identification of any and all utilities, above ground and/or underground, prior to any construction work. There is a potential for caving of the CIDH shafts due to looses native sands near proposed soundwall #40. Contractor will be required to control caving per Section 49-4.03 Drilled Holes, of the Standard Specifications. We do not anticipate difficulties with construction of the soundwalls, all soils should be easily drilled with standard equipment.

9.1.1 Soundwall #40

The finished face of Soundwalls #40 should be at least 0.5 meters from the existing chain link fence and/or the State Right of Way. Existing overhead utility lines above the proposed soundwall LOL shall not be relocated for construction of this soundwall.

9.1.2 Soundwalls #50 and #60

The finished face of Soundwalls #50 and #60 should be at least 0.5 meters from the hinge point of the proposed embankment.

9.2 Retaining walls

We do not anticipate difficulties with construction of the retaining walls, all soils should be easily excavated with standard equipment. The contractor will be responsible for the identification of any and all utilities, above ground and/or underground, prior to any construction work. Only non-corrosive soils were encountered within the project limits, therefore no special recommendations are provided regarding concrete corrositivity.

9.2.1 Soundwall on Retaining Wall #31

The extent of overexcavation and recompaction, to 95% relative compaction, shall extend horizontally 1 meter from the face of the footing heel and toe, and to a depth of 2 meters measured vertically from the bottom of the footing. Cross sections indicate the 1:1(V:H) back cut for footing excavation may day light beyond the Right of Way, if so, a temporary construction easement or shoring may be required.

9.2.2 Soundwall on Retaining Wall #37

Supplied cross section indicate the 1:1(V:H) back cut for footing excavation will day light beyond the Right of Way, a temporary construction easement or shoring will required prior to excavation. At the time of this investigation the known utilities along the proposed Retaining Wall #37 alignment included, overhead utility lines and a 0.5 meter diameter culvert with standing water near Station 37+80 southbound. Several medium sized Pine and Cottonwood trees will also need to be removed along the proposed wall alignment prior to construction.

9.2.3 Retaining Wall #42

In order to provide slope stability during construction of the wall, the existing slope will need to be cut back temporarily to a 1:1(V:H) slope. Because the 1:1 back cut will day light beyond the Right of Way, either a temporary construction easement will need to be purchased or temporary shoring will need to be installed prior to excavation. Shoring will be installed at least 1.5 meters horizontally from the pile cap of proposed Soundwall #40.

If Retaining Wall #42 is constructed prior to the proposed Soundwall #40, a temporary easement will be required and shoring may not be required. If the proposed Soundwall #40 will be constructed prior to the back cut and excavation for Retaining Wall #42, shoring will be required. The heavy equipment, which will be required to install and remove the temporary shoring, may disturb the existing residences, buildings and soundwall located on the slope bench. A 0.5 meter diameter storm drain culvert, which runs underground from an inlet on the slope bench at Station 42+00 and outlets into a catch basin in the roadway shoulder near Station 43+10, will need to replaced or diverted. Care must be taken when excavating near the existing Retaining Wall and soundwall near station 38+40 northbound.

9.2.4 Retaining Wall #123

The cross sections did not indicate where the 1:1(V:H) back cut for footing excavation will day light, although this needs to be checked. Care must be exercised during construction around the high voltage power tower, SCE should be consulted prior and during construction.

9.2.5 Retaining Wall #440

Care must be taken to not disrupt the existing environmentally sensitive ground adjacent to the Right of Way along the proposed LOL of Retaining Wall #440. Backfill should be keyed into the existing embankment.

9.2.6 Retaining Wall #450

Care must be taken to not disrupt the existing storm water channel adjacent to the Right of Way. Backfill should be keyed into the existing embankment.

9.3 Cuts and Excavations

9.3.1 Stability

Rockfall should be anticipated on freshly cut rock slopes and will require a Ritchie Criteria ditch (See Geophysical Data in Appendix). Any needed modifications of the proposed slope geometry should be recommended by an engineering geologist.

9.3.2 Rippability and Blasting

The attached geophysical seismic refraction exploration report validates rippability as the tool for excavation. Most of the proposed cuts will require ripping which should be able to be accomplished with standard equipment, although it is conservative to assume that some blasting will be needed. For estimate purposes, 20% of the total excavation volume may be assumed to be by blasting at Stations 111+85 to 112+80 and 164+70 to 166+40, 10% at Stations 210+80 to 215+00 and 223+30 to 228+40, and 30% at Stations 70+00 to 71+40. These are site specific values and it would not be correct to average them to 20%. The ripping process generally results in less disturbance to the rock-mass on the cut face than does blasting.

9.3.3 Grading Factors

Earthwork factors are estimated from seismic velocities given in the Seismic Refraction Surveys in the Appendix. For the sites at Stations 210+80 to 215+00 and 223+30 to 228+40, factors will be 0.93 to 1.4. For the sites at Stations 111+85 to 112+80 factors will be 1.20; for Stations 164+70 to 166+40 factors will be 1.27 to 1.35; and for Stations 70+00 to 71+40 factors will be 1.27 to 1.34.

9.4 Embankments

9.4.1 Embankment Stability

Fill slopes should be placed at 1:2(V:H) and compacted to 90% relative compaction or as required per Section 19 of the Standard Specification. Settlement is anticipated to occur during construction.

10.0 Material Sources

It is estimated that 37,000 cubic meters of surplus material will be generated from this project. However if import material is needed, District Materials will find a source of suitable import material.

11.0 Material Disposal

As of this writing, this Office has not been requested to investigate potential disposal sites. Surplus material may be disposed of in accordance with Section 7-1.13 of the Standard Specifications "Disposal of Materials Outside the Highway Right of Way", or upon authorization from the Engineer, surplus material may be placed in accordance with Section 19-2.06 of the Standard Specifications.

LAYOUT SHEET LEGEND

Qal	ALLUVIUM
Qod	DISSECTED ALLUVIAL FAN
Mvz	MESOZOIC SIDEWINDER VOLCANIC SERIES
KJt	CRETACEOUS/JURASSIC TONOLITE
KJqm	CRETACEOUS/JURASSIC QUARTZ MONZONITE
Gr&P	UNDIFFERENTIATED GRANITE AND PERIDOTITE
Ls	PALEOZOIC LIMESTONE

⊕	BORING
▼	BORING, WITH PEIZOMETER
⧗	BACKHOE TRENCH
25 / 35E	BEDDING ATTITUDE
SL1	SEISMIC REFRACTION LINE
- - - -	APPROXIMATE GEOLOGIC CONTACT

U / 70 D — FAULT, WITH ORIENTATION, DOTTED WHERE BURIED, QUERIED WHERE UNCERTAIN, U - UPTHROWN BLOCK, D - DOWNTHROWN BLOCK

Roadway Geotechnical Engineering - South

	GEO	COUNTY	ROUTE	KILOPOST	DIST.	E.A.	FIGURE
	CAH	SBd	15	67.4/113.6	08	355500	L1

Highway 15 Victorville to Barstow

LEGEND OF EARTH MATERIALS

CLAY with some coarser

SILT with clay or sand

SAND with silt or clay or minor gravel

SAND AND GRAVEL with minor clay or silt

GRAVEL with minor clay, silt or sand

08-15-KP67.6/113.6 08-355500/355520	Division of Structural Foundations	CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/26/99	BORING DESIG	SW1
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	34+95
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	68.38
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	23 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	882.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH GRAVEL	SM				
2			Fn. Sandy SILT, v. stiff to hard, lt. to med. brown, dry to moist, tr. mica, layering w/caliche in between	ML	S1	71	16.6	LL-28 PI-4
3			SAND-from cuttings & drill rate					
4	▽		3" Clayey SILT-as above, then Silty SAND, fn. to med. grained, dense to v. dense, med. brn., lt. grey w/ some orange stains, moist to wet, w/ mica	SW-SM	S2	75	14.2	
5	▽		2" Clayey SILT-as above, then Silty SAND, fn. to coarse gr., med. dense to dense, lt. yel. grey w/ some orange stain, moist to wet, tr. mica	SW-SM	S3	64	12.2	LL-30 PI-8
6			SAND, med. to c. gr., med. dense, lt. br., moist top, dry bottom	SP	S4	48		
7								
8	▽		Silty SAND, fn. to med. gr., dense to v. dense, br., dry to wet, mica	SM	S5	86/10"		
9			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

▽ GROUND WATER

▽ PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/26/99	BORING DESIG	SW2
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	37+00
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	68.58
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	23 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	883

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SAND WITH GRAVEL	SP				
2			SAND with silt, mostly med. gr., dense, lt. brown, moist at top, dry at bottom	SP-SM	S1	41	10.1	
3 4			Sandy CLAY, sl. plastic, v. stiff to hard, lt. to med. brown w/ one 1/4" dk. br. layer, orange stains, moist, tr. mica	CL	S2	34	17.5	LL-32 PI-14
5 6			5 cm Sand (SP), med. to c. gr., lt. br., wet then Sandy CLAY, sl. plastic, v. stiff to hard, lt. br., tr. orn & mica, dry	CL	S3	50	13.0	LL-32 PI-15
7			Silty SAND, fn. to med. grained, dense to v. dense, lt. brn. w/ some orange stains, moist to dry, w/ mica	SM	S4	84	12.7	
8			Silty SAND, mostly fn. gr., multi-layered, med. dense, greys, reds & orn., moist to wet	SM	S5	68	18.9	
9			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/26/99	BORING DESIG	SW3
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	38+50
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	68.73
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	884

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH MINOR GRAVEL AND TRACE COBBLES ON SURFACE	SM B				Corrosion sample
2			SAND, mostly med. gr., dense, lt. to med. brown, moist at top, dry at bottom	SP	S1	35	20.6	
3 4			Fn. Gravelly CLAY, sl. plastic, gap-graded, v. stiff, med. brown, moist, w/ fn. sand, tr. c. gravel, caliche	CL	S2	40	19.7	LL-36 PI-15
5 6			7.5 cm Sand (SP), med. to c. gr., lt. br., med. dense, moist to wet then Sandy CLAY, sl. plastic, hard, med. br., tr. dk. br., moist	CL	S3	25	18.6	LL-35 PI-14
7			Clayey SAND, fn. to c. grained, v. dense to hard, lt. to med. brn. w/ tr. orange stains, moist to dry, tr. mica	SC	S4	50/4"	12.4	LL-30 PI-9
8			Silty SAND, v. dense, med. br. w/ some orn., moist to wet, some mica	SM	S5	77		
9			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/9/99	BORING DESIG	SW4
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	39+60
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	68.84
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	33 Rt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	884

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			SILTY SAND WITH A TRACE OF GRAVEL TO COBBLE-6"					
2			SAND, fn. to c. gr., dense, lt. br., dry to moist	SW	S1	32		
3			Pea gravel lens					
4			Sandy SILT, non-plastic, firm to stiff, med. br., dry to moist, tr. pea gravel	ML	S2	48	15.4	
5	▽		Silty SAND, fn. gr., dense to v. dense, med. br. w/ tr. orn., mica, wet to moist	SM	S3	56	15.2	
6			Silty CLAY, firm, med. br., tr. fn. sand, moist to wet at top	CL	S4	41	23.0	LL-38 PI-19
7								
8			Silty SAND, fn. gr., v. dense, med. br. & orn., dry to moist	SM	S5	75	10.0	
9			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

▽ GROUND WATER

▽ PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/26/99	BORING DESIG	SW5w
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	40+80
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	68.96
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	22 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	876

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SAND WITH GRAVEL	SP				
2			Silty Fn. SAND, w/ tr. c. sand, mica & pea gravel, v. dense, lt. to med. br. w/ some orn., dry to moist	SM	S1	74	13.7	
3			Silty SAND, well-graded, fn. to c. gr., dense, lt. brn., dry to wet	SM	S2	66	15.4	
4								
5			SAND, med. to c. grained, med. dense, v. lt. brn., wet, tr. mica	SP	S3	51	14.9	
6			Top-as above, wet					
7			Bottom-Sandy SILT, v. stiff, lt. to med. br., some orn., dry to moist	ML	S4	75	11.8	
8			SILT, w/ tr. fn. sand, gravel & mica, v. stiff, lt. to med. br. w/ some orange stains, dry to moist	ML	S5	82	15.9	LL-32 PI-8
9			Sandy SILT, stiff to hard, lt. to med. br. w/ grey, dry to moist, micaceous	ML	S6	87	12.3	LL-27 PI-2

Install water level pipe for perched water - No Groundwater encountered

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/9/99	BORING DESIG	RW1A
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	42+30
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	69.11
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	30 Rt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	873

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			SILTY SAND					
2			Silty SAND, tr. pea gravel, med. dense to dense, med. br., moist	C SM	S1			Corrosion sample
3			Gravel-cuttings and drill					
			SAND, fn. to c. gr., dense, tan, wet (irrigation line next to hole)	SW	S2	42		
4								
5			Silty SAND, tr. fn. grav., dense, med. br., moist	C SM	S3			Corrosion sample
6			Sandy CLAY, fn. to med. sand w/ tr. c. sand, med. dense, med. br., moist	CL	S4	25	20.6	LL-33 PI-13
7								
8			Clayey SAND, fn. to med. sand w/ tr. c. sand, dense, med. br., moist	SC	S5	40	21.2	LL-34 PI-18
			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	11/18/99	BORING DESIG	RW1
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	43+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	69.13
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	15 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	864

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt .15, Base .2					
1			Silty Fine SAND, med. brown, trace of clay & mica (cuttings)					
2			Silty fn. SAND, med. dense, med. br., dry to moist, mica present	SM	S1	23		
3								
4			SAND-as above, then two layers of SILT, stiff, lt. br., moist, mica	SM ML SM ML	S2	5 19 12 31		
5			Silty SAND, fn. to med. gr., tr. c., dense, lt. to med. br., sl. moist, mica	SM	S3	34		
6								
7			SAND, fn. to med., tr. c., v. dense, lt. br., dry	SP	S4	52		
			SILTY-cuttings					
8			.07 loose, Silty fn. SAND w/ mica, moist Sandy CLAY, stiff, lt. br., moist,	SM CL	S5	20	14.9	LL-32 PI-14
9			mica, w/ a few small, hard caliche nodules Reddish br. Silty SAND-cuttings					
			Silty SAND, fn. to c. gr., v. dense, lt. br. to lt. reddish br., sl. moist, mica	SM	S6	61		

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	11/18/99	BORING DESIG	RW2
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	44+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	69.23
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	16 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	859

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt .15, Base .2					
1			Med. SAND, med. brown, (cuttings)					
2			SAND, fn. to c. gr., dense, lt. br., dry to moist, mica present	SW	S1	33		
3								
			SAND, Silty SAND & .05 SILT top & bot, med. dense, lt. br., sl. moist, mica	SP-ML	S2	18		
4			Silty, med. br.-cuttings					
5			SAND, fn. to med. gr., tr. silt, dense, lt. br., moist, mica	SP	S3	34		
6								
			.07 loose, silty fn. SAND, orange @ contact .15 clayey SILT, w/ tr. caliche, stiff, br.	SM MH?	S4	16	13.9	NP
7			.22 sandy SILT, w/ organics, firm, br. all moist	ML				
8			Silty SAND, fn. to med. gr., dense, med.br. & orange, sl. moist, mica	SM	S5	36		
9			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	11/18/99	BORING DESIG	RW4
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	46+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	69.43
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	33 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	849.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt .15, Base .3					
1			Silty Coarse SAND, med. brown some fine Gravel (cuttings)					
2			Top .17 m, med. SAND, loose, lt. br.,dry Mid .17 m, Sandy SILT, stiff, moist, mica Bot .17 m, Silty SAND, dense, moist	SP ML SM	S1	4 15 39 24		
3			SAND-cuttings		B			Corrosion sample
4			Fn. to c. Sandy SILT, stiff, med. br., moist, mica	ML	S2	16		
			Coarse SAND-cuttings and drill					
5			Top .25 m, coarse SAND, med. dense Bot .25 m, Sandy SILT, stiff, moist	SP ML	S3	10 12 37 25		
6			C. Sandy SILT-cuttings					
7			Fn. to c. SAND, dense, tan, moist	SW	S4	46		
			Gravel lense-cuttings and drill, then c. SAND					
8			Sandy CLAY, stiff, med. br., moist	CL	S5	24	15.6	LL-27 PI-8
9			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/25/99	BORING DESIG	RW5
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	103+00
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	75.18
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	882

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH SOME GRAVEL	SM B				Corrosion sample
2			Silty SAND, w/ pea gravel, v. dense, med. br., moist to wet, tr. caliche	SW-SM	S1	75	12.8	
3			Silty SAND w/ gravel to 3/4", v. dense, lt. green br. to med. red br., moist to wet	SM	S2	50/5"	16.4	
4								
5			Silty SAND w/ pea gravel, v. dense, med. red brn., moist, tr. soft caliche	SM	S3	50/5"	12.8	
6								
7			Silty SAND, well-graded, v.dense, med. red br., moist, tr. gravel & caliche	SM	S4	80	11.8	
8			Silty Fn. SAND @ top, coarse @ bottom v. dense, med. red br., moist	SM	S5	86		
9			Silty Coarse SAND, v. dense, br., w/ thin (1/2") tan caliche, moist	SM	S6	79/11"	12.3	
			Install water level pipe for perched water - No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/27/99	BORING DESIG	RW6w
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	104+40
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	75.32
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	880.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH SOME GRAVEL	SM [B]				Corrosion sample
2			Silty SAND, w/ pea gravel, well-graded, fn. to c. gr., dense to v. dense, lt. to med. br., moist, abundant soft caliche	SM	S1	83/11"	15.3	NP
3	▽		Silty SAND w/ tr. pea gravel, well-graded, v. dense, med. brn., moist to wet, tr. hard caliche	SM	S2	50/6"	11.0	NP
4								
5			Silty SAND, w/ tr. gravel to 1 1/2", well-graded, v. dense, lt. to med. br., moist	SM	S3	90	14.5	
6								
7			Silty SAND, w/ tr. pea gravel to 1/2", v. dense, lt. to med. br., moist,	SM	S4	50/4"	10.9	
8			As Above, tr. gravel to 1/2"	SM	S5	50/5"	12.6	
9			A/A, w/ abundant hard caliche	SM	S6	50/4"	13.9	
			Install water level pipe for perched water - No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

▽ GROUND WATER

▽ PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	11/17/99	BORING DESIG	RW7A
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	30+85
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	67.49
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	20 Lt
OF BORING	6"	DROP (MM)	760	GSE (M)	883.6

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt .22, Base .15					
1								
2			Fill-Silty SAND & Fine Gravel, med. brown, moist					
3			Fill-Clayey SAND & Gravel, med. br., moist					
4			CG					
			Silty SAND-cuttings					
5			Silty SAND, fn. to c. gr., grav. to 1/2", loose, med. br., moist	SM	S1	6		
6								
			As Above	SM	S2	6		
7								
8			SAND, fn. to c., w/ grav. to 1/4", med. dense, med. br., moist	SW	S3	16		
9								
			Silty SAND, fn. gr., tr. c., med. dense, med. br., tr. org. moist	SM	S4	23		
10			Sandy Clayey SILT-cuttings					
11			Sandy Clayey SILTw/ caliche specs & lines, v. stiff, lt. br., dry	CL-ML	S5	17		
12			Sandy Clayey SILT-cuttings					
			Sandy Clayey SILT, stiff, lt. br., moist	CL-ML	S6	14	12.5	~~LL-25~~ PI-6
13			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	11/17/99	BORING DESIG	RW7B
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	31+90
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	67.59
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	20 Lt
OF BORING	6"	DROP (MM)	760	GSE (M)	883.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt .22, Base .15					
1			Fill-Med. SAND & Fine Gravel, tr. silt, med. brown, moist					
2			Fill-Silty Fn. SAND, Tr. Gravel, med. br., moist					
3			CG					
			Silty SAND, fn. to c. gr., tr. grav., med. dense, med. br., moist	SW	S1	13		
4					B			Corrosion
5			SAND, well graded, some silt & grav., loose, lt. br., sl. moist	SW	S2	7		
6								
			Silty Fn. SAND w/ tr. fn. grav., loose, med. br., sl. moist	SM	S3	5		
7								
			Fn. Gravel & SAND-cuttings					
8			Silty Fn. SAND, tr. fn. grav., loose, med. br., tr. caliche, sl. moist	SM	S4	9		
9								
			Silty Fn. SAND, some soft caliche, med. to v. dense, lt. br., dry	SM	S5	37		
10								
11			SAND, fn. to c. gr., v. dense, lt. br., dry	SW	S6	56		
12			No groundwater encountered					
13								

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/27/99	BORING DESIG	RW8
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	105+50
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	75.43
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	882

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH SOME GRAVEL and w/ some caliche	SM				
2			Silty SAND, w/ gravel to 1", v. dense to hard, lt. to med. br., moist to dry, tr. caliche	SM	S1	95	12.5	
3			Rock in shoe, no sample			50/1"		
4								
5			SAND, w/ pea gravel, well-graded, fn. to c. gr., v. dense, lt. to med. br., moist to wet, tr. silt & clay	SW	S3	50/4"	15.4	
6			Silty SAND, v. dense, lt. to med. br., moist, tr. fn. gravel	SM	S4	50/5"	13.3	
7								
8			SAND, fn. to c. gr., v. dense, med. br., moist	SW	S5	50/5"		
9			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/25/99	BORING DESIG	RW9
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	107+00
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	75.58
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Lt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	884

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing Hard Pan @ .6 m SILTY SAND WITH SOME GRAVEL	SM				
2			Silty SAND, w/ pea gravel to 1/2", v. dense, tan to lt. br., moist to dry	SW-SM	S1	75	6.6	
3			No sample			50/2"		
4								
5			Silty SAND, w/ pea gravel, v. dense, med. br., moist, some sand layering seen	SM	S3	50/5"	14.5	
6			As Above, no layering	SM	S4	72	11.1	
7								
8			A/A, w/ layering, tr. tan caliche	SM	S5	96/11"	12.5	
9			As Above	SM	S6	50/4"	12.8	
			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	5/25/99	BORING DESIG	RW10
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	122+70
PROJECT EA	08-355520	LOGGED BY	C.HOADLEY	POST KM	77.14
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	21 LT
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	904

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			1 m Casing SILTY SAND WITH GRAVEL	SM B				Corrosion sample
2			Silty SAND AND GRAVEL to 3/4", well-graded, v. dense, lt. br. to lt. greenish br., moist	SW-SM	S1	84/11"	12.2	
3			Silty Fn. SAND w/ tr. pea gravel, v. dense, lt. brn., moist	SW-SM	S2	45	11.5	
4								
5			As Above-mostly fine sand	SP-SM	S3	58	14.8	
6			Refusal-rock?			0		
7								
8			Silty SAND, w/ tr. pea gravel to 1/2", v. dense, lt. br., moist	SW-SM	S5	50/5"		
9			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/8/99	BORING DESIG	RW11
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	440+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	69.0
TYPE & SIZE	MUD ROTARY	DRIVE WT(KG)	63.5	OFFSET (M)	25 Rt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	742

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			SANDY COBBLES AND BOULDERS TO 0.2 M					
1			Rocky					
			Silty SAND w/ gravel to 1", v. dense lt. brown, dry	SP	S1	50/4"		
2			Rocky					
3			Too rocky-drill ahead					
4			Rocky					
			Too rocky-drill ahead					
5			Rocky					
6			GRAVEL with Sand, dry	GP	S2	50/2"		
7								
8			No Groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/17/99	BORING DESIG	RW12
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	449+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	109.9
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	15 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	727.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt & Base-12 to 18"					
1			FILL-Silty Sand and Gravel					
2			FILL-Silty Sand w/ minor gravel to 1 1/2", v. dense, lt. to med. br., dry to moist	SM	S1	67		
3			OG-Silty SAND w/ minor grav. to 1", med. dense, lt. br., dry	SM	S2	16		
4								
5			Silty SAND and gravel to 1", v. dense, lt. br. w/ some red br., dry to moist (red portion)	SM	S3	50/5"		
6			As Above-less red	SM	S4	50/5"		
7								
8			Silty SAND w/ one grav. to 1 1/4", v. dense, lt. br., dry	SM	S5	64		
9			Silty SAND, coarse with grav. to 1 1/4", v. dense, lt. br., dry	SM	S6	83		

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/17/99	BORING DESIG	RW13
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	450+00
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	110.0
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	15 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	727.0

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt & Base-12 to 18"					
1			FILL-Silty Sand and Gravel					
2			FILL-Silty Sand w/ minor gravel to 1", v. dense, med. br., dry to moist	SM	S1	60		
3			OG					
4			Silty SAND w/ minor grav. to 1", med. dense, lt. br., dry	SM B	S2	39		Corrosion sample
5			Silty SAND and gravel to 1", v. dense, lt. br., dry	SM	S3	56		
6			As Above	SM	S4	50/4"		
7								
8			No sample Sand & Gravel-cuttings and drill			50/5"		
9			On rock, no penetration					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/17/99	BORING DESIG	RW14
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	450+95
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	110.1
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	15 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	726.5

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt & Base-12 to 18"					
1			FILL-Silty Sand and Gravel					
2			FILL-Silty Sand w/ gravel to 1/2", v. dense, lt. br., dry to moist	SM	S1	77		
3			FILL-Silty Sand w/ minor grav. to 1/2", med. dense, lt. br., dry to moist	SM	S2	21		
4			OG?					
5			Silty SAND and gravel to 1/2", v. dense, lt. br., dry	SM	S3	50/5"		
6			Silty SAND w/ gravel to 1", v. dense, lt. br., dry	SM	S4	50/4"		
7			Silty SAND and gravel to 1/2", v. dense, med. br., dry to moist	SM	S5	50/3"		
8								
9								

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/17/99	BORING DESIG	RW15
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	451+90
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	110.2
TYPE & SIZE	Auger	DRIVE WT(KG)	63.5	OFFSET (M)	15 Rt
OF BORING	6"	DROP (MM)	760	GSE (M)	726.0

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
			Asphalt & Base-12 to 18"					
1			FILL-Silty Sand and Gravel					
2			FILL-Silty Sand w/ gravel to 1", v. dense, lt. br., dry	■ SM	S1	50/5"		
3			FILL-Silty Sand w/ grav. to 1/2", v. dense, lt. br., dry	■ SM	S2	60		
4			OG?					
5			Silty SAND and gravel to 1 1/4", v. dense, lt. to med. br., dry	■ SM	S3	50/5"		
6			Silty SAND w/ gravel to 1/2", v. dense, lt. to med. br., dry	SM	S4	50/5"		
7				[B]				Corrosion sample
8			As Above	■ SM	S5	50/3"		
9								

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/9/99	BORING DESIG	CS1
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	470+50
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	111.95
TYPE & SIZE	Mud Rotary	DRIVE WT(KG)	63.5	OFFSET (M)	50 Rt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	766.25

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			SILTY SAND AND GRAVEL TO 3"					
2			Silty CLAY w/ sand & tr. pea grav., v. dense, med. br., moist	CL	S1	80/9"	15.2	LL-30 PI-17
3			Gravel-cuttings and drill					
			SAND, med. to c. gr. w/ pea gravel, v. dense, lt. br., dry to moist,tr. clay	SW	S2	50/5"		
4			Gravel-cuttings and drill					
5			Silty SAND w/ grav. to 1", v. dense, lt. br., some caliche -grades to	SM	S3	50/6"	8.8	
6			Silty CLAY, firm, med. br., moist Silty CLAY-cuttings and drill	CL				
			Gravel-no penetration	GP	S4	Refusal		
7			Silty CLAY-cuttings and drill					
8			SAND, fn. to med. w/ grav. to 1/2", v. dense, med. br., moist, tr. clay	SP	S5	50/4"		
9			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- [C] 2" x 4" CALIFORNIA SAMPLER
- [B] BULK SAMPLE

GROUND WATER

PERCHED WATER

CT ENGINEERING SERVICE CENTER

GEOTECHNICAL BORING LOG

DIST-CO-RT	08-SBd-15	DATE DRILLED	9/9/99	BORING DESIG	CS2
DESCRIPTION	WIDENING	DRILLED BY	K.BLACK	STATION	471+40
PROJECT EA	08-355500	LOGGED BY	C.HOADLEY	POST KM	112.04
TYPE & SIZE	Mud Rotary	DRIVE WT(KG)	63.5	OFFSET (M)	55 Rt
OF BORING	2 7/8"	DROP (MM)	760	GSE (M)	769.25

DEPTH METERS	ELEVATION (M)	GRAPHIC LOG	SOIL DESCRIPTION	USC GROUP SYMBOL	SAMPLE NO.	BLOWS/FT	MOISTURE CONTENT %	OTHER TESTS
1			SILTY SAND AND GRAVEL TO 3"					
2			SAND, fn. to c. gr. w/ gravel to 3/4", v. dense, lt. br., dry, tr. clay & caliche	SW	S1	50/5"		
3			Gravelly-cuttings and drill					
			SAND, fn. to c. gr. w/ gravel to 3/4", v. dense, lt. br., dry, tr. clay & caliche	SW	S2	50/5"		
4			Gravelly-cuttings and drill					
5			Silty SAND w/ tr. grav. to 1 1/2", v. dense, lt. br., grades to	SM	S3	50/6"	10.5	
6			Silty CLAY-cuttings and drill					
			Silty CLAY w/ abundant caliche, hard, med. br. to whitish, moist, tr. fn. sand	CL	S4	50/5"	18.3	LL-37 PI-23
7			Gravelly-cuttings and drill					
			Silty CLAY w/ caliche-cuttings					
8			Clayey SAND, fn. to med. gr. w/ caliche, hard, v. moist, tr. c. sand	SC	S5	50/3"	24.0	
9			No groundwater encountered					

SAMPLE TESTS:

- ■ SAMPLE LOCATION-SPT
- C 2" x 4" CALIFORNIA SAMPLER
- B BULK SAMPLE

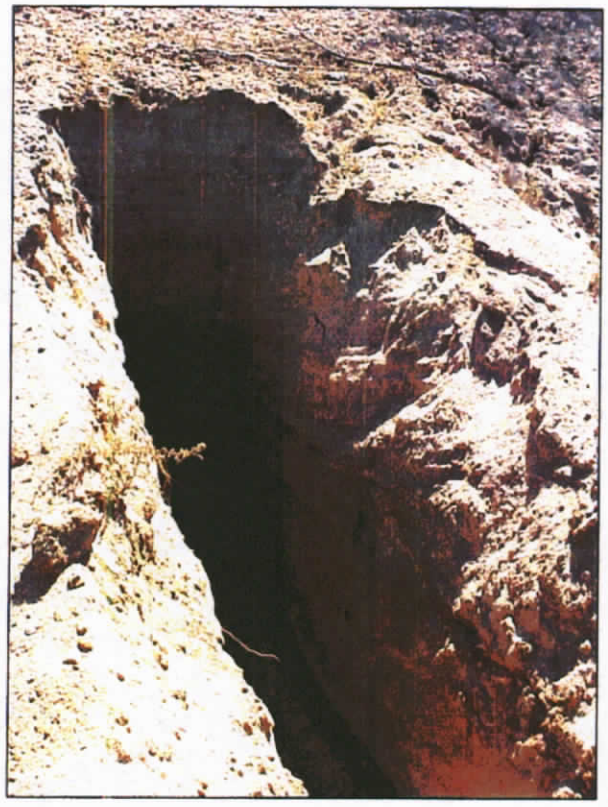
GROUND WATER

PERCHED WATER

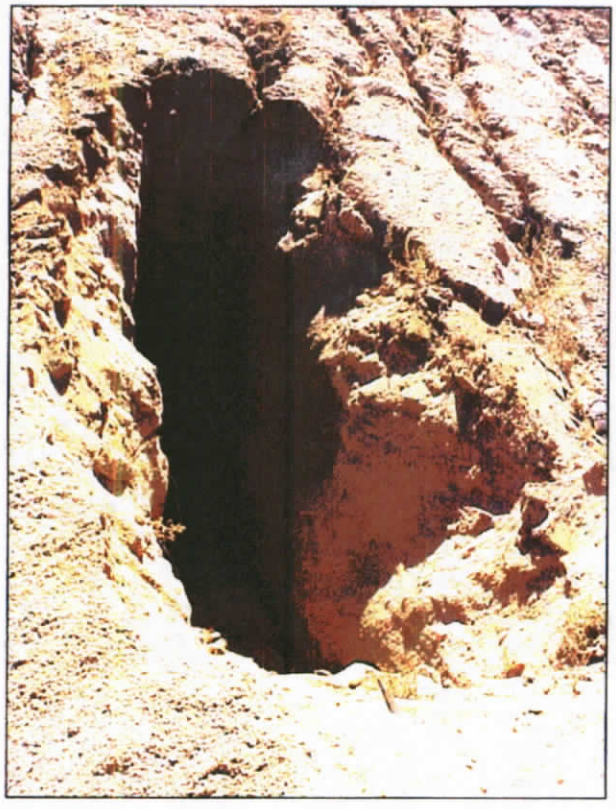
CT ENGINEERING SERVICE CENTER

APPENDIX 13.3

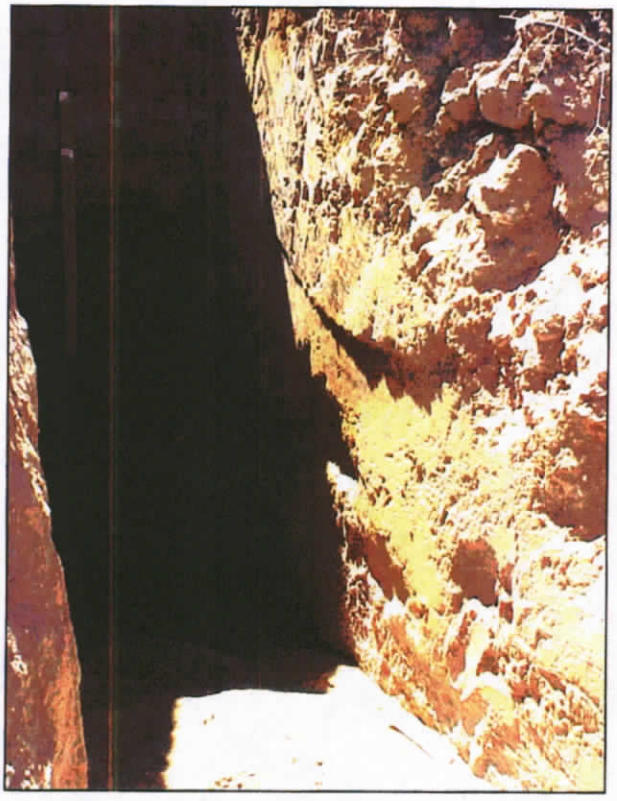
TRENCH LOGS



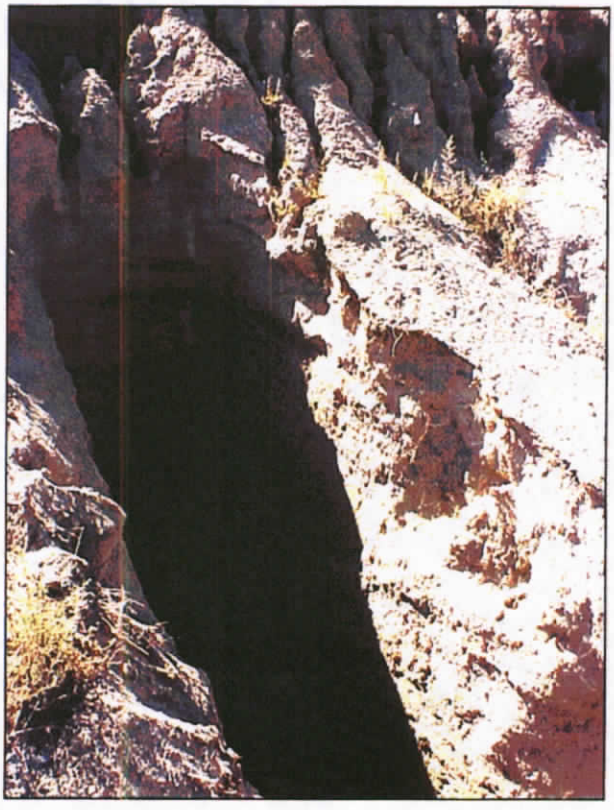
TRENCH #TR1-99
N/B I-15 Station 39+00
Trench is approximately 2 meters deep with bottom elevation approximately 0.3 meters below AC dike. Upper 1.5 meters is light brown clean loose coarse Sand with gravel. A Reddish/Black coarse Sand and gravel layer approximately 10 centimeters thick can be seen on top of a dense fine sandy Silt layer.



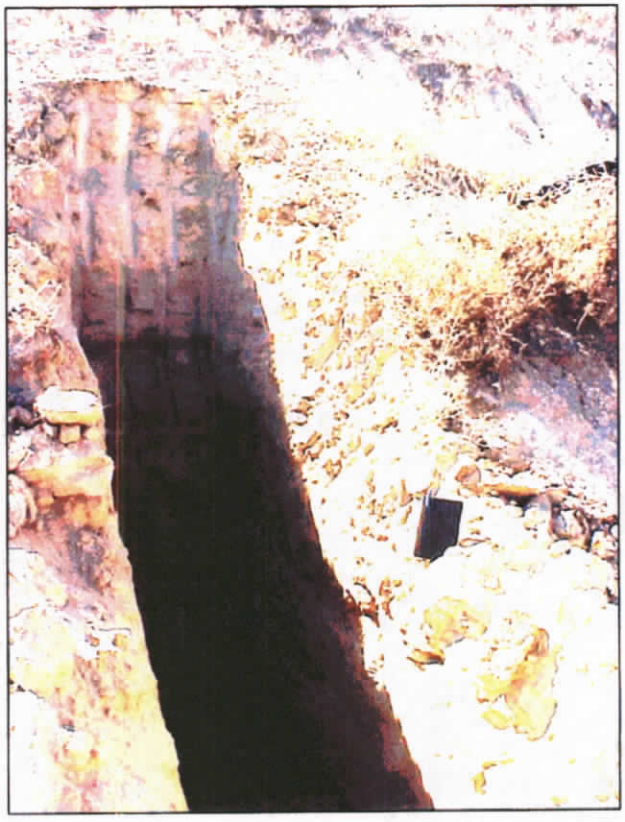
TRENCH #TR2-99
N/B I-15 Station 40+50
Trench is approximately 2.2 meters deep with bottom elevation approximately 0.3 meters below AC dike. Trench is homogenous brown clean damp coarse to medium SAND. Sand walls were loose and sloughed off in thin sheets when tapped with palm of hand. Upper section of trench appeared to be medium sand slightly more dense than bottom section of trench.



TRENCH #TR3-99
N/B I-15 Station 42+00
Trench is 2.3 meters deep with bottom elevation approximately 0.3 meters below AC dike. Upper 1.5 meters is brown stiff fine sandy SILT. Bottom 0.8 meters is loose to medium dense medium to coarse SAND.



TRENCH #TR4-99
N/B I-15 Station 43+80
Trench is approximately 2.2 meters deep with bottom elevation approximately 0.3 meters below AC dike. Trench is homogenous brown clean coarse, loose to medium dense SAND.

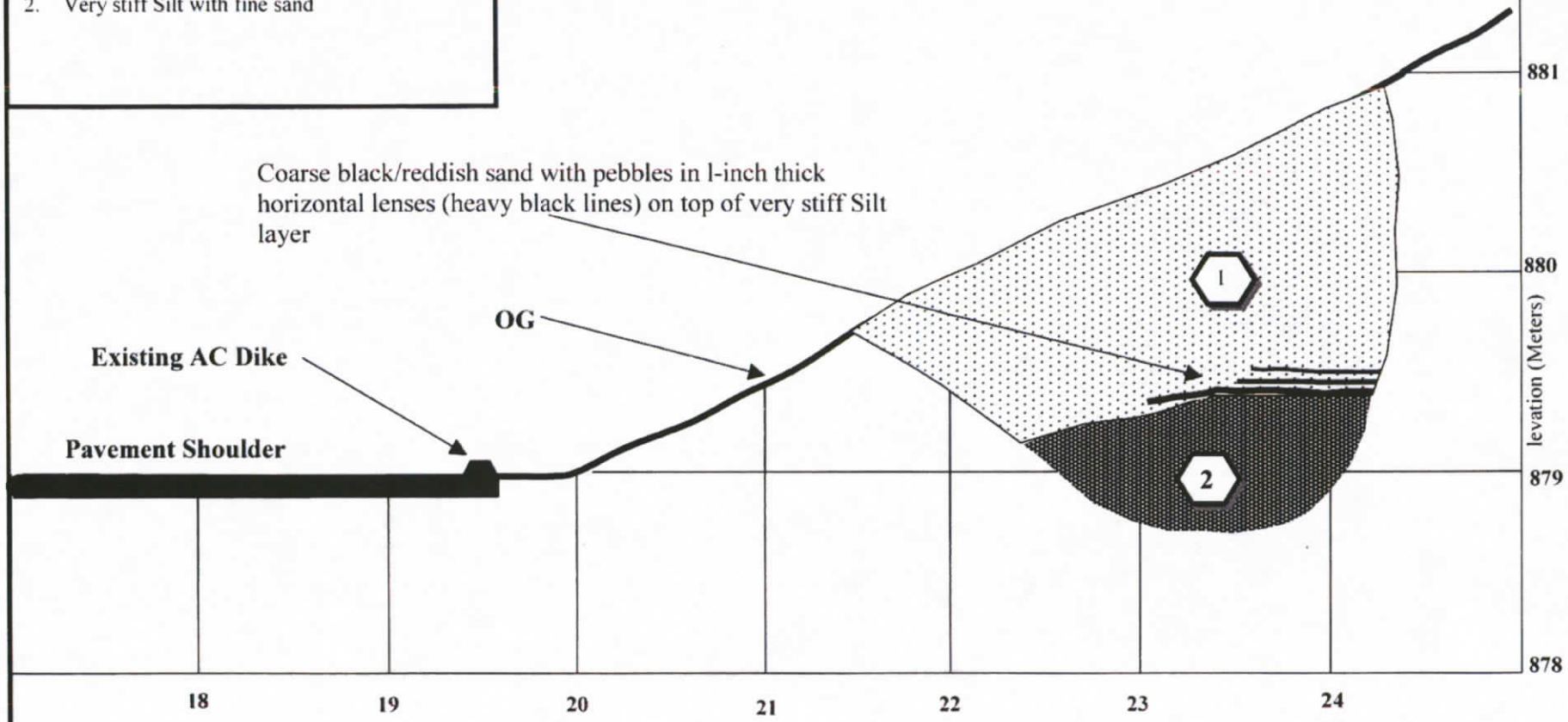


TRENCH #TR5-99
N/B I-15 Station 45+00
Trench is 2.5 meters with bottom elevation approximately 0.5 meters below AC dike. Upper 1.2 meters is brown dry dense fine sandy SILT. Middle layer is dark brown, moist dense to medium dense SILT with fine sand. Bottom 0.5 meters is clean, loose to medium dense, medium to coarse SAND.

TRENCH #TR6-99
N/B I-15 "D" Street Offramp Station 46+50
Trench is 2.0 meters with bottom elevation approximately 0.3 meters below AC dike. Upper 0.8 meters is brown dry dense medium to dense fine sandy SILT with coares sands. Middle layer is dark brown, coarse medium SANDS. Bottom 0.5 meters is moist dense fine sandy SILT.

Visual description of soil

1. Loose, dry, silty Sand, fine to medium grained with trace gravel to 1"
2. Very stiff Silt with fine sand



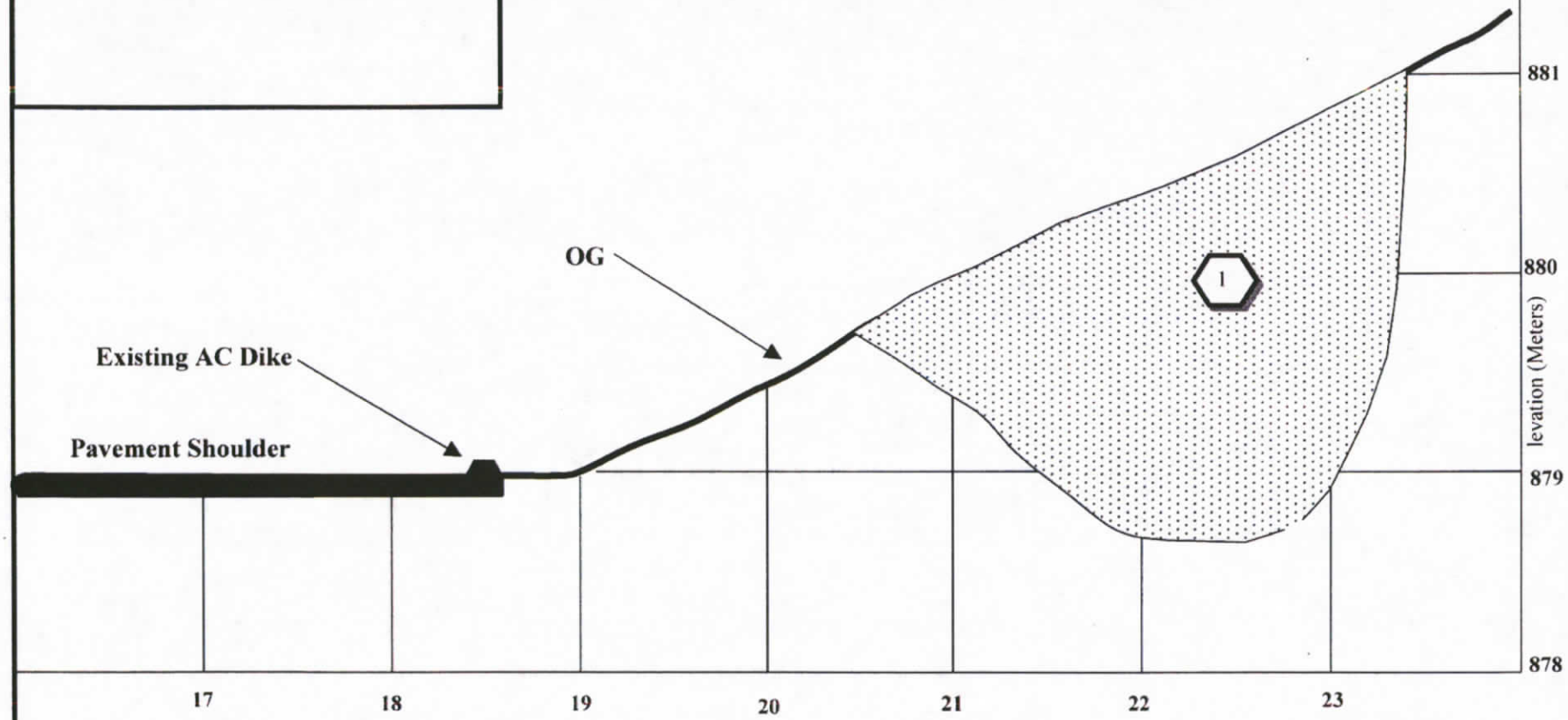
Not to Scale

Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 39+00
EA 08 - 355500			SEPTEMBER 1999
TRENCH #1			

Visual description of soil

1. Loose to medium dense, moist, medium to coarse grained Sand with trace silt.



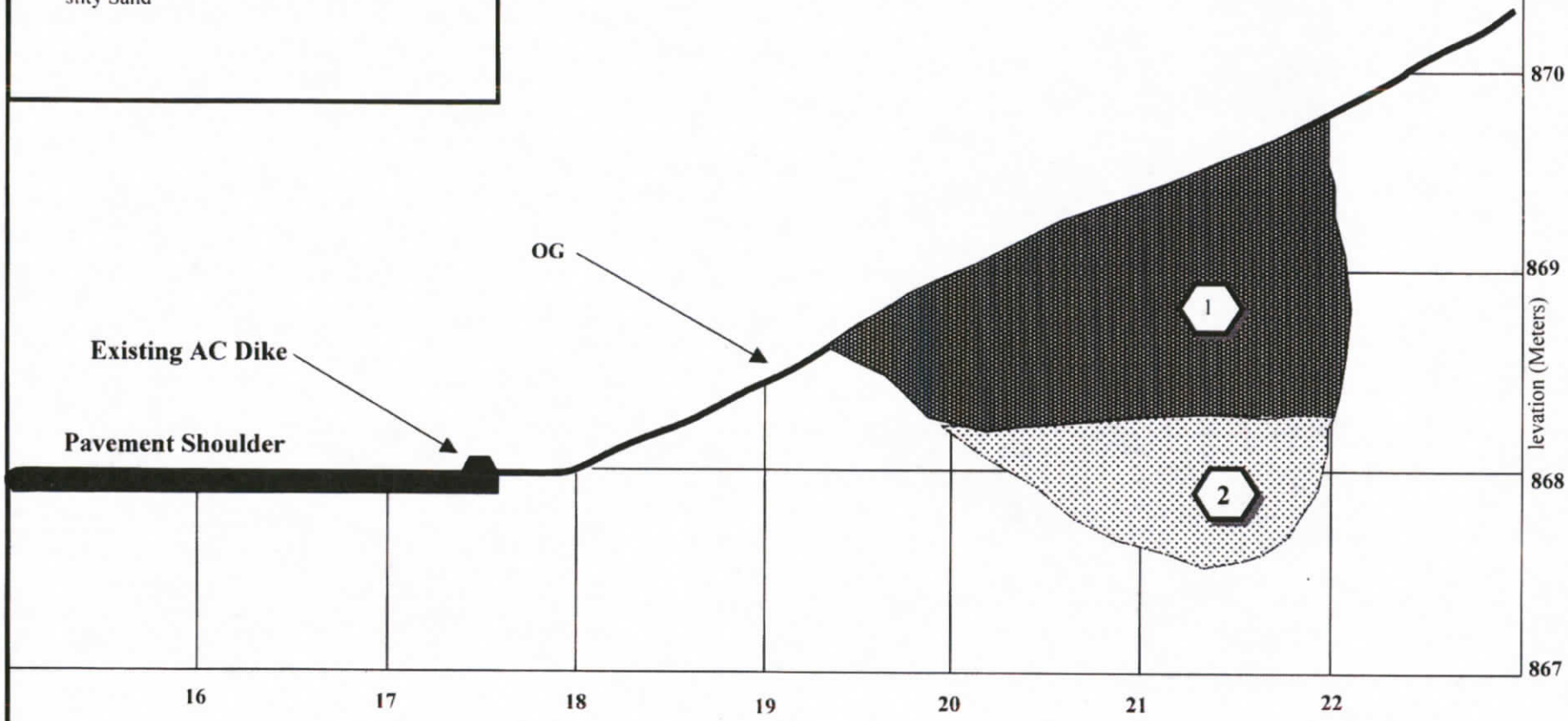
Not to Scale

Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 45+50 NB
EA 08 - 355500			SEPTEMBER 1999
TRENCH #2			

Visual description of soil

1. Stiff , dry, Silt with fine sand
2. Loose to medium dense, dry, medium grained silty Sand



Not to Scale

Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 42+00
EA 08 - 355500			SEPTEMBER 1999
TRENCH #3			

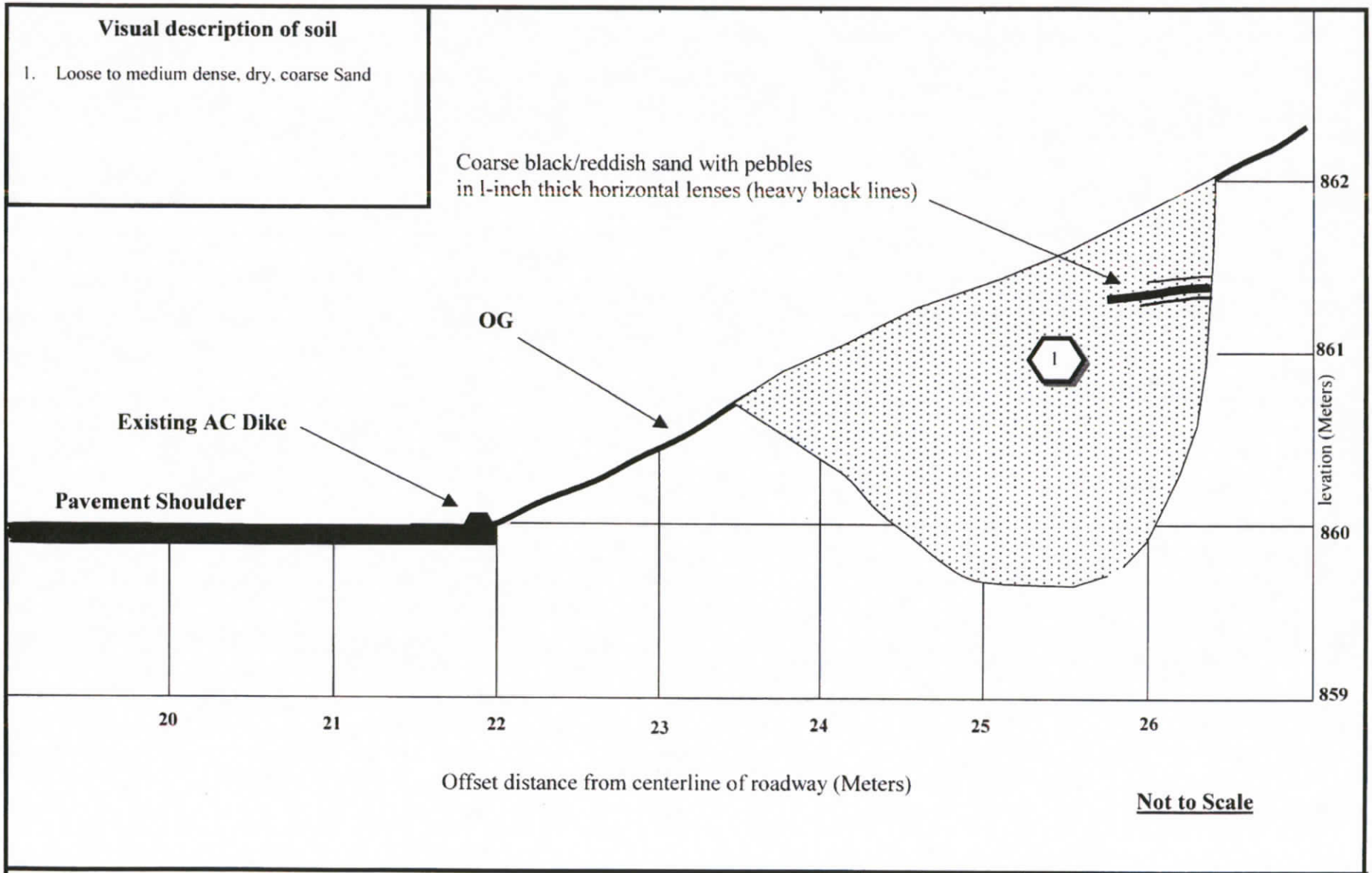
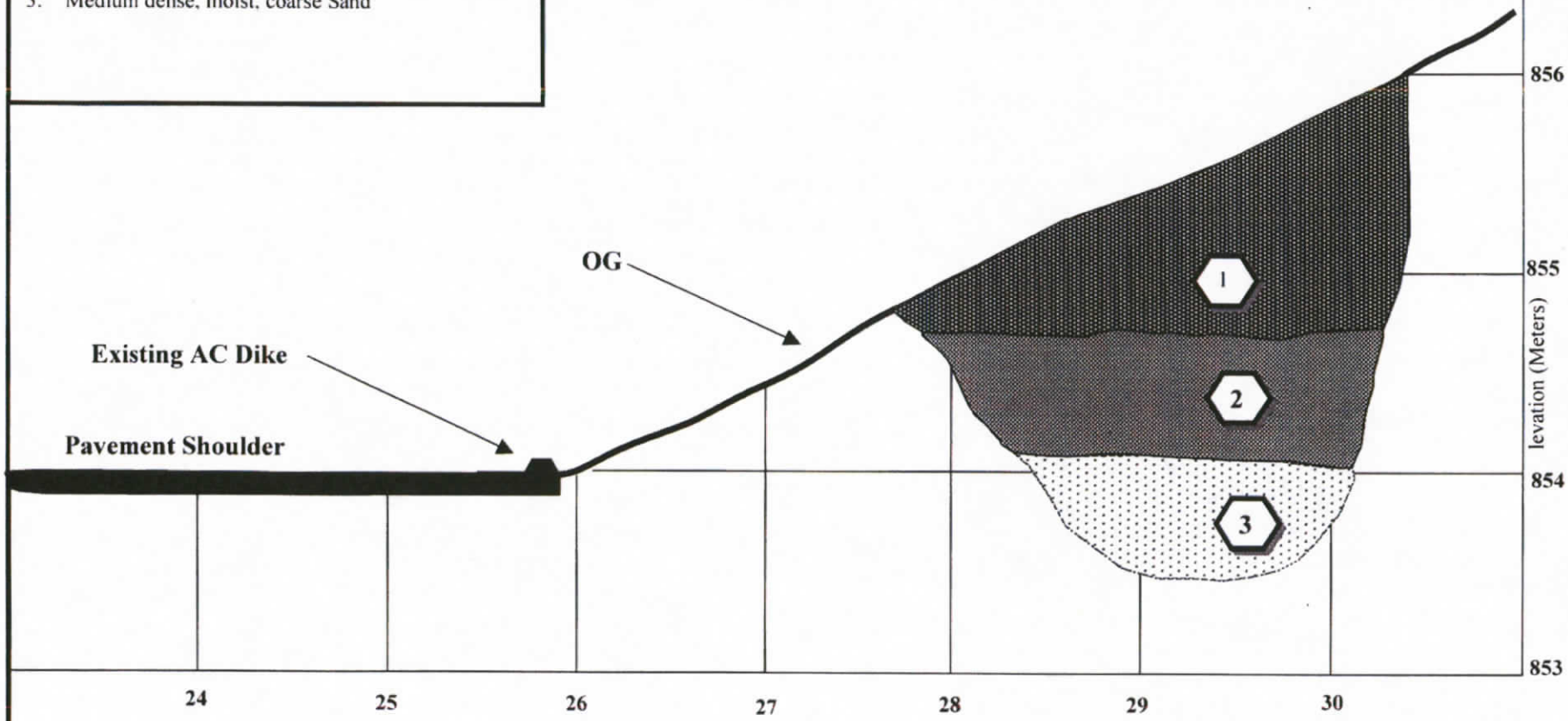


FIGURE 4. Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 43+80
EA 08 - 355500			SEPTEMBER 1999
TRENCH #4			

Visual description of soil

1. Stiff, dry fine sandy Silt
2. Medium to stiff Silt, moist with fine sand
3. Medium dense, moist, coarse Sand



Offset distance from centerline of roadway (Meters)

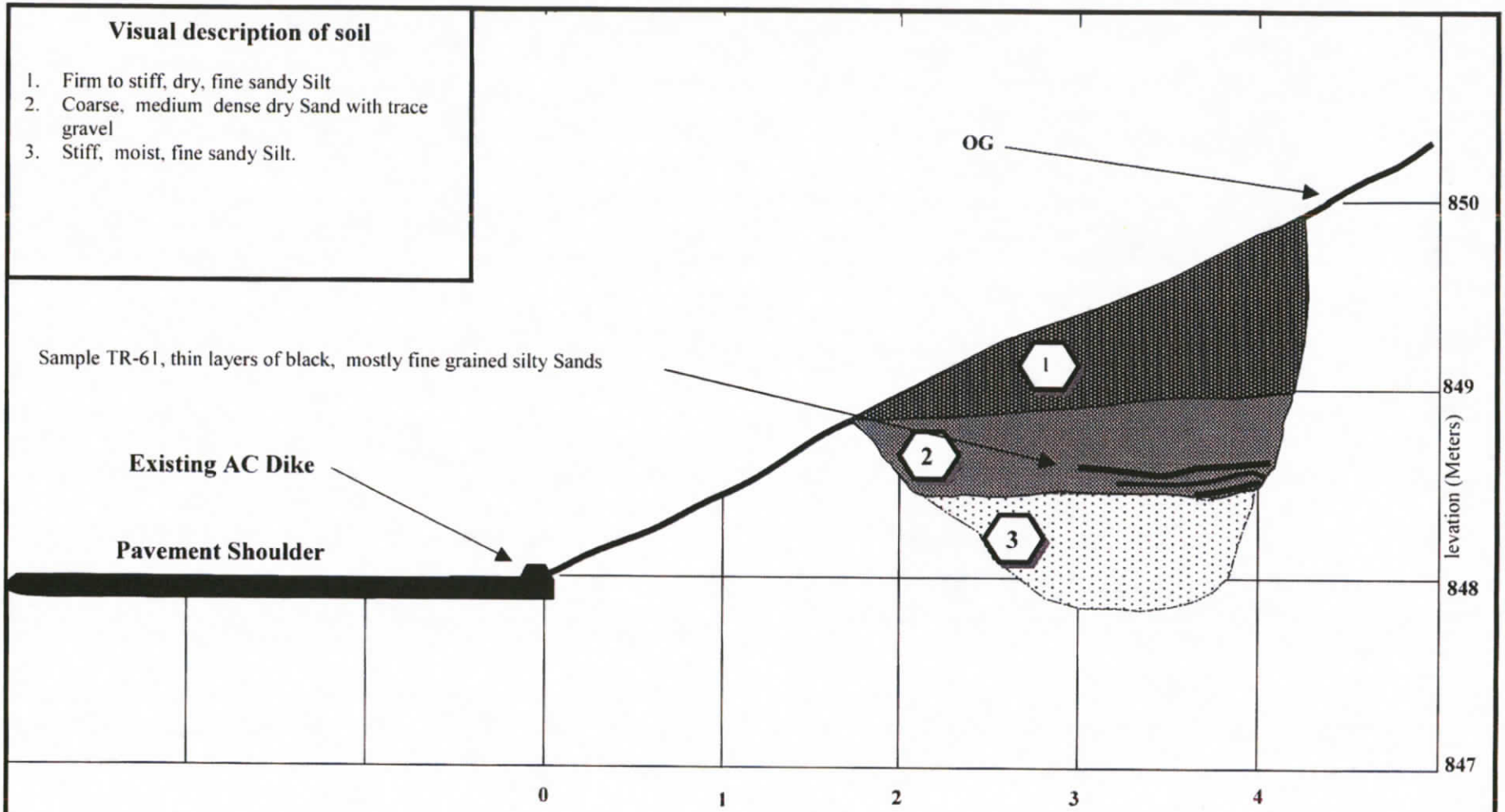
Not to Scale

Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 45+00 NB
EA 08 - 355500			SEPTEMBER 1999
TRENCH #5			

Visual description of soil

1. Firm to stiff, dry, fine sandy Silt
2. Coarse, medium dense dry Sand with trace gravel
3. Stiff, moist, fine sandy Silt.



Offset distance from AC dike of "D" Street Off Ramp

Not to Scale

Test pit trench log. This drawing is intended to visually present the approximate locations of the different soil layers and their approximate relationship to the existing roadway.

DIST	COUNTY	ROUTE	STATION
08	SBd	15	STA 46+50 NB
EA 08 - 355500			SEPTEMBER 1999
TRENCH #6			

APPENDIX 13.4

GEOPHYSICAL DATA

STATE O
DEPARTMENT C

PROJECT PLANS I

STATE

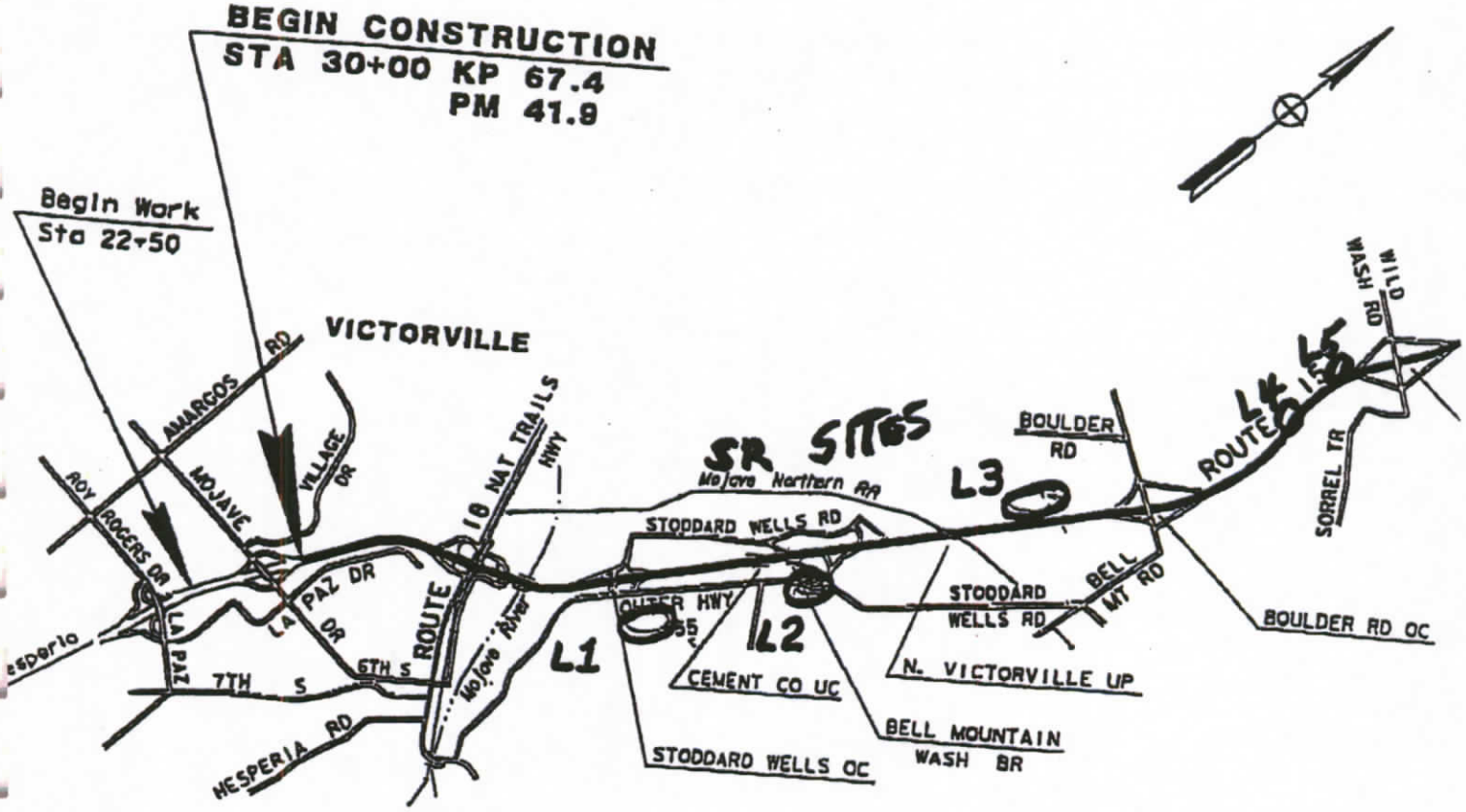
IN SAN BERNA

IN VICT

FROM 0.3 km NORTH OF M

TO 0.830 km NORTH OF 15/

To be supplemented by Standc



NO SCALE

ATTACHMENT 1

State of California

Business, Transportation and Housing Agency

Memorandum

To : MR. GIL DAAB - 08
Design Branch D

Date : October 13, 1998

File No. : 08-SBd-15-KP 85.7/89.6
08-427700

From : **DEPARTMENT OF TRANSPORTATION**
ENGINEERING SERVICE CENTER
Office of Structural Foundations-MS#5

Subject : Truck Climbing Lane Widening: Rippability Investigation

Per your July 23, 1998 request, Roadway Geotechnical Engineering - South (RGES) has conducted a geologic study to assess rock rippability and factors bearing on the design of proposed cut slopes for widening on the west (southbound) side of Highway 15 between Kilometer Post 85.7 and 89.6. The results of the rippability study are presented in the attached Rippability Investigation Report.

Site Description

As observed during our August 25 and 26, 1998 site reconnaissance, Route 15 at the project site is an asphalt concrete (AC) paved rural freeway with two northbound lanes and two southbound lanes (See Site Map, Figure 1). The shoulder for the southbound lane is paved but there is no AC dike.

The present cut slopes, originally cut in the late 1950's, rise from the edge of the shoulder to a maximum height of 22 m and are fairly flat above the cut slopes to the Right of Way fence. The areas under study are two cut slopes between Stations 210+80 and 215+00 at variable heights to 11 meters high, slope ratio at 1:1-1/2 (V:H) in the south project location (identified as the South Slope for this report, Cut 1 in Rippability Report), and the other between Stations 223+30 and 228+40 at variable heights to 22 m high, at 1:1 in the north location (North Slope, Cut 5 in the Rippability Report). At other locations within the project limits, cut and fill heights do not exceed 1.5 m.

The general topography in the project vicinity consists of rocky ridges projecting above alluvial plains in a desert environment. The two sites are in the northeast flanks of Silver Mountain at an elevation of 1000 m for the South Slope site and 970 m for the North Slope site. The Mojave River is the principal drainage of the region flowing partially underground from Victorville, 13 km south of the site and making an arcuate path 11 km west of the site, as it flows to Barstow to the north. The principal drainage courses in the vicinity of the site are the ephemeral Wild Wash, flowing northwesterly from the Turtle, Stoddard and Silver Mountains to the Mojave River, and the Bell Mountain Wash, flowing southerly from the Turtle and Silver Mountains to the Mojave River in Victorville. These washes do not directly affect the subject cut slopes and, accordingly, erosion at these two sites has produced very little sloughing or rockfall since they were originally cut in the late 1950's.

The climate is fairly typical for elevated desert environments with less than 150 mm of rain falling between December and April and an occasional summer shower (38 mm fell in an hour and a half during our seismic refraction survey). The temperature covers a range from a minimum of -11°C to a maximum of 47°C (it was 43°C during our survey). Temperature variations of 28°C within a 24-hour period are not uncommon during the summer months. Occasional snowfalls on the slopes in the winter months can produce freeze/thaw conditions. Groundwater may be as deep as 200 m (USGS, 1974).

Proposed Project

The project as proposed would widen the present southbound roadway, adding two truck climbing lanes, one of which will be converted to normal traffic in a future project now in the planning stages. The work will require removal of the present 3.6 m wide shoulder, widening the present cuts by cutting them back 7.6 m at their current slope ratios, and then reconstructing two new structural sections that will each be 3.6 m wide (See Figure 4b). A 4 m width of unpaved dirt (rock) will be left between the outside edge of the truck climbing lanes and the toe of the new slope to accommodate a future shoulder. Roadway and cut slope runoff will flow to a swale at the toe of slope, which will then be carried off site. Cut slope heights will increase only slightly after widening.

Geologic Conditions

Regionally, the Mojave Geomorphic Province can be sectioned into the East Mojave subprovince and the West Mojave subprovince as defined by the northerly flowing Mojave River. This study is located on the west side of the East Mojave subprovince.

The structure of the two proposed cut areas is controlled by the Holocene Helendale fault, a zone which is about 1 km wide (See Figure 1). Both of the sites sit on transverse splays of the fault. The fault is expressed topographically in an escarpment that forms the northeast flank of Silver Mountain. The Helendale fault is a near vertical dip-slip fault with some left lateral strike-slip component. Visible faulting can be seen on the North Slope face (See Figure 3). The Helendale fault extends approximately 90 km southeast to northwest. It is capable of a M7.25 earthquake with a maximum acceleration of 0.6g (CT, Mualchin, 1996).

The site can be divided geologically as it is divided topographically, i.e., North and South. During our August 31 to September 2, 1998 seismic refraction survey, we performed surface mapping of the rock outcrops in which the proposed cuts will be made and a stereographic analysis is included in the rippability report. (No subsurface exploration, sampling or testing have been conducted other than the seismic refraction work described in the attached report.)

At the South Slope site at Station 210+80 to 215+00 the rock exposed in the cut is a hard Mesozoic quartz monzonite (granitic) rock that is moderately weathered and moderately to intensely fractured. It is also faulted and has hydrothermal alteration in some areas.

Numerous mining adits surround the site but economic minerals were not found in abundance. At Station 214+00 near the north end of the slope, the quartz monzonite is in fault contact with the material that makes up the North Slope part of the site, flow-banded metavolcanic rock.

The North Slope consists of the Mesozoic Sidewinder Series, composed of hard flow-banded metavolcanic rocks. These rocks are moderately weathered and intensely fractured with severe faulting (See Figure 3). Some hydrothermal alteration has left several friable zones of fine-grained sericite and quartz about a meter wide.

The north end of the North Slope was chosen to begin our fracture study. Every 10 m we took about ten orientations reaching up the slope as far as we could safely reach. A total of 57 orientations were taken and every one was different. As stated before, these were plotted on stereonets and presented in the Rippability Report. Fractures generally exhibit very thin weathering stains and are tight and smooth with mostly planar contacts. However, a few fractures had undulating contacts such as one seen on the North Slope that was wavy, open about 1.5 cm and filled with soil. Very little in-filling was seen in the other fractures. The largest solid, unfractured rock size of these cuts measured about 0.3 m square as seen on the cut face infrequently but the average size was about 4-5 cm square. Minor raveling was seen at the toe of the slopes in both areas.

Geotechnical Factors Related to Design

The factors that control the stability of cut slopes in rock at the two locations are:

- Rock Material
- Structural Makeup of the rock-mass in the body of the cut slope
- Properties of the fractures
- Ground Water Regime
- Excavation method
- Long term weather conditions
- Dynamic stability against seismic forces and slip along the fault zone

As discussed in the Section on Geologic Conditions, the rock materials comprising the slopes at the sites are of igneous and metavolcanic types that are moderately weathered and fractured. This implies that the rock material is competent but the integrity of the rock-mass is governed by the structural makeup, i.e., spacing and type of fractures.

The fractures as seen on the exposed surfaces appeared tight with minimal in-fill material. The tightness and absence of in-fill material impart sufficient shear strength to the discontinuity surfaces (fractures) and provide resistance against large scale sliding. The randomness of the fracture surfaces prevents formation of a continuous sliding surface. The close spacing between the discontinuities excludes the toppling mode of failure. Iron-staining observed on the fracture surfaces indicates water-flow, perhaps from rainwater

percolating through the body of the cut slopes. Since groundwater is very deep, it is not a factor that needs to be considered for design.

An observational factor that provides a clue to the continued overall stability of the slopes, after future excavation, is that there was no visual evidence of past large scale sliding in the existing slopes over nearly 40 years of their existence. The cut slopes do undergo minor degradation on their faces in the form of occasional loosening of rock blocks that result in their rolling down the slope and surface weathering resulting in minor talus formation at the base of the cut slopes.

The attached geophysical seismic refraction exploration report validates rippability as the tool for excavation. The ripping process generally results in less disturbance to the rock-mass on the cut face than does blasting. From the refraction survey, velocities greater than and close to, 2400 m/sec (in the transition zone between ripping and blasting) were estimated for greater depths. In the absence of rock mass structure data (e.g., RQD values from core data), it is conservative to assume that some blasting will be needed. For estimate purposes, 10% of the total excavation volume may be assumed to be by blasting.

The Helendale Fault zone is capable of producing M7.25 earthquake with a peak acceleration of 0.6g. Should such an episode occur, it could cause loosening of some of the rock blocks that could roll down the slope. However, we do not anticipate any major rock-mass sliding.

Geotechnical Design Analysis

The analysis of stability of slopes involves a two-stage process: static stability and dynamic stability. For the two cut slopes in question, a third process is possible in the form of slip along splays of the fault transecting the cuts.

Stability of igneous rock slopes is governed predominantly by the nature and orientation of discontinuities. The shear strength of the closely jointed rock mass is highly non-linear with respect to effective normal stress because of dilatancy effects. For low normal stresses which are relevant in the case of shallow slides, the friction angle (slope of the strength curve) will be very high (on the order of 60° or more) but the shear strength will be very small. Since the strength increases rapidly with depth, slope failure in such rock is usually in the form of a shallow slip surface.

Failure in the form of a continuous slip surface is possible only when the rock material fractures or the rock mass is decomposed in the advanced stage of weathering. As discussed in the previous section, the existing slopes (the North Slope and South Slope) have remained stable over the last 40 years. Assuming similar rock-mass conditions after excavation, the new cut slopes are expected to have adequate resistance against large scale sliding.

The above analysis assumes that there are no new constructions or modifications to the terrain adjacent to and above the crests of the slopes. As per the Highway Design Manual,

Section 304.2, the minimum clearance between top of slope and the right-of-way for cuts between 15 m and 25 m high is 7.5 m and is 6 m for cuts of height between 10 m and 15 m.

A quantitative evaluation of the static stability of the cut slopes is not possible since (1) the failure surface is difficult to define and (2) strength parameters can not be reliably quantified.

Since both the sites are within the transverse splay zone of the Helendale Fault, ground displacements will occur during the maximum credible earthquake. During the Landers Earthquake, no permanent displacement was observed in the vicinity of the cut slopes. Based on measurements of ground movements after the Landers Earthquake at other locations encompassing the two sites, the fault could slip on the order of 3 cm to 10 cm for a similar earthquake on the Helendale Fault.

The yield acceleration for both cut slopes is expected to be greater than the anticipated maximum ground acceleration of 0.6 g. However, it is difficult to quantify the value of yield acceleration for slopes in jointed rock-mass.

Measures to Protect Traffic from Rock-fall

Loosening of rock blocks is bound to occur because of continued mechanical weathering and potential ground shaking from seismic events. However, rockfall will occur sporadically and we recommend a catchment width of 4 m to catch falling rock blocks. The proposed catchment area shall be sloped 5% down from horizontal towards the cut slope toe. The water shall not be allowed to accumulate in the catchment area (Figure 4b).

If part of the catchment area is to be used for a future lane or shoulder, we recommend that the slopes be cut back an additional 3.5 m under the present study instead of cutting back the slope again, say a year from now, requiring additional investigations (See Figure 4c).

Conclusions and Recommendations

Based on our visual observations of the cut slopes and results of seismic refraction studies, the following conclusions and recommendations are made:

1. The existing cut slopes at the two locations appear to have remained stable without major rock falls over the last 40 years.

2. Ripping as the mode of excavation is feasible, based on the low wave-velocities in the body of the rock; however, approximately 10% of the excavation (by volume) may need to be done by blasting.

3. After excavation the cut slopes are expected to continue to remain stable under static conditions.

4. Minor rock falls are bound to occur, as the rock mass undergoes mechanical weathering. Some erosion of slope surfaces is possible during very heavy rains.

5. Since both sites lie in the broad zone of the Helendale Fault system, some rockfall will occur because of ground shaking. The body of the slopes may undergo minor slip resulting in loosening of the rock blocks. Both slopes are expected to have yield accelerations greater than the expected maximum ground acceleration.

6. Provide a catchment area between the toe of the cut slope and the edge of the road. The catchment area should be sloped down at 5% from the horizontal from the edge of pavement towards the toe of the cut. Positive drainage should be provided along the ditch to prevent accumulation of water at the toe of the slope.

7. An engineering geologist from RGES should be present during the ripping operations at both sites to identify loose rock blocks that warrant scaling from the excavated faces. The geologist will also search for planes of weakness that could adversely affect the stability of the cut faces and recommend modifications, if needed, to the slope geometry.

If you have any questions or comments, please call Mr. Chris Hoadley at (916) 227-7273 (CalNet 8-498-7273) or Mr. Panch Sundaram at (916) 227-7188 (CalNet 8-498-7188).

CHRISTOPHER A. HOADLEY
Associate Engineering Geologist
Geotechnical Section 6

PANCHANATHAM N. SUNDARAM, P.E.
Transportation Engineer (Civil)
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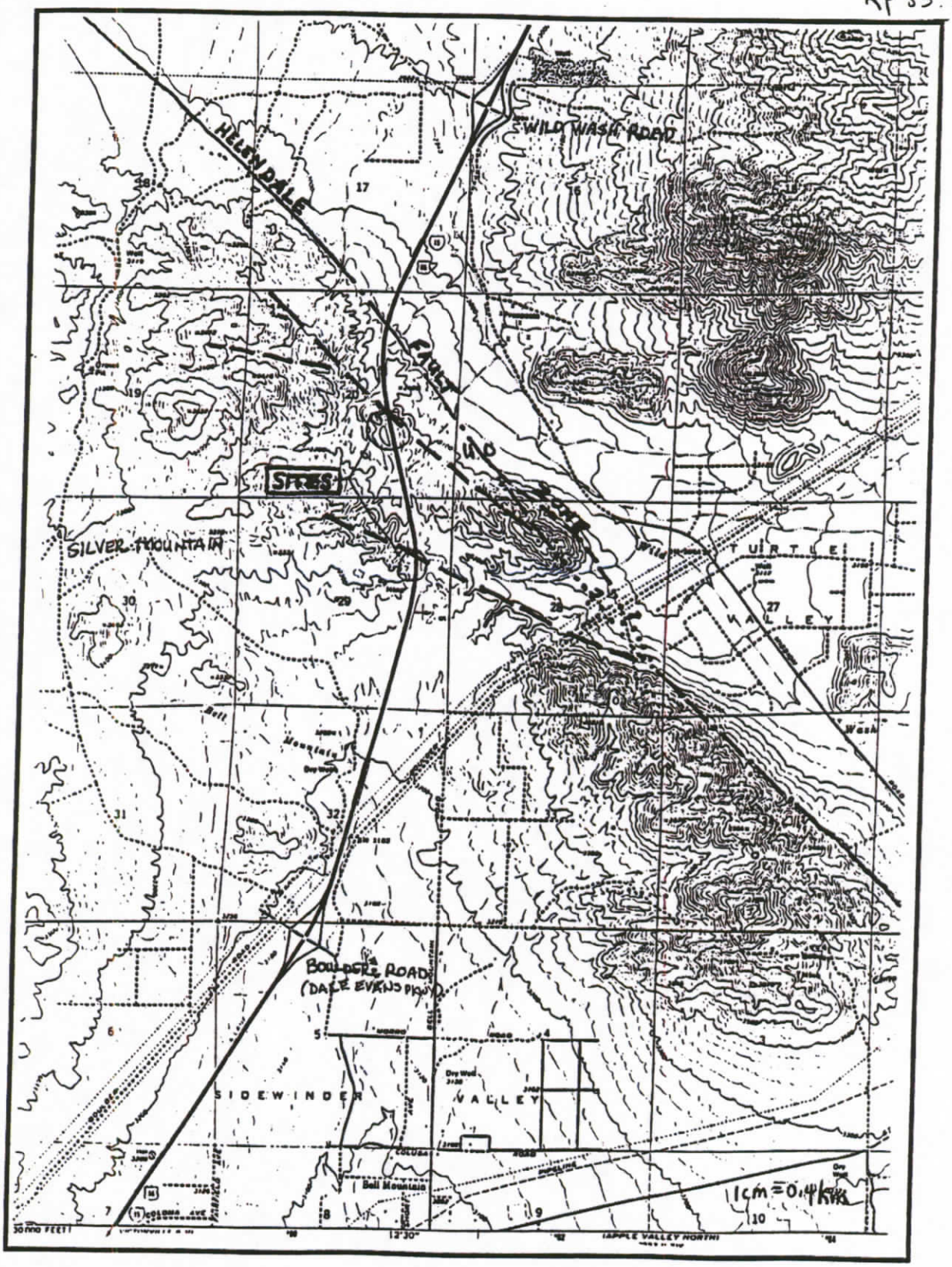
GERALD F. PEARCE, III, G.E., Chief
Geotechnical Section 6
Roadway Geotechnical Engineering-South

REGISTERED PROFESSIONAL ENGINEER
PANCHANATHAM N. SUNDARAM
No. C57665
Exp. 12/31/2001
CIVIL
STATE OF CALIFORNIA

Attachments

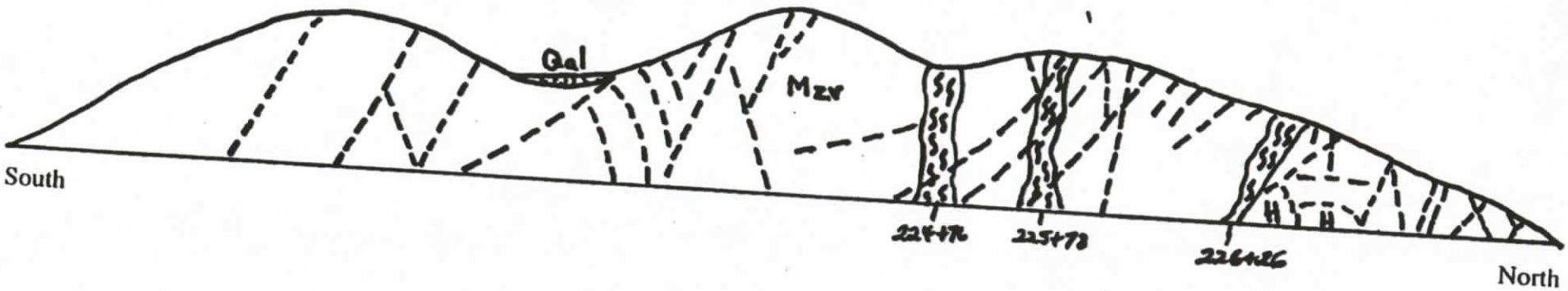
c: KJackura (RGES.02)
BKean, DME-08
JKermode
RGES.02
98/9007

08-427700
KP 85.7/89.6



Location Map

Figure 1



FAULTS EXPOSED IN CUT SLOPE
STATION 223+30 - 227+00

- - - - FAULTS
S=Shear, H=Hydrothermal Alteration

Not to Scale

Mzv = Sidewinder Volcanics
Qal = Alluvium

Figure 3

By Chris Hoadley, AEG
SEPTEMBER 2, 1998

08-427700
KP 85.7-89.6

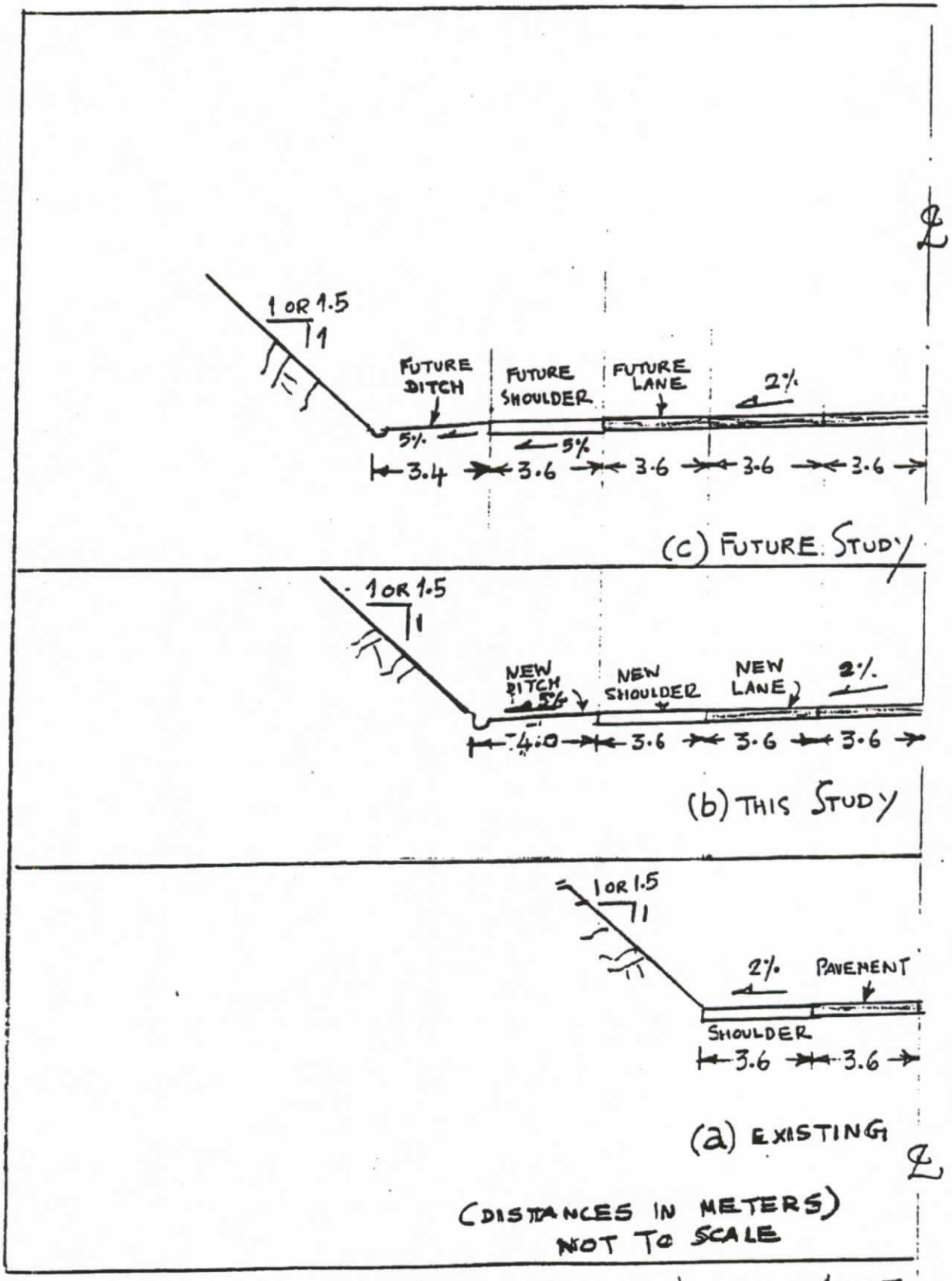


FIGURE 4. CUT SLOPE - TRUCK CLIMBING LANE

OCT 9, 98

State of California
Agency

Business, Transportation and Housing

MEMORANDUM

To : Mr. Chris Hoadley
Associate Engineering Geologist
Roadway Geotechnical South

Date : January 19, 2000

File : 08-SBD-15
KP 85.7/89.6
08-427701
Rippability Investigation

From : **DEPARTMENT OF TRANSPORTATION**
Division of Structural Foundations
Office of Roadway Geotechnical Engineering - South

Subject : **Rippability Investigation** ***Proposed widening of I-15***

Per your telephone request of August 27, 1998, a shallow seismic refraction survey was conducted on August 31, 1998 through September 2, 1998 at the subject site. This investigation was conducted to estimate bedrock rippability. Four seismic refraction lines of varying length and geophone spread were developed on two proposed cut locations. Topography was conducive to the study and seismic lines were laid out on the materials to be cut. A 1:500 scale drainage and contour grading map (dated 08/18/98, revision 00-00-00) and 1:200 scale cross-sections were provided to assist the investigation.

A materials report for an antecedent project (08-SBD-15-31-58, Powerline Road Overcrossing), dated June 19, 1956, indicated that two borings were developed at the subject site to evaluate material characteristics. Since boring logs were not included within the report, we could not correlate Rock Quality Designation (RQD) with site P-wave velocities. We requested a copy of aforementioned report and the Logs of Test Borings from the District 8 DME; however, at the time of writing of this report the requested information was unavailable. On September 2, 1998 and during the subsequent phone conversation, we gave you (verbally) an initial estimate that about 10% of the material would require blasting with the caveat that additional data resolution was required to refine the estimate. We suggested that a more accurate estimate could be made if the boring logs were made available, and that it might be possible to eliminate the recommendation for a blasting specification if RQD values were acceptably low. It is important to note that the materials report for the antecedent project indicated that blasting would be required to develop the (then proposed) existing cuts.

Scope

Per arrangement with the Project Geologist, this report is limited to rippability estimates and discontinuity data analysis. Since the quantity of data would be difficult to resolve manually, stereonet plots of discontinuities and discontinuity intersections were developed and are included as attachments to this report.

Proposed Project

The project proposes to construct slopes inclined at 1:1 1/2 (V: H) or flatter to a maximum height of 22 m and a maximum thickness of 8 m. The project widens Interstate Freeway I-15 to the west. The proposed construction leaves up to 7.6 m between the edge of traveled way and the toe of the slope.

Site description

The project site lies within the Mojave Desert, one of the 11 geomorphic provinces that comprise California. This area is characterized by north-west and east-west trending faults, large alluvial plains, internally terminating large drainages, playas, large low relief expanses punctuated by rugged hills and mountains comprised of metamorphic rocks, intrusive granitics, volcanics, and alluvium. Rock material exposed within existing site cuts is comprised of intensely to moderately weathered and intensely to moderately fractured crystalline rock (basic to intermediate chemistry igneous intrusive rock and granites).

The project widens I-15 to the west of the existing traveled way and modifies 5 existing cuts; Table 1 identifies cuts intervals and heights. These cuts are intersecting discontinuities developed in fractured igneous rock. Existing slope ratios are 1:1 or flatter. Rock exposed within existing cut V (the largest cut) is comprised of intensely to moderately weathered (Grade IIB, Deere and Patton), intensely to moderately fractured, very hard (q_u >100 MN/m^2; field test by hammer blow, Australian Geological Association) crystalline granitic rock. Fracture pattern is random (see stereonet plots); however, several shear zones cross the cut obliquely. The fractures range from low persistence to very high persistence, planar to undulating, and are tight to slightly open. The rock body is sheared, altered, and exhibits a homogeneous stratified weathering profile. The shear zones are of variable thickness, up to several meters thick. Rock within some of the shears is pulverized, and as such is soft. Rock ravel and talus at the foot of the cuts range from sand and gravel sized material to small boulders.

Table 1: Cuts Intervals and Heights.

CUT#	FROM CENTERLINE STATION:	TO CENTERLINE STATION:	CUT HEIGHT	CUT WIDTH	CUT TREND
I	210 + 80	215 + 00	9.5 m	7 m	N02E
II	217 + 40	217 + 79	<1.5 m	Tbd	N10W
III	219 +40	219 + 90	<1.5	NA	N06W
IV	222 + 50	222 + 80	<1.5	Tbd	N06W
V	223 +31	228 + 40	23 m	8 m	N11W

Tbd - to be determined, for information not provided with request.
NA – not available

Soils mantling the top of the cuts are comprised predominately of regolith, with minor colluvium. They are consisting of gravels that range from 0 to 1.8 m in thickness, are medium dense (estimated), and typically thicken in and around minor drainages that incise and cross the cuts. The site was readily accessible and we were able to place seismic lines directly above materials to be excavated. Surface relief was minor and did not impede choice of line layout. Vegetation was sparse and was comprised of succulents, creosote, and desert legumes and grasses. The weather was hot, humid, clear, and sunny - with the exception of severe afternoon and evening thunderstorms. Soils were moistened by these intense sporadic rains; but not enough to significantly alter P-wave velocities (v_p water = 1500m/s).

Seismic Refraction Investigation

The geologic structure of this terrane produced complicated seismic refraction records, and their interpretations relied heavily upon observations of rock characteristics exposed in cuts. Line locations were chosen upon the basis of cut size. Each line was run forward and reverse (bi-directional) to obtain true velocities and to facilitate resolution of and depth to subsurface interfaces. Line characteristics are presented in Table 2. Truck noise from the highway traffic and the damping affect of the fractured rock limited geophone spread. Available space and the propagation characteristics of the ground determined geophone spacing. Energy was imparted to the ground by 2.99 kg sledgehammer or by the "Betsy" seismogun using an 8 gauge 25.9 g (400-grain) black powder blank. First break arrival times and the subsequent wave trains were identified and recorded with the EG&G 1222 seismograph, a 12 channel seismograph. Each line was comprised of 12 geophones. It was necessary to stack 4 or more signals per direction to obtain interpretable records. At some locations, the absence of regolith prevented the use of the Betsy Gun. Line 1 was developed by both Betsy and by hammer-blows to establish that the energy source did not significantly alter signal record.

Table 2: Line Characteristics

LINE #	CUT #	CENTERLINE STATION OF FORWARD INITIATION POINT	CENTERLINE STATION OF REVERSE INITIATION POINT	TREND	LINE LENGTH	PHONE SPACING	APPROX DEPTH OF INVEST.
1	V	28 m left station 213+87	24 m left station 213+48	N08W	50.29 m	4.57 m	16.76 m
2	V	26 m left station 213+64	46 m left station 213+61	N82E	36.58 m	3.05 m	12.19 m
3	I	37 m left station 225+18	44 m left station 224+68	N03W	36.58 m	3.05 m	12.19 m
4	I	28 m left station 225+46	69 m left station 225+62	N84E	19.51 m	2.44 m	6.50 m

All four Seismic Refraction lines produced complex return signals interpreted as irregularly shaped and oriented subsurface refraction interfaces. While a stereonet analysis indicated that discontinuities attitudes were random, inspection of cut faces revealed east-west (N80E +/-) shears and foliation trends. In fact, data scatter was less on lines 2 and 4 (oriented N82E and N84E) than that on lines 1 and 3 (oriented N08W and N03W). This observation is consistent with structure striking across lines 1 and 3, and parallel to lines 2 and 4.

Seismic velocities are presented in Table 3. A single velocity contrast interpretation (two layer case) readily fit all four seismic lines; however, a two velocity contrast interpretation (three layer case) can be fit to line 1 (cut 5) and line 3 (cut 1). Velocities from the two-layer case are consistent with materials observed in the cut face. The significance of the three layer contrast is that the third "layer" exhibits P-wave velocities consistent with materials that would require splitting to facilitate removal. There are other scenarios that could explain the data; the most consequential is rock hardness. The materials report (1956), referenced above, indicated that blasting would be required to excavate the cuts for that project (now existing). Without having the logs of test borings, anecdotal accounts, or construction diaries from the previous project, the higher velocities of a three-layer interpretation should not be ignored.

Table 3: Seismic Velocities

LINE #	NUMBER OF LAYERS	VELOCITY LAYER 1	THICKNESS LAYER 1	VELOCITY LAYER 2	VELOCITY LAYER 3
1	2, 3**	600 m/sec	0 to 1 m	1423 m/sec	2822 m/sec
2	2	671 m/sec	0 to 2.5 m	1228 m/sec	N/A
3	2, 3**	709 m/sec	0 to 1 m	1507 m/sec	2822 m/sec
4	2	694 m/sec	0 to 2 m	2723 m/sec	N/A

** 3rd layer revealed at distal end of a single line (forward or reverse) in a 2-way (cross-plot) seismic refraction survey. Velocities are apparent. Depth (thickness of layer 2) not presented due to lack of control (apparent depth to layer 3).

Pertaining literature and my professional experience allow generally to state that materials with a P-wave greater than 2400 m/sec (Caterpillar Tractor Co) are marginally rippable. The majority of the site materials encountered exhibit a P-wave velocity in the range of 1500 m/sec. Line 1, 3, and 4 encountered materials exhibiting P-wave greater than 2400 m/sec. A paper written by Allen D. Bailey with Nimbus Instruments concludes that highly fractured rocks confined by over-burden retain their former velocity characteristics and once exposed in excavation, they are ripped with less effort than that implied by their P-wave velocities.

Based on the presence of materials exhibiting P-wave velocities greater than 2400 m/sec, combined with the observed site geology and characteristics of materials encountered in borings during a previous phase of the project (1956), we recommend that a blasting specification be released with the project. We estimate that at least 90% of the material should be rippable by heavy construction equipment such as D9, D10, or D11 bulldozers fitted with rippers.

Large, hard, durable knobs of rock may be encountered during excavation. Blasting is not the only technique available for splitting such materials. Bulldozers and excavators equipped with hydraulic hammers, chemical expandants, and line drilling (as closely spaced as 0.3 m) are methods that can be used in-lieu of blasting. These methods are slow and equipment intensive. The technique used will be determined by engineering economics, so the project should be funded and scheduled appropriately. In addition, prospective contractors should be alerted to the site subsurface conditions.

Earthwork Factors

Earthwork factors can be estimated from P-wave velocities. Elgar Stephens of the California Department of Transportation developed an empirical relation between seismic velocities and earthwork factors (Calculating Earthwork Factors Using Seismic Velocities, FHWA-CA-TL-78-23, August 1978Z). Table 4 below presents Earthwork Factors.

Table 4: Earthwork Factors

P-wave VELOCITY	EARTHWORK FACTOR	
m/second	LOW	HIGH
600 -700	0.93	0.97
1200 - 1400	1.09	1.14
2680 - 2820	1.24	1.4

Discontinuity Analysis

Per our discussion, the discontinuity data have been plotted upon stereonet diagrams utilizing the ROCKWARE STEREO software. The data has been plotted as planes, poles to planes, and intersections of the planes (BETA plot). Plots were both individual field worksheets (one location on cut 5) and combined (all locations on cut 5). The data have also been statistically plotted using both a density plot, and a step-function contour plot. The plots did not include the plane defining the cut. The plots indicate that the discontinuities are randomly oriented in space.

Discontinuities were generally described above. Entering the chart of the Rock Mass Properties of Granite and Gneisses (Dearman et al, 1978; enclosure) with the field data collected from these slopes indicates slope design of 1:1 or flatter should be stable and should perform well. It should be noted that serrated benches will rapidly fail in this material and should not be used. The number of discontinuities, their spacing, and their random orientation indicate that this slope will ravel. Typical ravel will be comprised of .3 m clasts or smaller. A Ritchie Criteria catchment should be provided.

Conclusions and Recommendations

- The site is conducive to the proposed project. Approximately 10% of the materials will require splitting to facilitate ripping. A blasting specification should be included with the contract; although prospective contractors may have a more cost effective method of splitting and removing large rock knobs.

- Blasting operations should be limited to controlled blasting. Pre-splitting is the preferred method for the excavation of these slopes. The drill shafts should be closely spaced (typically 10 to 12 times the hole diameter) and parallel the final grade forming a final break line. These materials will be highly susceptible to over-breakage and back breakage. Production blasting should not be allowed on this project. A blasting consultant should plan blasting operations and prospective contractors should be limited to those experienced in excavating materials such as those found in the project.

- If the Logs of Test Borings for the previous phase of the referenced project (1956) are located, and if the RQD values are 50% or less and the core recovery was 50% or less, then the blasting specification can be removed from the contract.

- Grading factors for the site materials will vary from 0.93 to 1.4.

- Slopes cut at 1:1 or flatter should produce stable low maintenance slopes that will ravel.

- Ritchie Criteria should be used for this project. For the proposed slopes, the Ritchie criterion indicates that a 3.0 m wide and 1.5 m deep ditch is necessary. If the Ritchie ditch is not provided because it is considered a traffic hazard, then an additional catchment setback should be provided.

- A Caltrans geologist or geotechnical engineer should approve final slopes.

- If you have any questions or need my further assistance, please contact me at (619) 467-4062.

Reviewed By:

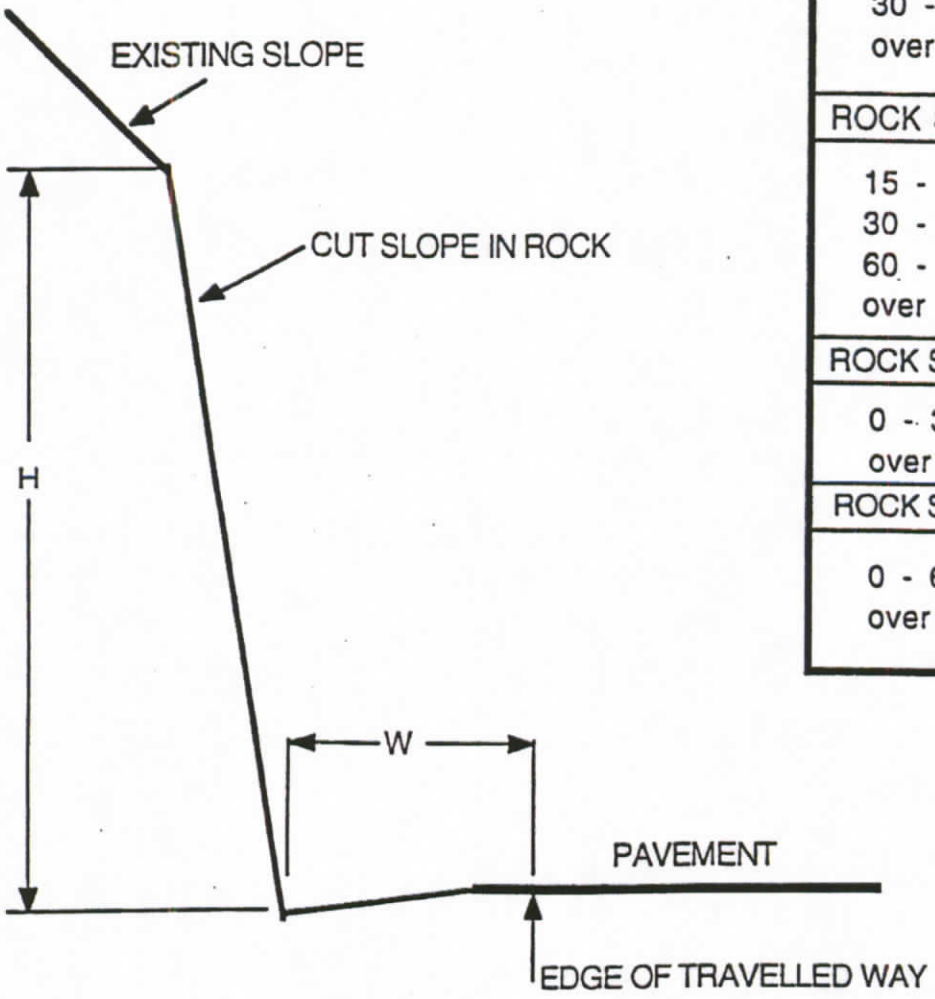
Jeff Kermode
Associate Engineering Geologist

Joseph P. Egan-11
Senior Engineering Geologist
Roadway Geotechnical South

SUGGESTED CRITERIA FOR DESIGN OF ROCKFALL CATCHMENT USING A BENCH AT GRADE

6/21/93

(AFTER RITCHIE, 1963)



ROCK SLOPE NEAR VERTICAL	
H (ft.)	W (ft.)
15 - 30	10
30 - 60	15
over 60	20
ROCK SLOPE 1/4:1 TO 1/2:1	
15 - 30	10
30 - 60	15
60 - 100	20
over 100	25
ROCK SLOPE 3/4:1	
0 - 30	10
over 30	15
ROCK SLOPE 1:1	
0 - 60	10
over 60	15

H = HEIGHT OF CUT IN ROCK. WHERE THE EXISTING GROUND ABOVE THE CUT IS APPROXIMATELY THE SAME SLOPE RATIO, THE HEIGHT SHALL INCLUDE ALL OR ANY PORTION OF THAT SLOPE WHICH CAN BE LOGICALLY CONSIDERED AS A POTENTIAL SOURCE OF ROCKFALL. IF THERE IS A BENCH ABOVE GRADE AND THAT BENCH CONFORMS TO THESE CRITERIA, "H" SHALL BE TAKEN AS THE HEIGHT FROM THE TOE OF SLOPE TO THE BENCH.

W = WIDTH OF CATCHMENT FROM THE EDGE OF THE LANE OR BARRIER TO THE BASE OF CUT. IT CAN INCLUDE PAVED OR UNPAVED SHOULDERS, IF ANY. THE CATCHMENT AREA SHOULD BE BACK-SLOPED AT 5 TO 7 DEGREES FOR DRAINAGE AND TO CONTROL ROLLING ROCK.

THESE CRITERIA WERE DESIGNED TO PREVENT ROCK FROM FREE-FALLING OR BOUNCING ONTO THE TRAVELED WAY. THEY SHOULD BE USED UNLESS AN ANALYSIS IS MADE OF ROCKFLALL AT THE SITE.

State of California

Business, Transportation and Housing Agency

MEMORANDUM

To: Mr. Chris Hoadley
Associate Engineering Geologist
Roadway Geotechnical South

Date: July 7, 1999

File: 08-SBD-15
KP 67.4/113.6
08-355500

From: **DEPARTMENT OF TRANSPORTATION**
Office of Materials and Foundations
Roadway Geotechnical Engineering - South

Subject: Seismic Refraction Study

Pursuant to your request, Caltrans RGES has conducted a Seismic Refraction (SR) study encompassing three locations along Interstate 15 north of the City of Victorville (Attachment 1). The study was conducted to estimate the rippability of native soils at proposed embankment cuts. The embankment cuts are necessary to accommodate the proposed widening of I-15.

Field Testing

Field testing was performed on May 19 and 20, 1999. Two seismic refraction lines were developed at each proposed cut location. The three test sites are summarized as follows:

Location 1: I-15 Centerline Station 70+00 to Station 71+40.
Highly weathered quartz monzonite monolith with pegmatite.
Seismic Refraction Line No. 5 and No. 6.
Displayed in Attachment 2.

Location 2: I-15 Centerline Station 111+85 to Station 112+80.
Folded limestone faulted against quartz monzonite and peridotite.
Seismic Refraction Line No. 3 and No. 4.
Displayed in Attachment 3.

Location 3: I-15 Centerline Station 164+70 to Station 166+40.
Tonalite with mineralization.
Seismic Refraction Line No. 1 and No. 2.
Displayed in Attachment 4.

The seismic refraction lines consisted of 12 geophones arrayed linearly along the ground surface and connected to an EG&G 1222 12 channel seismograph. Energy was imparted to the ground by successive blows from a 2.99-kg sledgehammer. Energy impact points were located at either end of the geophone lines to facilitate data collection in both forward and reverse directions. First break arrival times and subsequent wave trains were identified and

recorded by the seismograph. Signal stacking was often necessary to obtain interpretable records.

Efforts were made to array the geophones in a true linear alignment (horizontally and vertically) to minimize the effect and potential errors caused by irregular terrain. Data was gathered during gaps in the adjacent freeway traffic to diminish signal noise generated by passing trucks. Each line was run in forward and reverse directions to obtain true velocities and to facilitate resolution of, and depth to, subsurface interfaces.

Analysis

Typical of the three locations addressed in this study, colluvium and regolith overlay fractured and jointed parent rock displaying various degrees of weathering. For the SR study, the site soil profile was viewed and analyzed as a two-layer system. The MULLI4 Seismic Refraction Program was utilized for processing the collected data. The results of the analysis are summarized in tabular form in Attachment 5. The MULLI4 program output is included in Attachment 6.

As a general guideline, materials with primary wave velocities V_p greater than 2400 m/s are considered to be marginally rippable (Caterpillar Performance Handbook, Edition 26. 1995, Attachment 7). P-wave velocities were considered in combination with observed rock characteristics, such as weathering and jointing, to estimate rippability.

Rock that is deemed non-rippable will require splitting. Rock that is deemed marginal may require splitting of some portion of the material to be cut. Large, hard, durable knobs of rock may be encountered during the excavation. Rock splitting may be accomplished through the use of several techniques including blasting, hydraulic hammering, wedging with chemical expandants, and line drilling

Earthwork factors were estimated from P-wave velocities based on empirical relationships for various rock types (Elgar Stephens, California Department of Transportation, "Calculating Earthwork Factors Using Seismic Velocities", FHWA-CA-TL-78-23, August 1978Z). The relationship chart is included in Attachment 8.

Recommendations

- At Locations 2 and 3, it is estimated that 20 percent of the cut material will require splitting to facilitate ripping.

- At Location 1, all exposed granitic monoliths will require splitting to facilitate ripping. In proximity to the exposed rocks, it is estimated that 30 percent of the material will require splitting prior to ripping. As more detailed plans, profiles, and cross sections become available for Location 1, additional SR testing may be desired to more accurately define the subsurface conditions.

- Due to the presence of non-rippable material, blasting specifications should be included with the project. Production blasting may be utilized for excavation at Location 1 - away from cut slopes. Blasting operations should be limited to the use of controlled blasting in all cut slope locations. Pre-splitting is the preferred method for these slopes. The drilled shafts should be closely spaced (typically 10 to 12 times the hole diameter) and parallel to the final grade - forming the final break line. The site materials are susceptible to over-breakage and back

breakage. Prospective contractors should be limited to those experienced in excavating materials such as those found on the project.

- Catchments satisfying the Ritchie Criteria should be provided at the base of each cut slope. An increased catchment setback may be substituted where the appropriate Ritchie ditch would constitute a vehicular hazard.

- Existing cut slopes have performed well. Proposed cut slopes designed with the same slope profile as existing cut slopes should be stable.

Brief soil/rock descriptions and project Layout plans were provided to facilitate the SR study. No other design information, such as cross sections or profiles, was conveyed. Testing, analysis, and recommendations are based on the project information provided.

RGES staff will be available for further assistance. Should you have any questions, please contact me at (619) 467-3290 or CALNET 734-3290.

Brian Hinman
Associate Materials and Research Engineer

Attachments
BH:
cc: K. Jackura (RGES-South)
J. Egan
RGES.02
Project File

SEISMIC REFRACTION STUDY: 08-Sbd-15-67.6

Line #	Station & Offset		Trend	Line Length	Geophone Spacing	Apprx. Survey Depth	Layer 1				Layer 2		
	Forward Origin	Reverse Origin					Velocity	Approx. Thickness	Rippability	Earthwork Factor	Velocity	Rippability	Earthwork Factor
1	43 m lt. 165+70	29 m lt. 166+16	N53E	47.5 m	3.66 m	15.8 m	580 m/s	1.6 m	Rippable	0.98	2730 m/s	Marginal to Non-Rippable	1.35
2	39 m lt. 165+64	82 m lt. 165+51	N75W	43.6 m	3.35 m	14.5 m	418 m/s	1.4 m	Rippable	0.93	1786 m/s	Rippable	1.27
3	60 m rt. 112+18	43 m rt. 111+80	N63E	39.6 m	3.05 m	13.2 m	566 m/s	6.2 to 1.0 m NE to SW	Rippable	0.98	1883 m/s	Rippable	1.20
4	67 m rt. 112+21	107 m rt. 112+11	N45W	39.6 m	3.05 m	13.2 m	888 m/s	1.4 m	Rippable	1.08	2628 m/s	Marginal	1.20
5	136 m rt. 71+15	112 m rt. 70+81	N65E	39.6 m	3.05 m	13.2 m	560 m/s	1.2 m	Rippable	0.98	1458 m/s	Rippable to Non-Rippable	1.27
6	171 m rt. 71+11	153 m rt. 70+74	N40E	40.5 m	3.05 m	13.5 m	339 m/s	1.9 m	Rippable	0.90	2015 m/s	Rippable to Non-Rippable	1.34

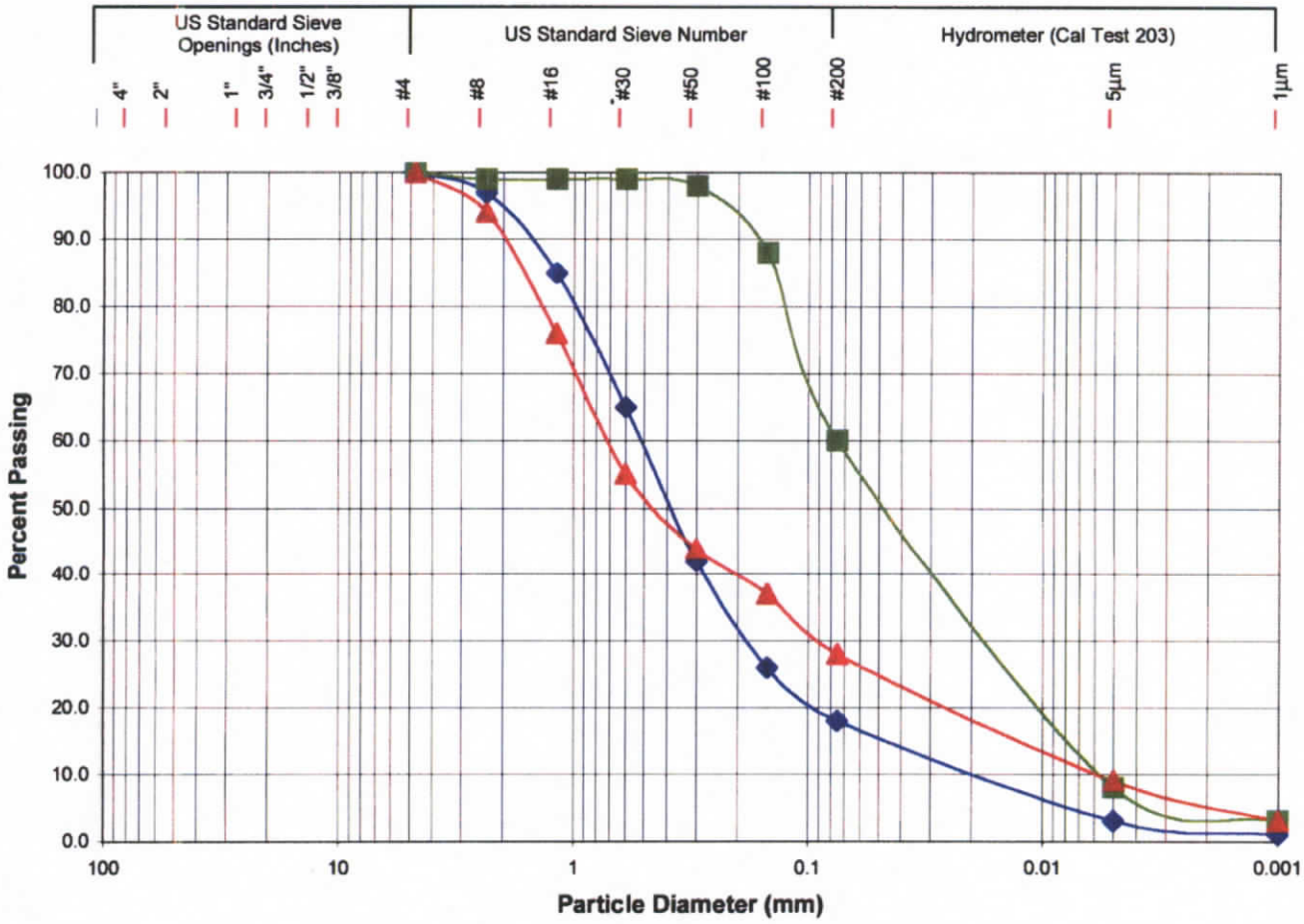
Stations and offsets are referenced to I-15 centerline.

ATTACHMENT 5

APPENDIX 13.5

GRADATION CURVES

Gradation Analysis Test Results

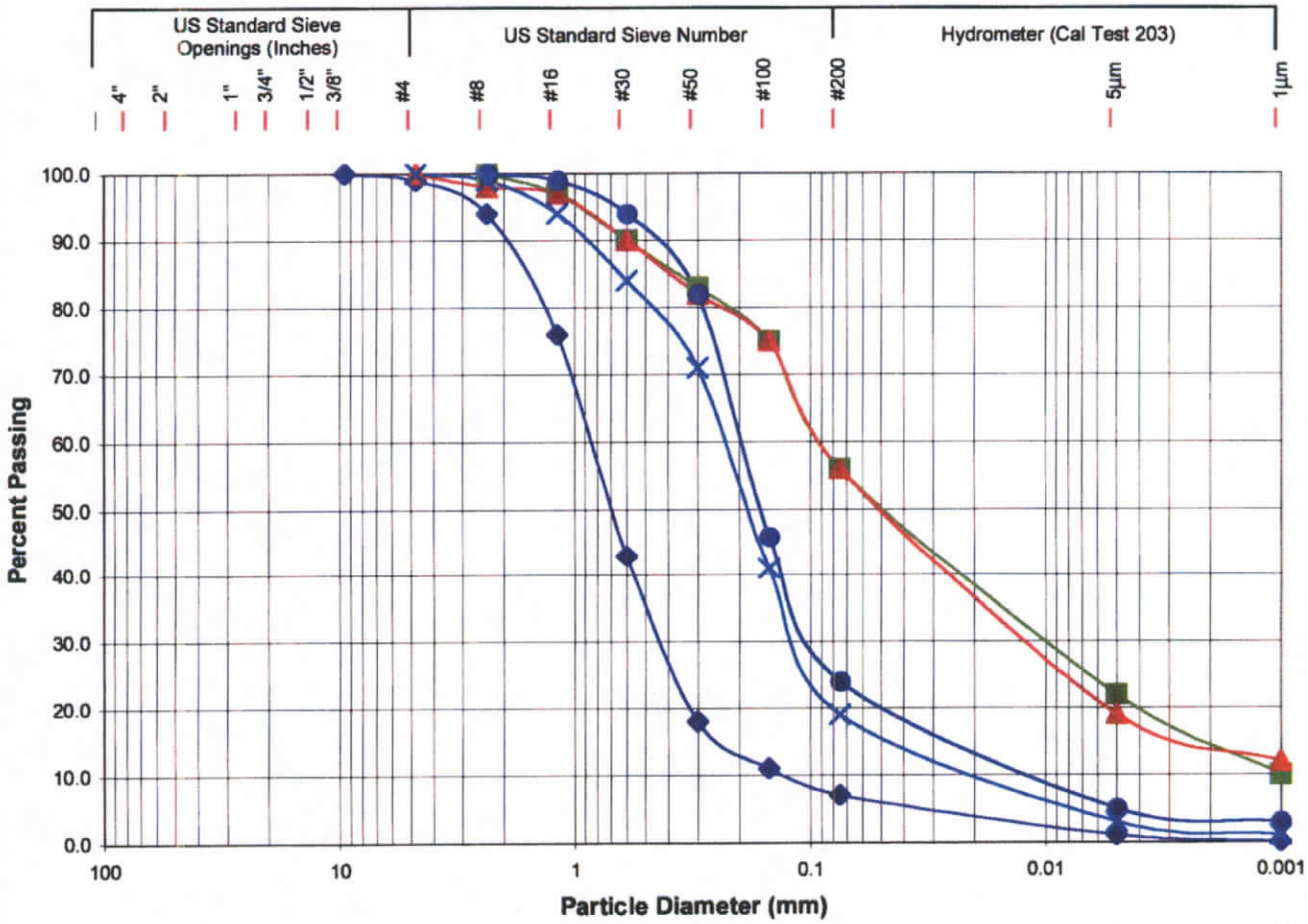


Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 26, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

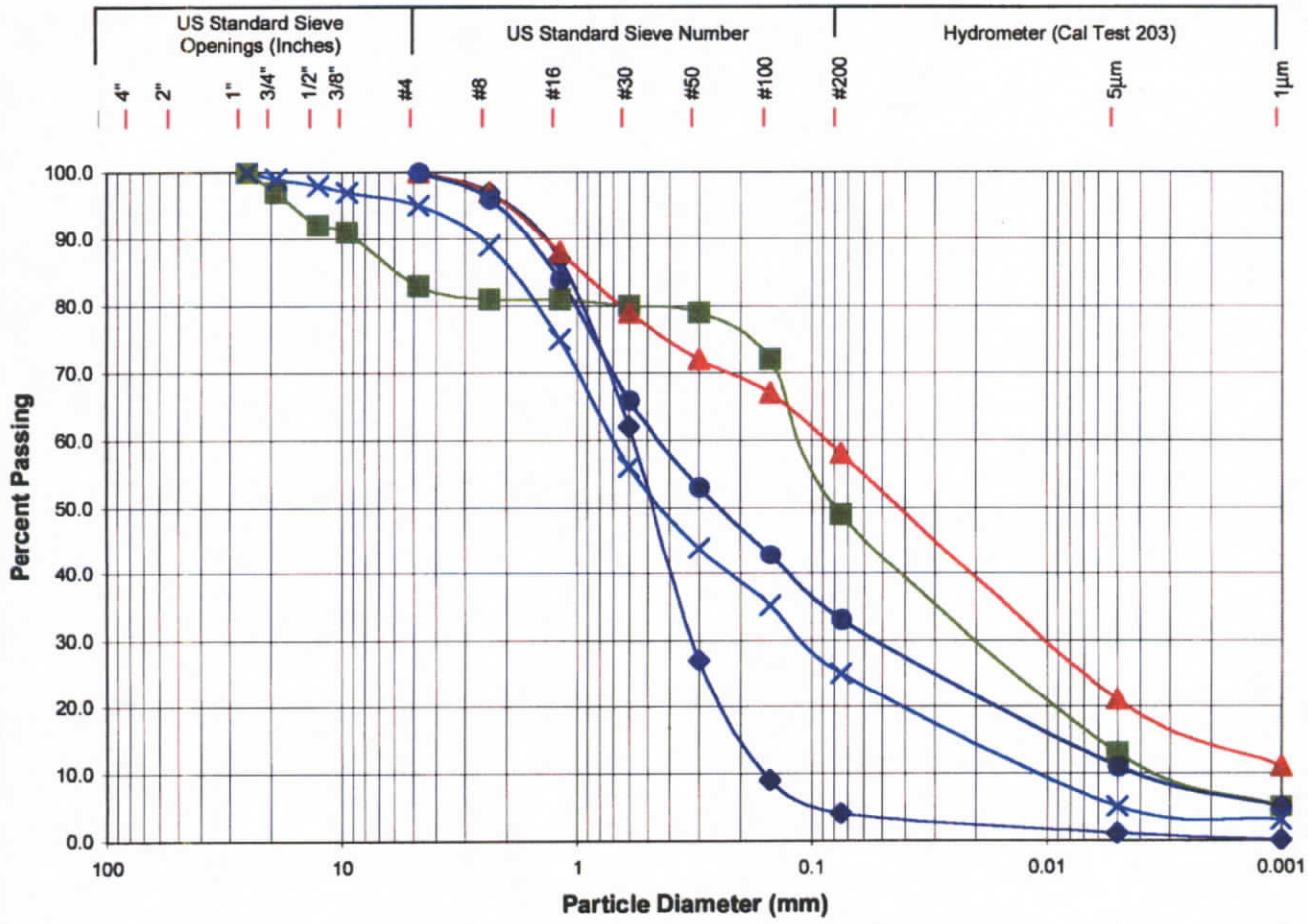
Sample ID: SW2,S1 — SW2,S2 — SW2,S3 — SW2,S4 — SW2.S5

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 26, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

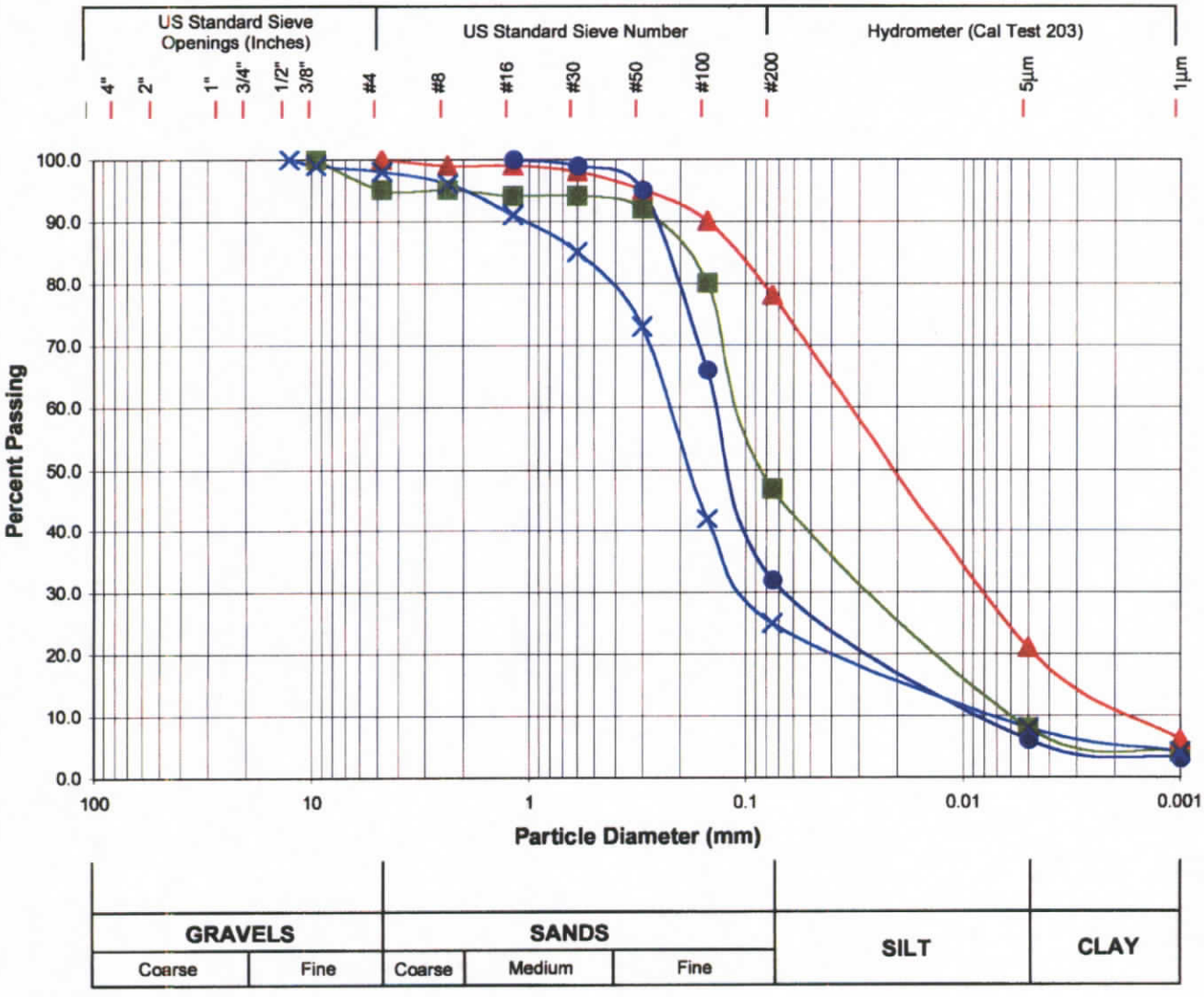
Sample ID: SW3,S1 — SW3,S2 — SW3,S3 — SW3,S4 — SW3c

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 26, 1999

Gradation Analysis Test Results



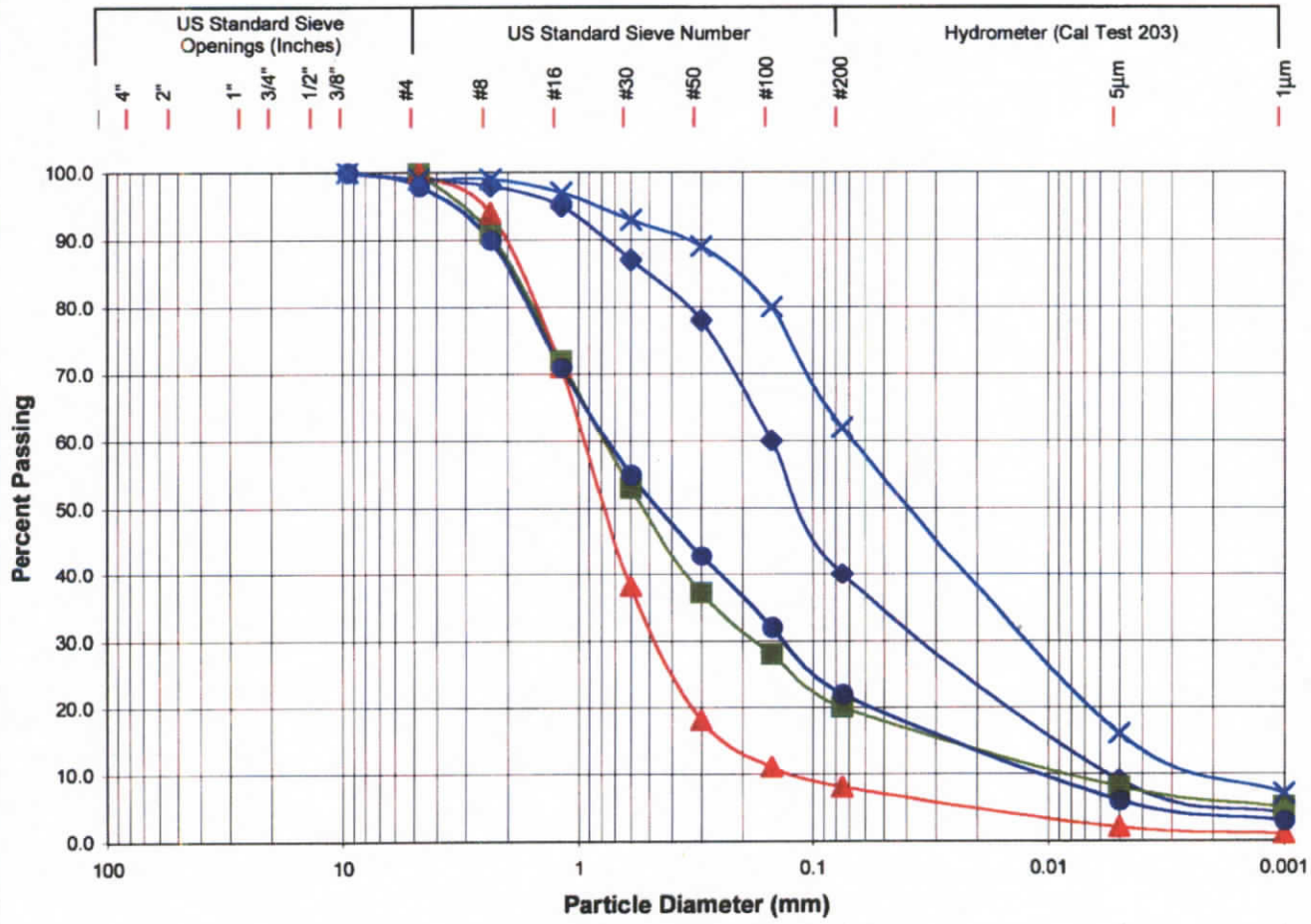
Sample ID:			
		SW4,S2	SW4,S4
	SW4,S5	SW4,S3	

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

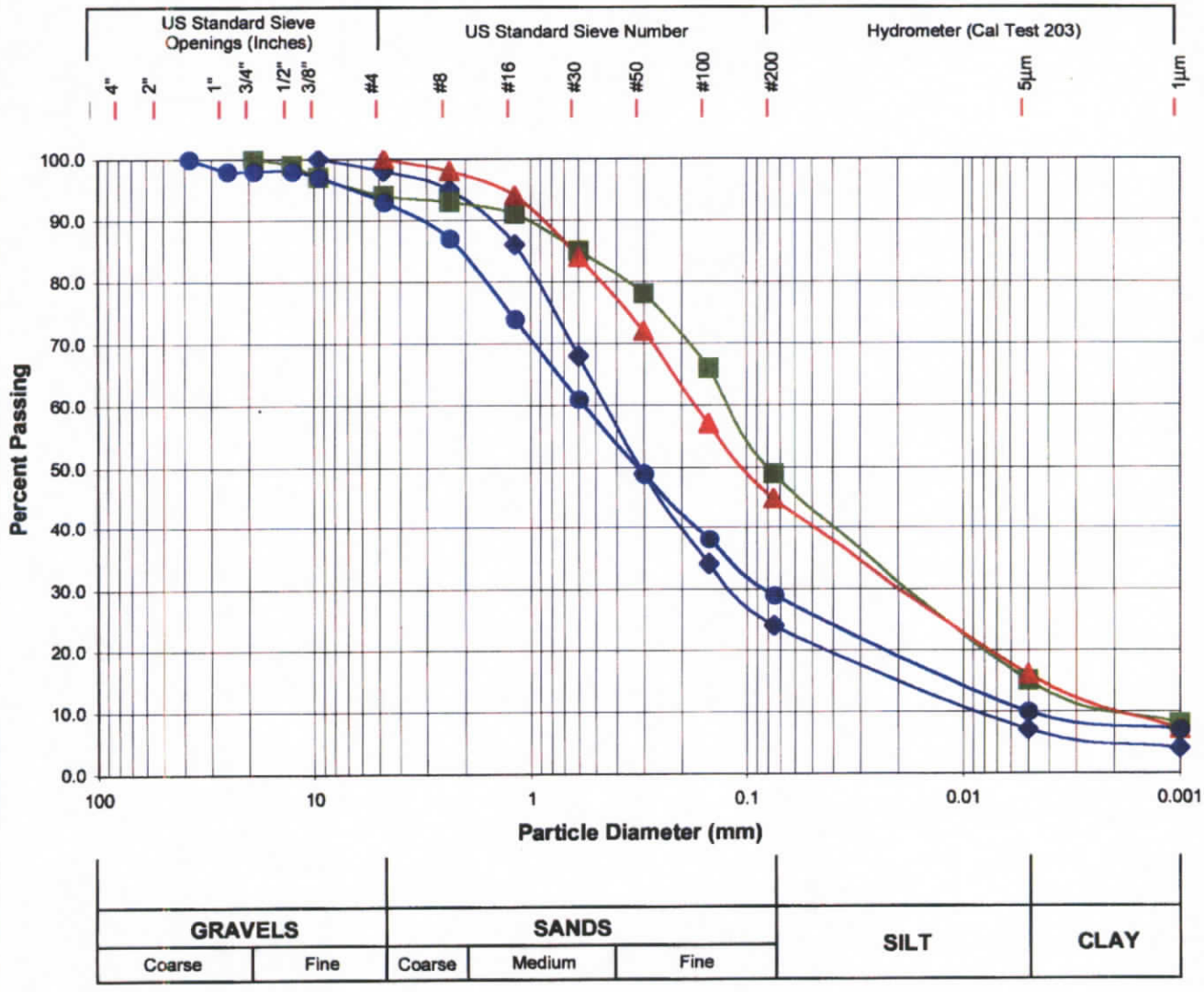
Sample ID: SW5,S1 — SW5,S2 — SW5,S3 — SW5,S4 — SW5,S5

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May 26,1999

Gradation Analysis Test Results



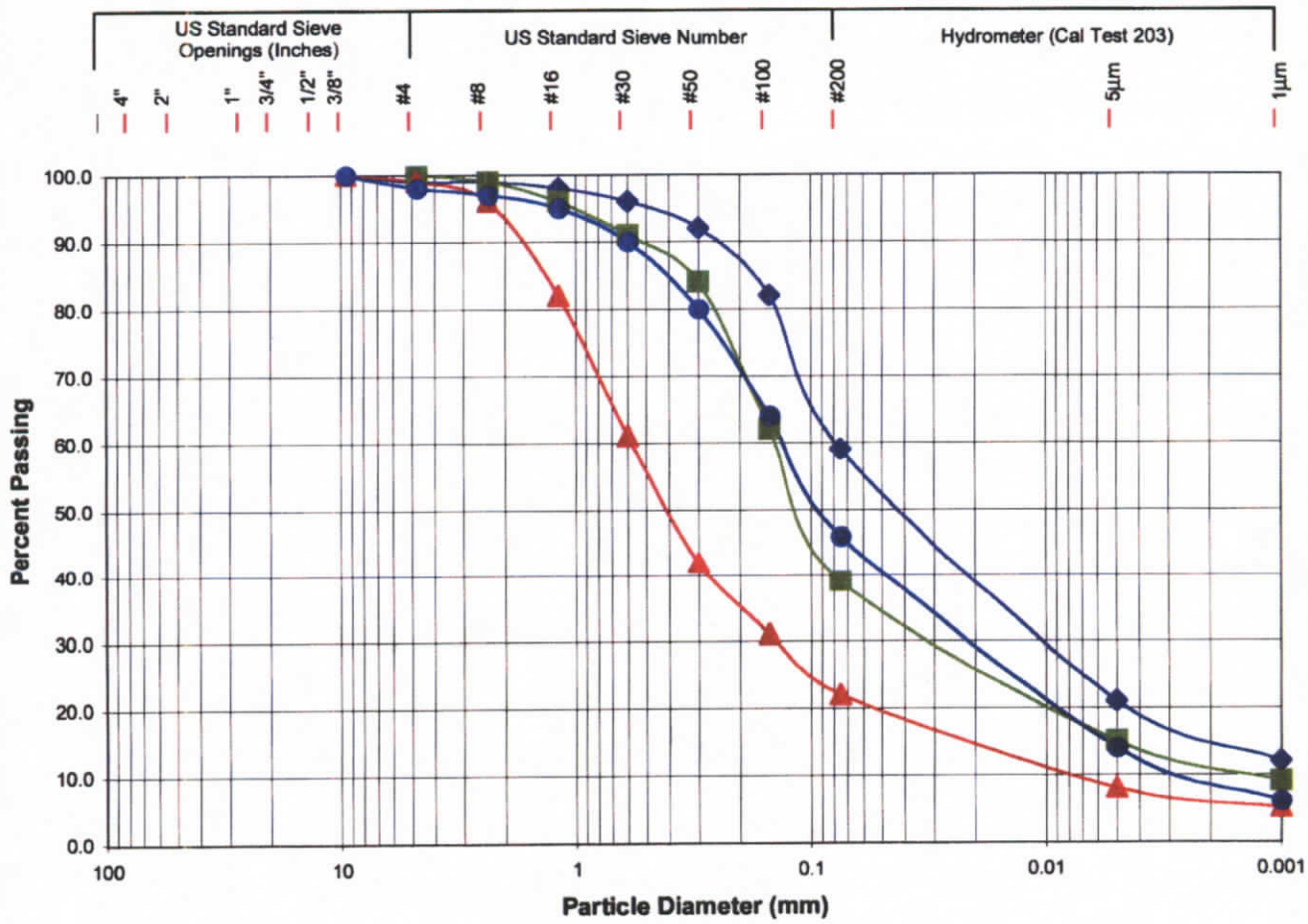
Sample ID: RW1A,5-7 — RW1A,S4 — RW1A,S5 — RW1A,15-17 — ×

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

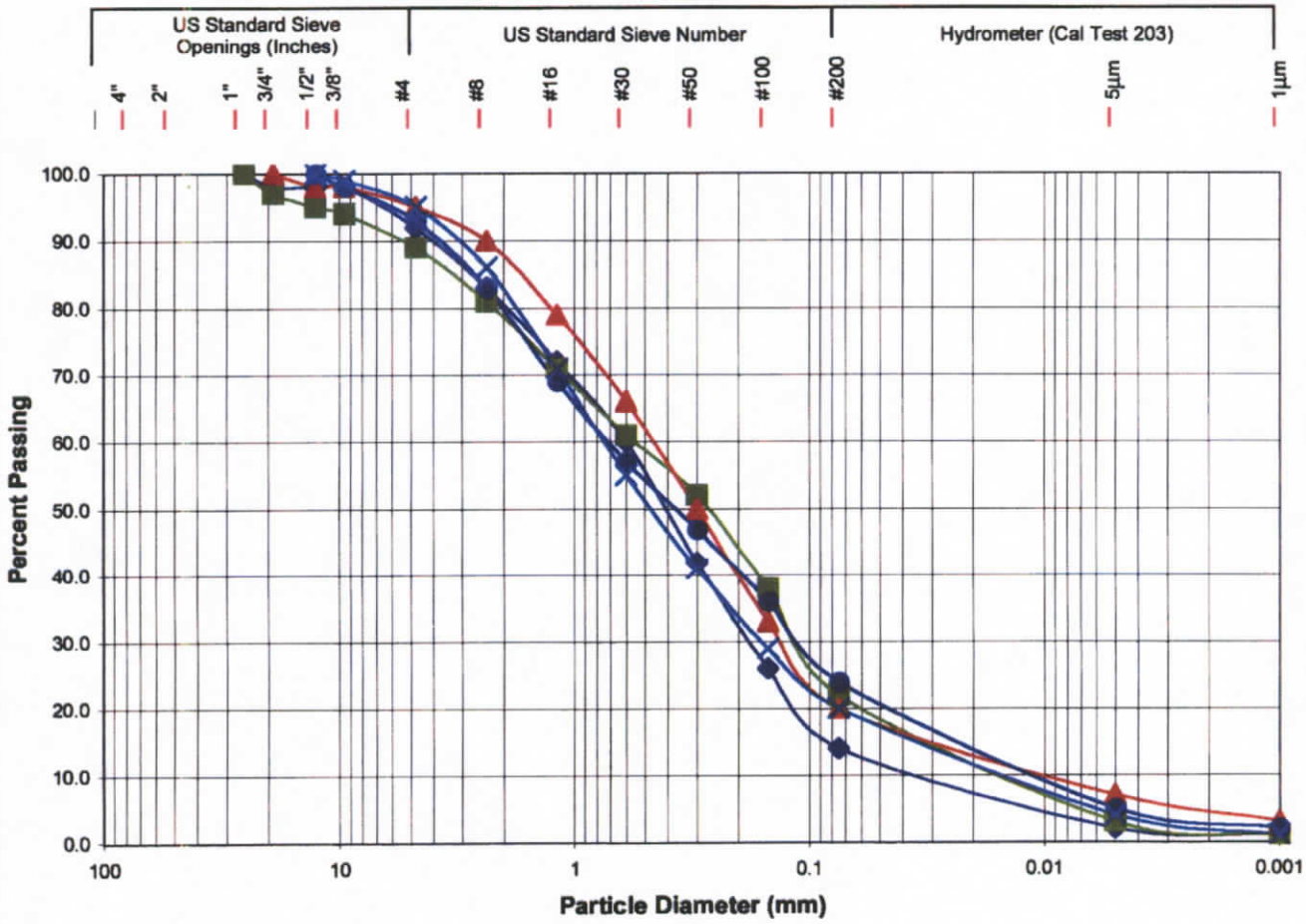
Sample ID: RW1-S5, RW2-S4, RW4,6-11', RW4-S5

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Nov. 18, 1999

Gradation Analysis Test Results

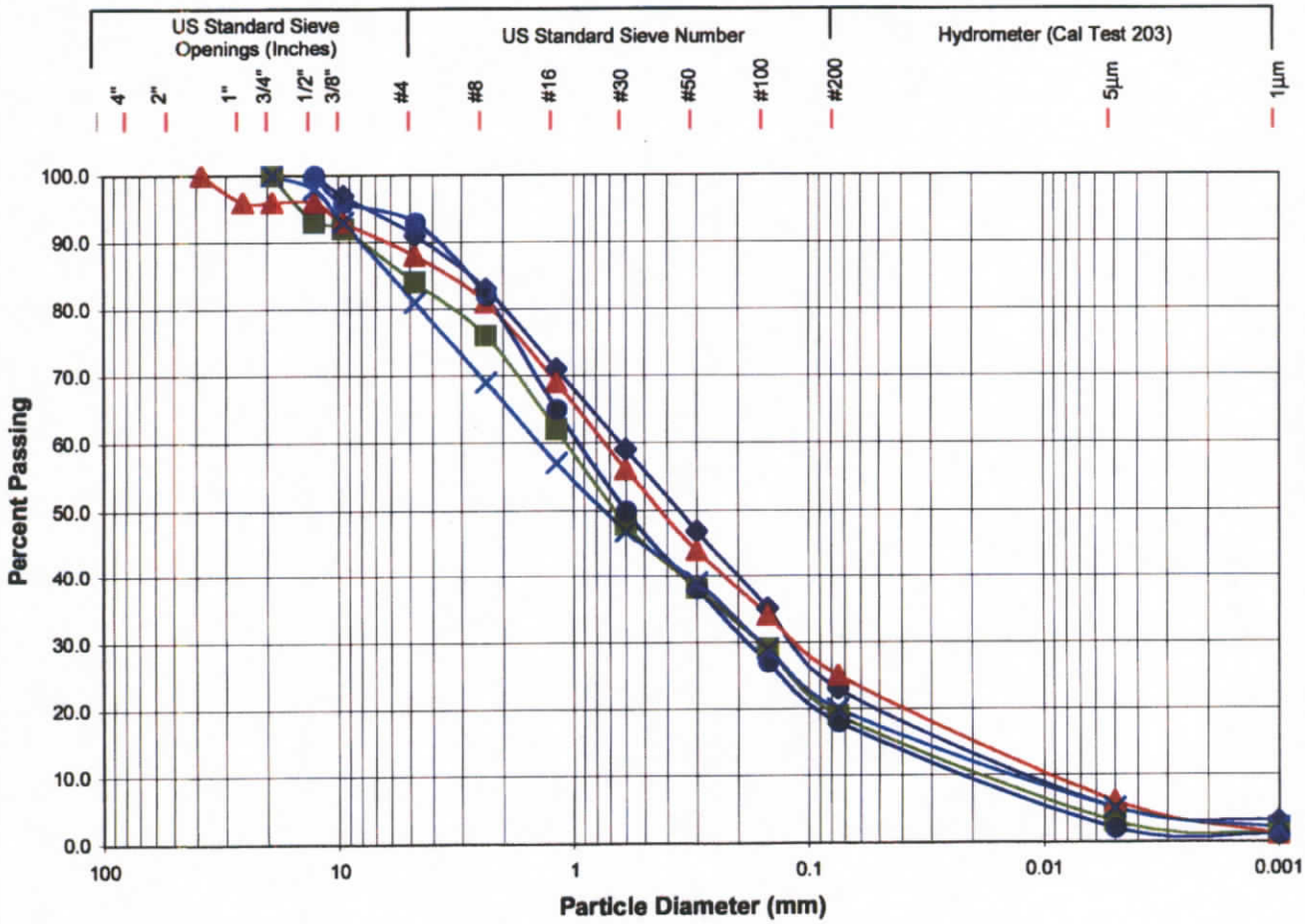


Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 25, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

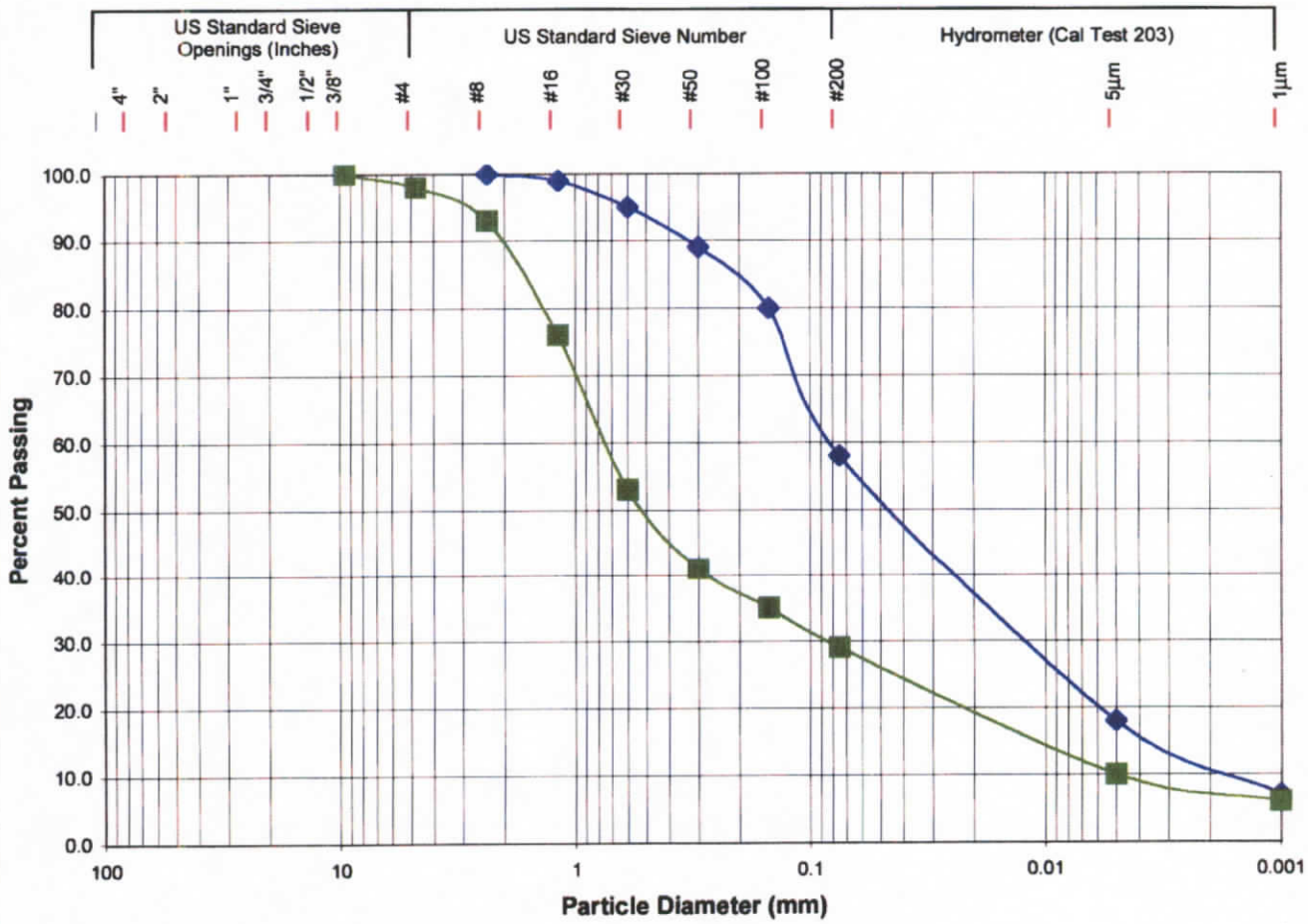
Sample ID: RW6,S1 — RW6,S2 — RW6,S3 — RW6,S5 — RW6,S6

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 27, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

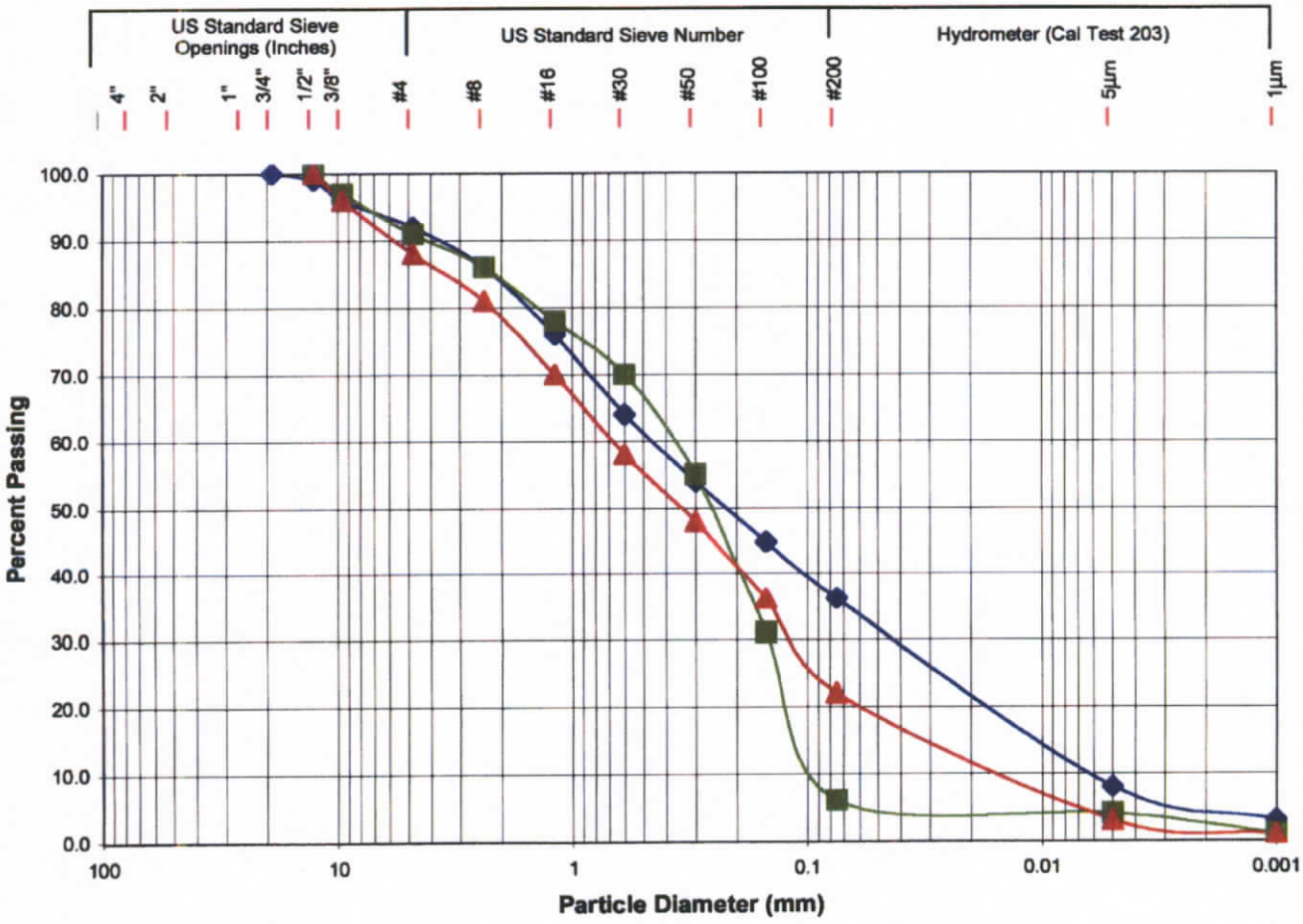
Sample ID: RW7A-S6 RW7B,12-15'c

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355520
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Nov. 17, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

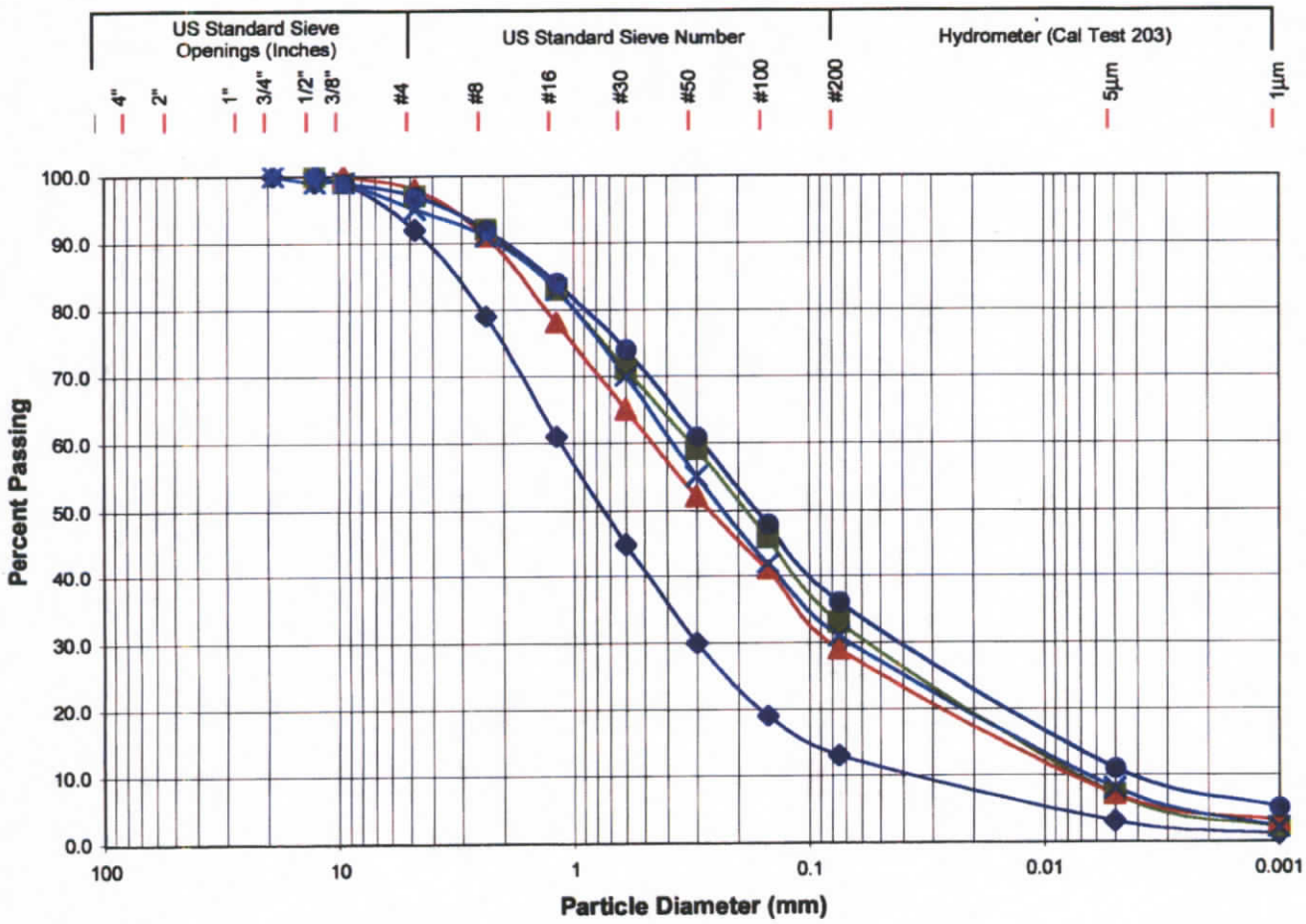
Sample ID: RW8,S1 RW8,S3 RW8,S4

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 27, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

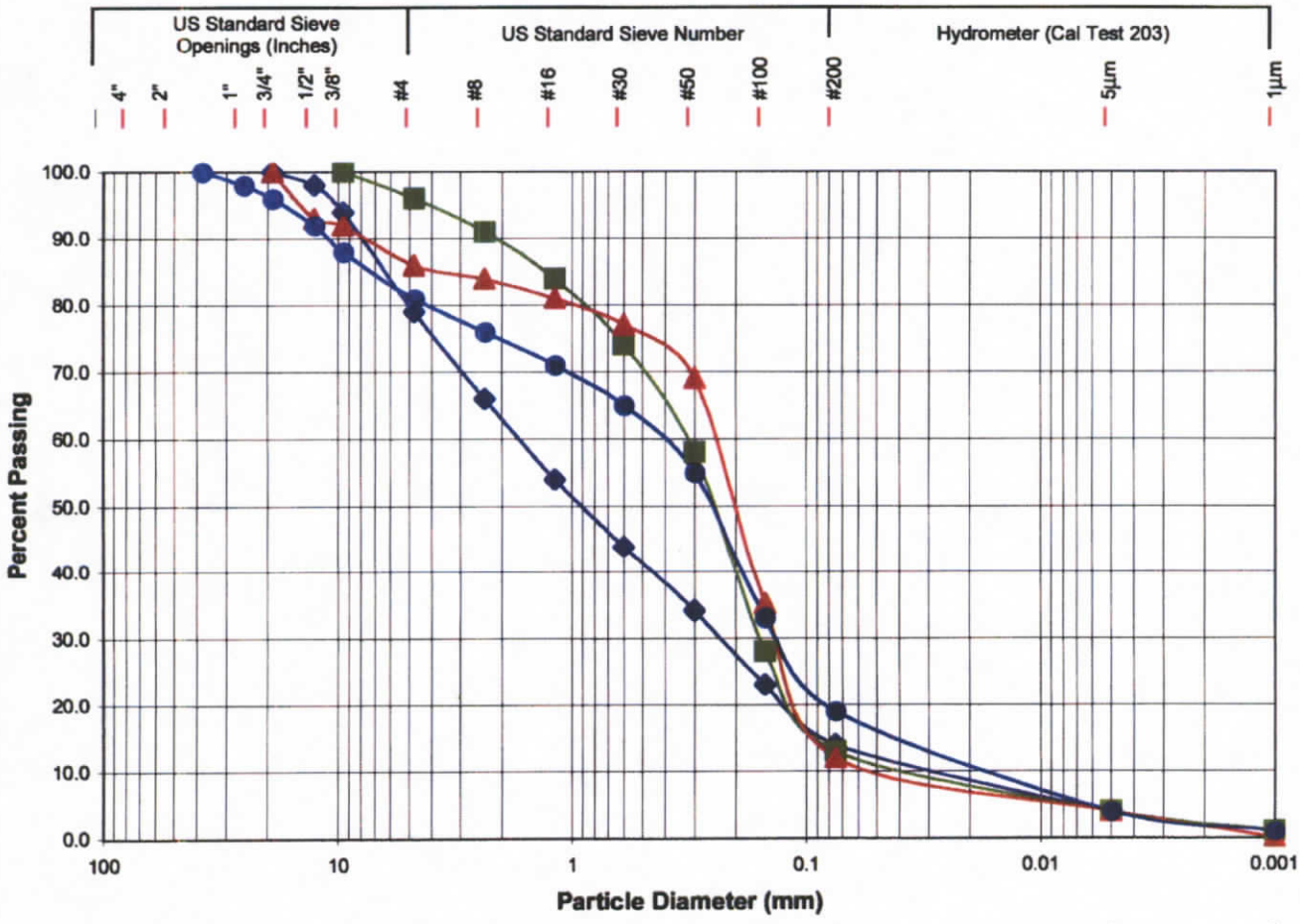
Sample ID: RW9,S1 — RW9,S3 — RW9,S4 — RW9,S5 — RW9,S6

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 25, 1999

Gradation Analysis Test Results

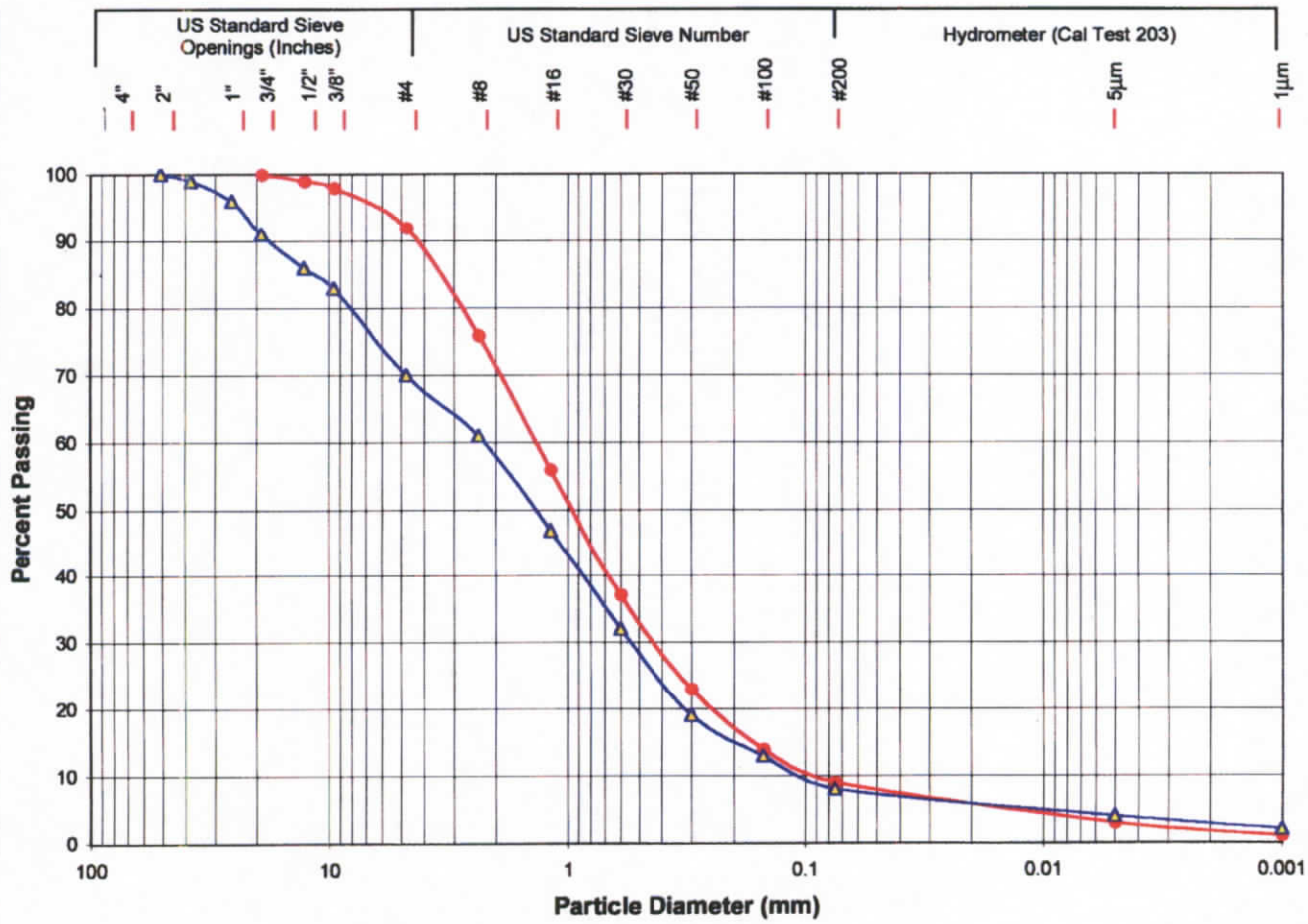


Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	May. 25, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

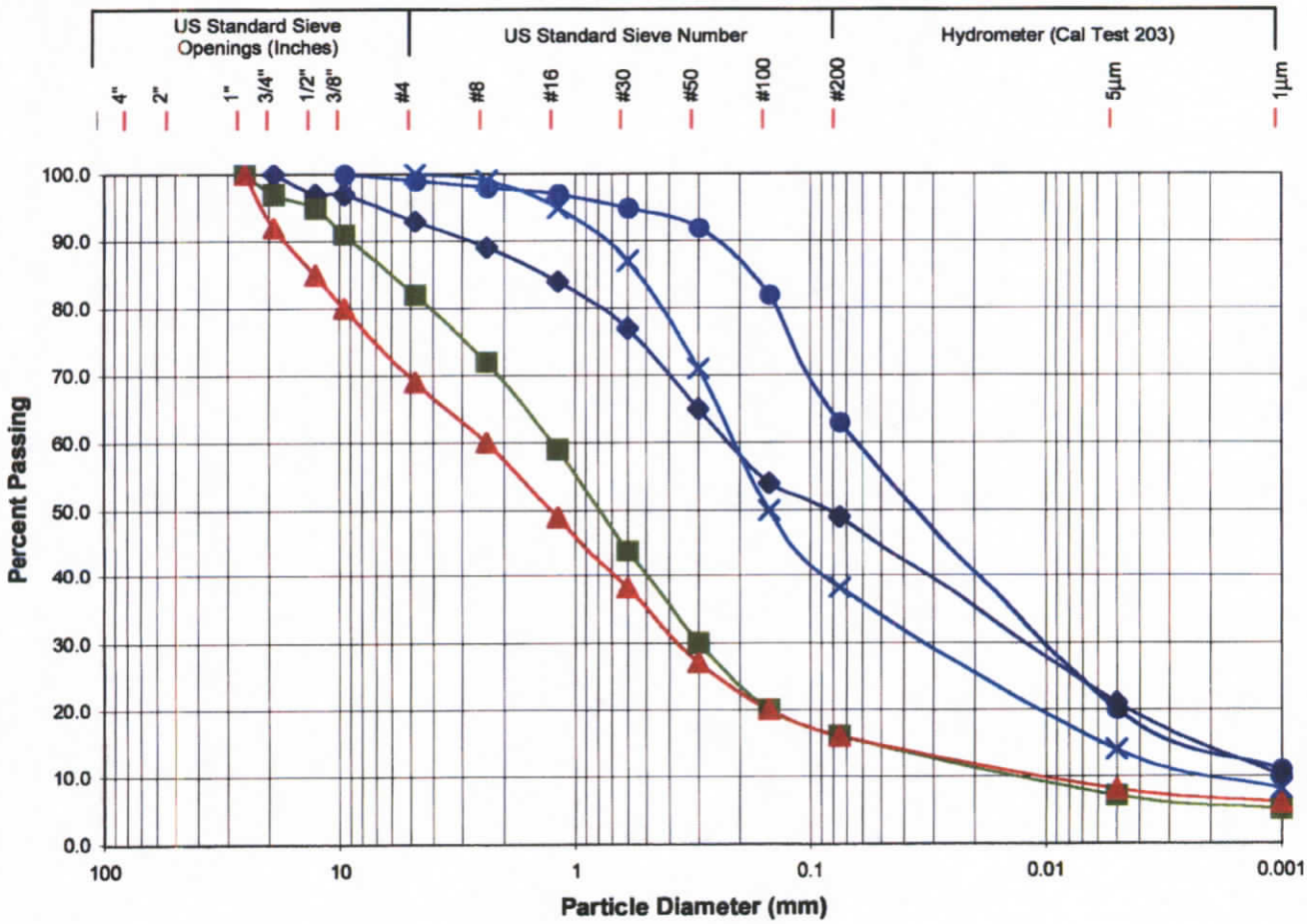
Sample ID: RW13c — RW15c

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 17, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

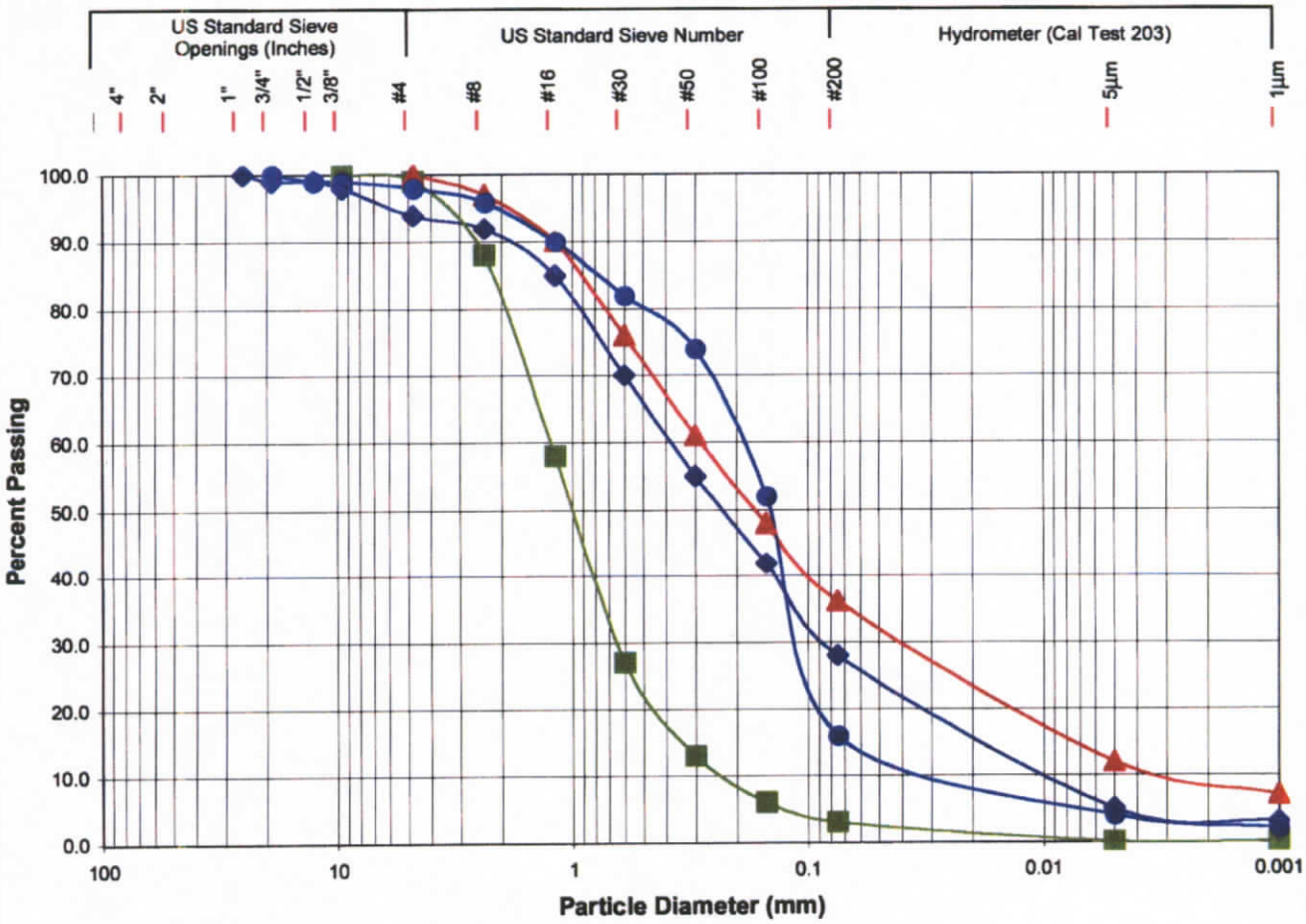
Sample ID: CS1,S1 — CS1,S3 — CS2,S3 — CS2,S4 — CS2,S5

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: TR1 TR2 TR3 TR6

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

APPENDIX 13.6

CORROSION TEST DATA

THE DIVISION OF MATERIALS AND FOUNDATIONS
TEST SUMMARY

REPORT BY: Angela Giordano
Corrosion Technology Section

MATERIAL SOURCE: 8 - Sol - 15 - 42/69
SAMPLE OF: Silty Sand & Gravel
EA : 08-355500

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	pH	MINIMUM RESISTIVITY (Ohm-Cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C435909	99-0651	Boring S3	Sta 38+50	8.3	3600	N/A	N/A	42
C435910	99-0635	Boring R5	N/A	7.7	5800	N/A	N/A	51
C435911	99-0636	Boring R6	N/A	8.5	4650	N/A	N/A	47
C435912	99-0637	Boring R10	N/A	8.3	4550	N/A	N/A	46
C537079	99-1185	RW 4	6' - 11'	8.4	3400	N/A	N/A	41
C537080	99-1186	RW 7B	12' - 15'	8.4	1800	N/A	N/A	32
C536551	99-1053	RW1A 15-17'	Sound Wall	9.2	3750	N/A	N/A	43
C536552	99-1054	RW1A 5-7'	Sound Wall	8.6	2800	N/A	N/A	38

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
TEST SUMMARY REPORT

REPORT BY: Corrosion Technology

MATERIAL SOURCE: 8 - SBd - 15 - 40.43
SAMPLE OF: Soil
EA : 08-355500

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	SAMPLE DEPTH	pH	MINIMUM RESISTIVITY (Ohm-Cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C4693286	99-1050	TR-6-99	Retaining Wall	N/A	8.0	2500	N/A	N/A	36
C4693287	99-1051	TR-3-99	Retaining Wall	N/A	8.5	660	870	210	21
C4693288	99-1052	TR-1-99	Retaining Wall	N/A	7.8	16000	N/A	N/A	78
C4693285	99-1049	TR-2-99	Retaining Wall	N/A	8.4	11000	N/A	N/A	67

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
TEST SUMMARY REPORT

REPORT BY: Corrosion Technology Section

MATERIAL SOURCE: 8 - SB - 15 - 41.9/70.3
SAMPLE OF: Silt, Sand & Gravel
EA : 08-355520

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	SAMPLE DEPTH	DISTRICT pH	DISTRICT MINIMUM RESISTIVITY (ohm-cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C100042	00-0043	B #RW7B	Sta 31 + 90	13' - 15'	7.7	950	430	70	24

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

DISTRICT 7 SOIL & AGGREGATE TESTS

Sample of: SILTY SAND + GRAVEL
Sampled from: 21-23'
Material Source: RW 15
Owner / Mfr.: CT
Date Sampled: 9/17/99

Materials Lab Stamp

ID	08	355520 CONTRACT NO	SAMPLE NO — 1733 LAB NO
DATE RECEIVED	1 7 1999	DATE	9/20
NUMBER OF CONTAINERS	1		By FAX ✓ MAIL PHONE OTHER
NORMAL	PRIORITY	DATE NEEDED	

By PSG for
G. ANYANWU
District Materials Engineer
(213)620-5692
Calnet 8-640-5692

R.E.: CHRIS HOADLEY
Address: 5900 FOLSOM BLVD SACRAMENTO CA MS#5 95819
Phone No.: 916-227273
Fax. No.: 916-227244

DISTRICT 7 MATERIALS LABORATORY
1616 S. Maple Street
Los Angeles, CA 90015
Phone (213) 620-5692 Fax (213) 620-5540

Laboratory Remarks:

GRADING ANALYSIS

Total Wt 1744 lbs By CN Date 9-23-99

Wt Ret	Size	Acc. Wt Ret	% Ret	% Pass	Comb % Pass	SPEC.
	3½					
	3					
	2½					
0	2	0	0		100	
150	1½	150	4		99	
514	1	664	9		96	
823	¾	1487	9		91	
886	½	2393	14		86	
666	⅜	3059	17		83	
2274	#4	5313	30		70	
12128		17441				

R-VALUE BATCH

% Run	Size	Wt
	1	
100	¾	1200
95	½	1140
91	⅜	1092
77	4	924

R= % CP = P/R P=

% CRUSHED PARTICLES

%Ret x (Wt Ct/Tot Wt) = Prod

SPEC. NL
Wtd. Avg % CP Ret No 4 =

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt 499

8	66	13	87	61
16	166	33	67	47
30	273	55	45	32
50	362	73	27	19
100	411	82	18	13
200	437	88	12	8

MECH. / HYDRO.		R	Corr.	CR	% Pass
1hr.	5M				
24hr.	1M				

SP. G. FINE (SSD)

(B) S S Dry
(A) Ov Dry
ABS. %
Wt S+C+H2O
Wt S+C
W = Wt H2O
Bulk = 500 / (500 - W) =

MOISTURE CONTENT

	A	B	C
Gr Wet			
Gr Dry			
H2O			
Tare			
Net Dry			
% H2O			

SAND EQUIVALENT

						MIN. SPEC.
Sand R2					Avg	
Clay R1						
S.E. Value						

SP. GR. COARSE

(B) S S Dry
(A) Ov Dry
ABS %
(C) Wt S in H2O
App = A / (A - C) =
SSD = B / (B - C) =
OD = A / (B - C) =

pH / RESISTIVITY

	Field	Lab
Soil pH		7.85
H2O		
Min Resistivity		1017

Based on 18 gauge CMP
Estimated life: 25 yrs

Chlorides	Sulfates

L.A.R.T.	Rev	Wt	Wt. Ret.	% Ret	% Loss	% SPEC.
A B	100	5000g				NM
C D	500	5000g				NM

Number of spheres = Weight of spheres =

DURABILITY INDEX

			SPEC.
Dura-Coarse	Sed Ht. =		NL
Dura-Fine	R2/R1 = /		NL

ORGANIC IMPURITIES

Sat Unsat

P.I.	P.I.	L.L.

Film Strip %	C.V. NL	C.V. Result	R-Value NL	R-Value Result

TESTS(s) REQUESTED

		✓
Fine Grade	202	✓
Coarse Grade	202	✓
Filler Material	202	
Mech. Analysis	203	
P.I.	203	
% Crushed Particles	205	
SpG. Coarse	206	
SpG. Fine (SSD)	207	
L.A.R.T.	211	
Unit Wt.	212	
Organic Impurities	213	
Soundness	214	
R.C.	215	
S.E.	217	
Moisture Content	226	
C.V.	227	
Durability Fine	229	
Durability Coarse	229	
Reactivity	289	
R-Value	301	
Film Strip	302	
Mortar Strength	515	
pH (RC)	532	
Resistivity (RC)	532	
Detrition Value	544	
pH (CMP)	643	✓
Resistivity (CMP)	643	✓
Expansion Index		

TI. 101 S I C NO

SAMPLE TYPE			✓
A.B.		BK FL.	
A.S.		RECL	
EMB.		MISC	
O.G.			
A.C. Agg.			

Instructions to Lab

CONTRACT NO

LAB NO 1733

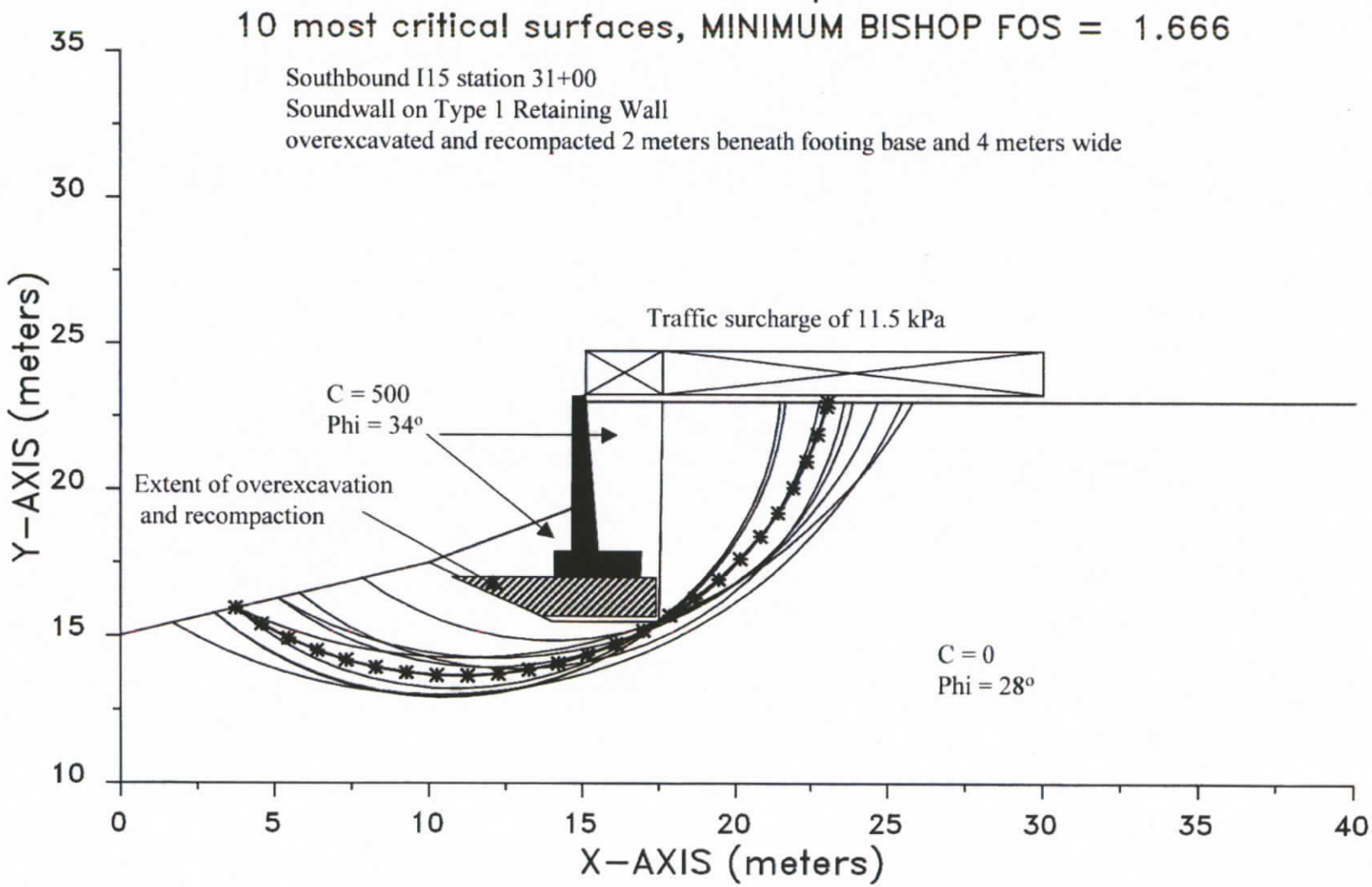
Sep-30-99 12:04pm From- T-442 P.02/03 F-504

APPENDIX 13.7

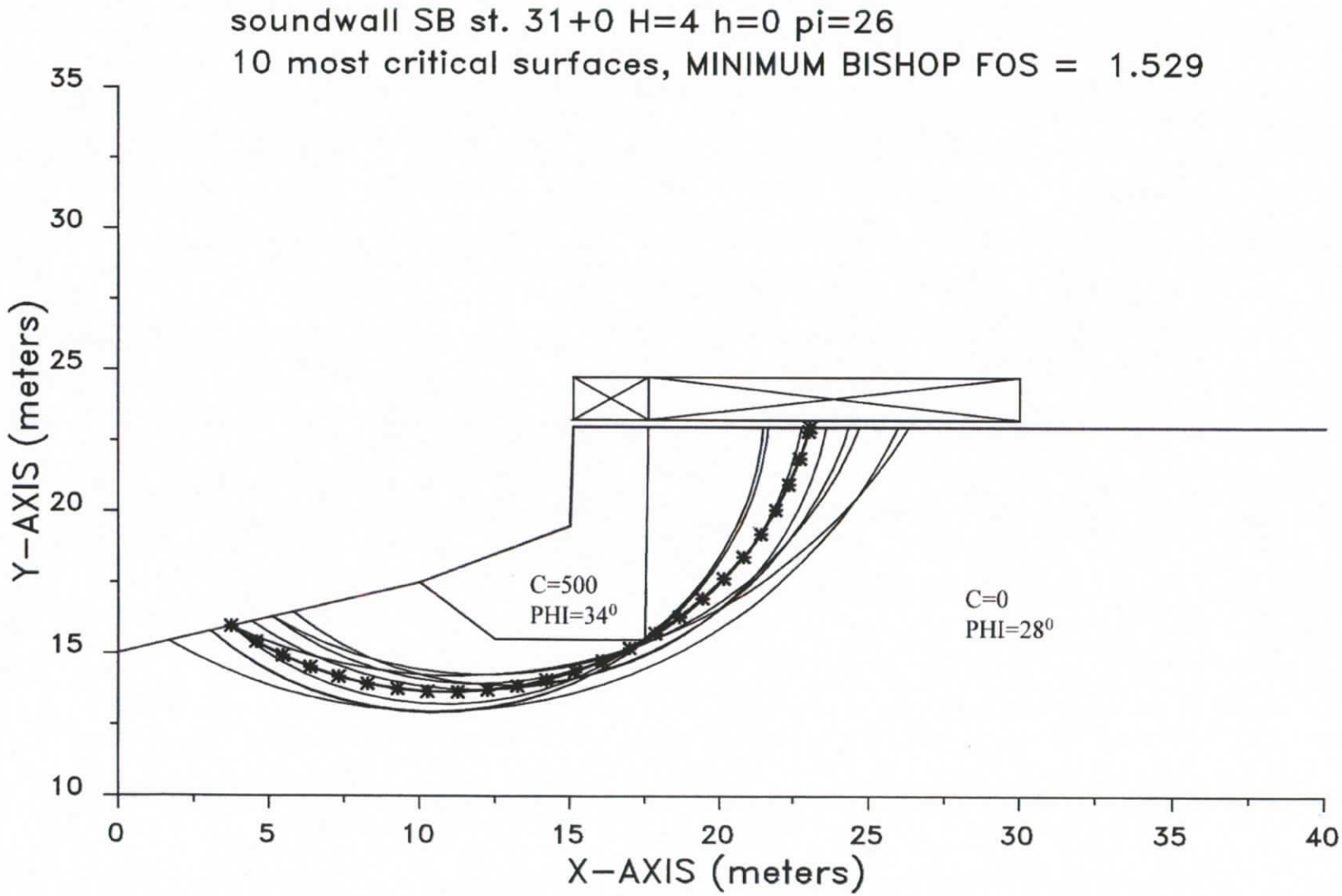
SLOPE STABILITY ANALYSIS

I15 1-11-** 9:38

Plot of XSTABL results, Wall #31, static conditions

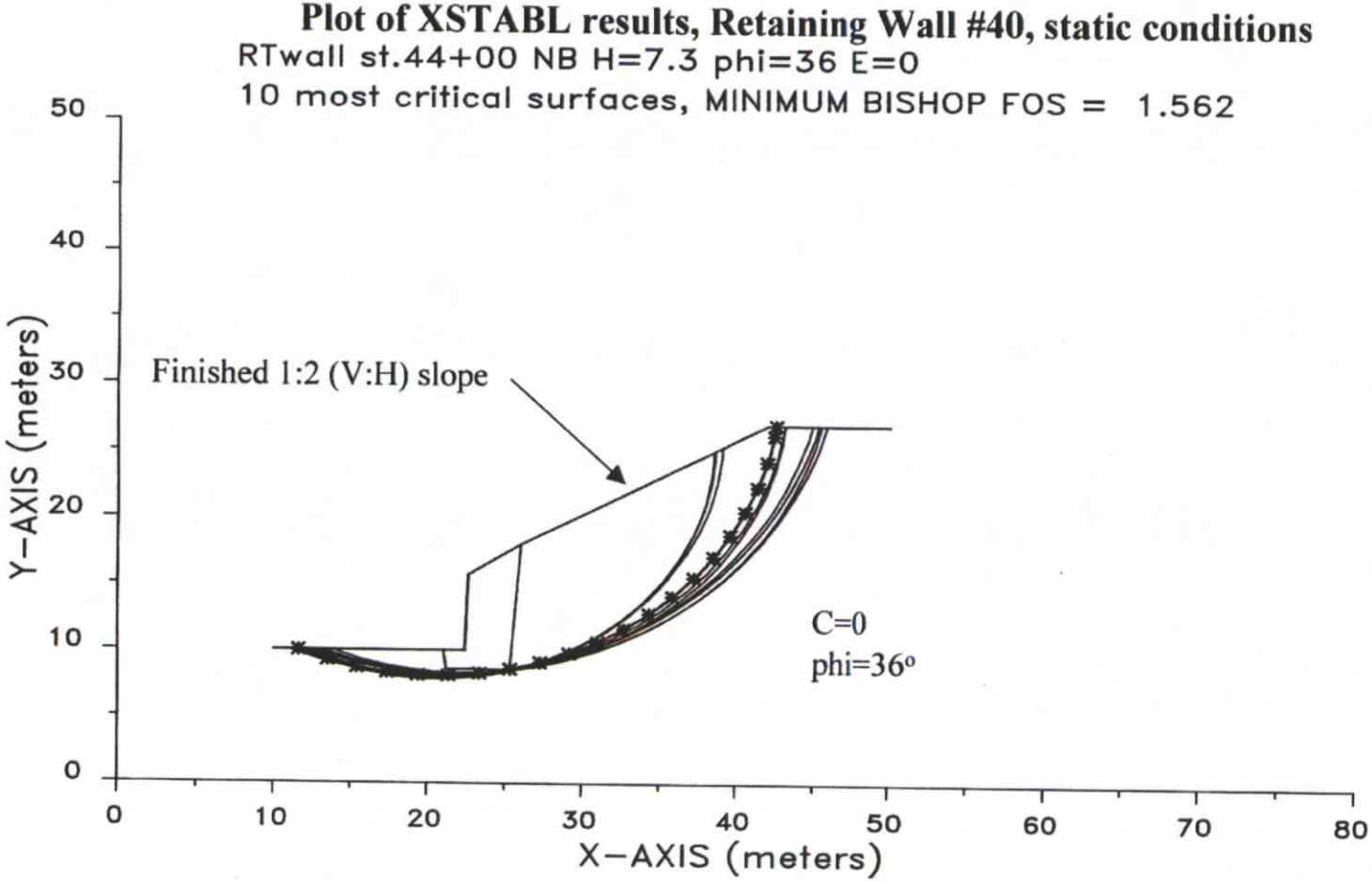


I155 1-05-** 12:52



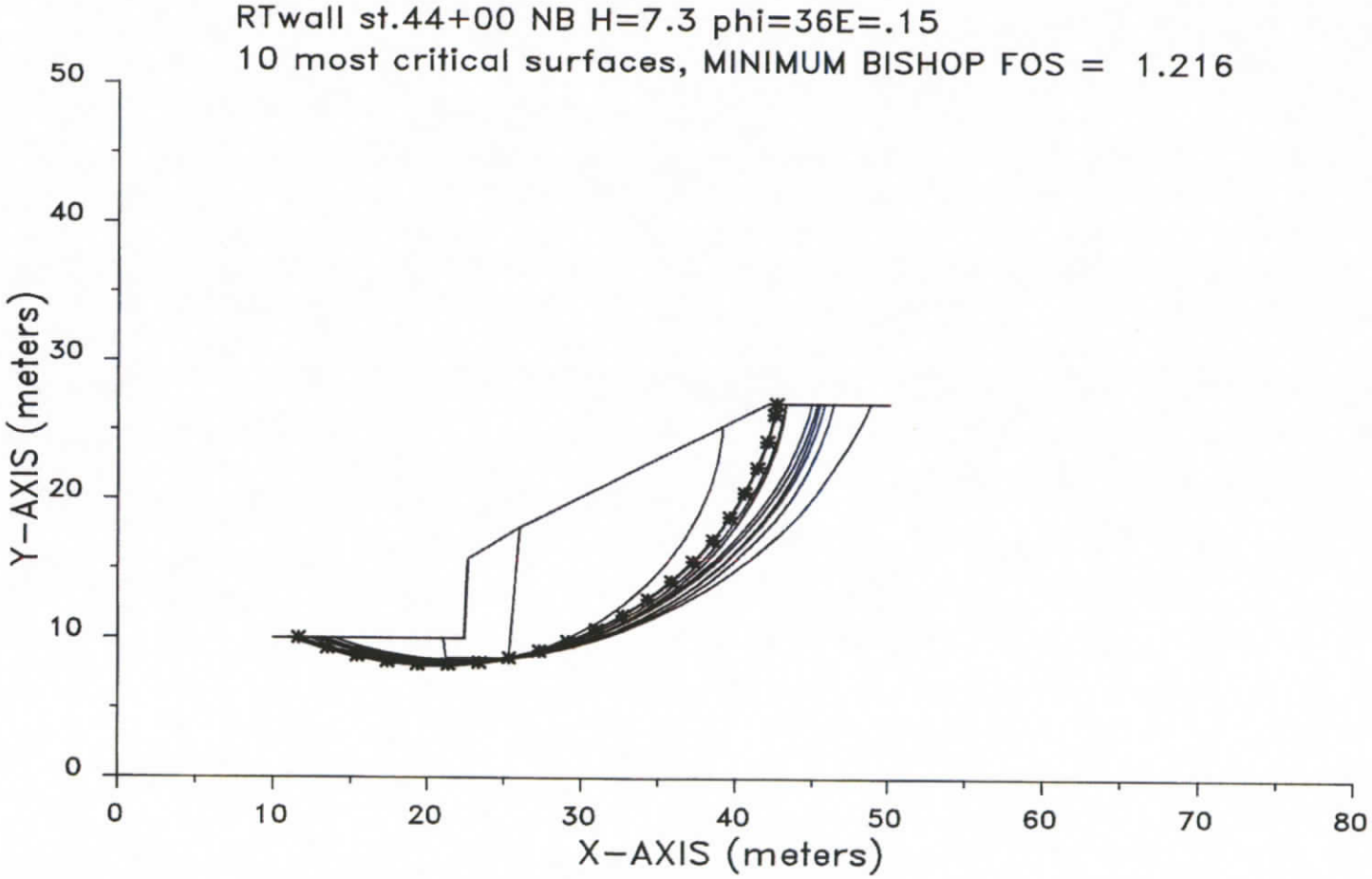
I154473 1-26-** 8:59

Plot of XSTABL results, Retaining Wall #40, static conditions



I154473E 1-26-** 9:01

Plot of XSTABL results, Retaining Wall #40, psudo-static conditions



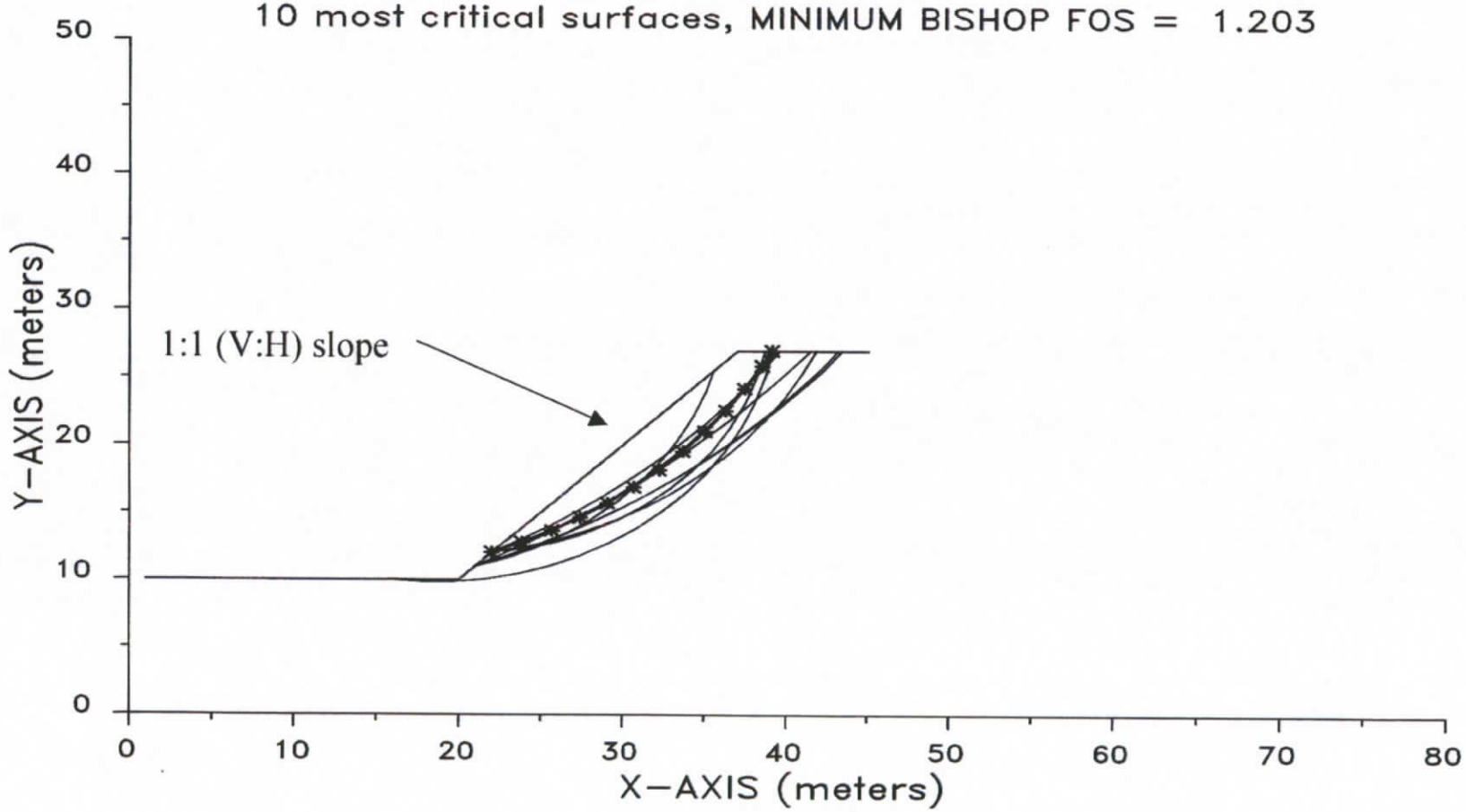
1544SLOP 1-26-** 10:00

Plot of XSTABL results, static conditions

Temporary construction back cut for Retaining Wall #40

1:1 cut st 44+0 phi=34 c=10 E=0

10 most critical surfaces, MINIMUM BISHOP FOS = 1.203



APPENDIX 13.8

REFERENCES

12.0 REFERENCES

California Department of Transportation, *bridge Standard Detail Sheets*, February, 1997.

California Department of Transportation, *Standard Specifications*, July, 1999.

Mualchin, L., East Southern California Seismic Hazard Map, Caltrans, 1995.

Mualchin, L., California Seismic Hazard Detail Index Map, Caltrans, 1995

Dibblee, T.W., Jr., *Areal Geology of the Western Mojave Desert, California*, 1967, U.S.G.S. Professional Paper 522.

California Department of Transportation, *California Seismic Hazard Detail Index Map*, 1996, Mualchin, L., 1996.

California Department of Transportation, *Highway Design Manual*, Sacramento, July 1, 1995.

California Division of Mines and Geology, *Geologic Hazards in Southwest San Bernardino County, California*, 1976, Special Report 113 and Maps.

California Division of Mines and Geology, *Geologic Map of the San Bernardino Quadrangle*, 1998, Map Number 3A.

California Division of Mines and Geology, *Geology of Southern California*, 1954, Bulletin 170, Vol. 2 and Maps.

California Division of Mines and Geology, *Mineral Land Classification of the Greater Los Angeles Area*, 1987, Special Report 143, Part VI.

California Division of Mines and Geology, *Preliminary Fault Activity Map of California*, 1992, OFR 92-03.

California Division of Mines and Geology, *Urban Geology, Master Plan for California*, 1973, Bulletin 198, Sacramento.

Hudnut, K.W., et. al., *Coseismic Displacement of the 1992 Landers Earthquake Sequence*, 1993, Bulletin of the Seismological Society of America.

United States Geological Survey, *Evaluating Earthquake Hazards in the Los Angeles Region-An Earth-Science Perspective*, 1985, Professional Paper 1360, ed., J. Ziony.

Padgett, D. C., and Rockwell, T. K., *Paleoseismology of the Lenwood Fault, San Bernardino County, California*, 1994, San Diego State University.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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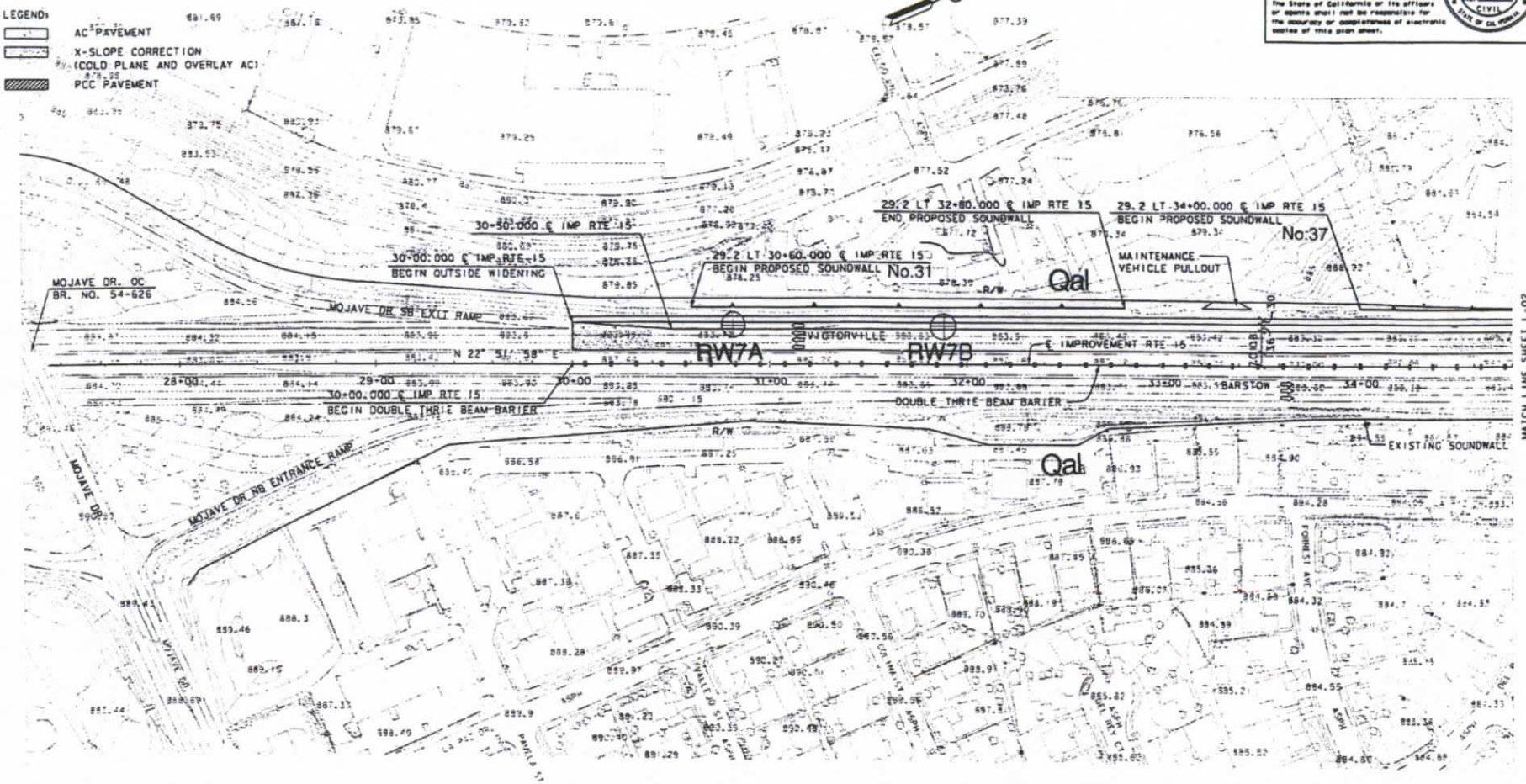
Caltrans Metric

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT



LAYOUT

SCALE : 1 : 1000

L - 01

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

CHECKED BY

PROJECT ENGINEER

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Caltrans

LAST REVISION 08-28-98

DATE PLOTTED => 16 OCT 1999
TIME PLOTTED => 13:34:24

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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CU 08222

EA 355510

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

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NOTE :

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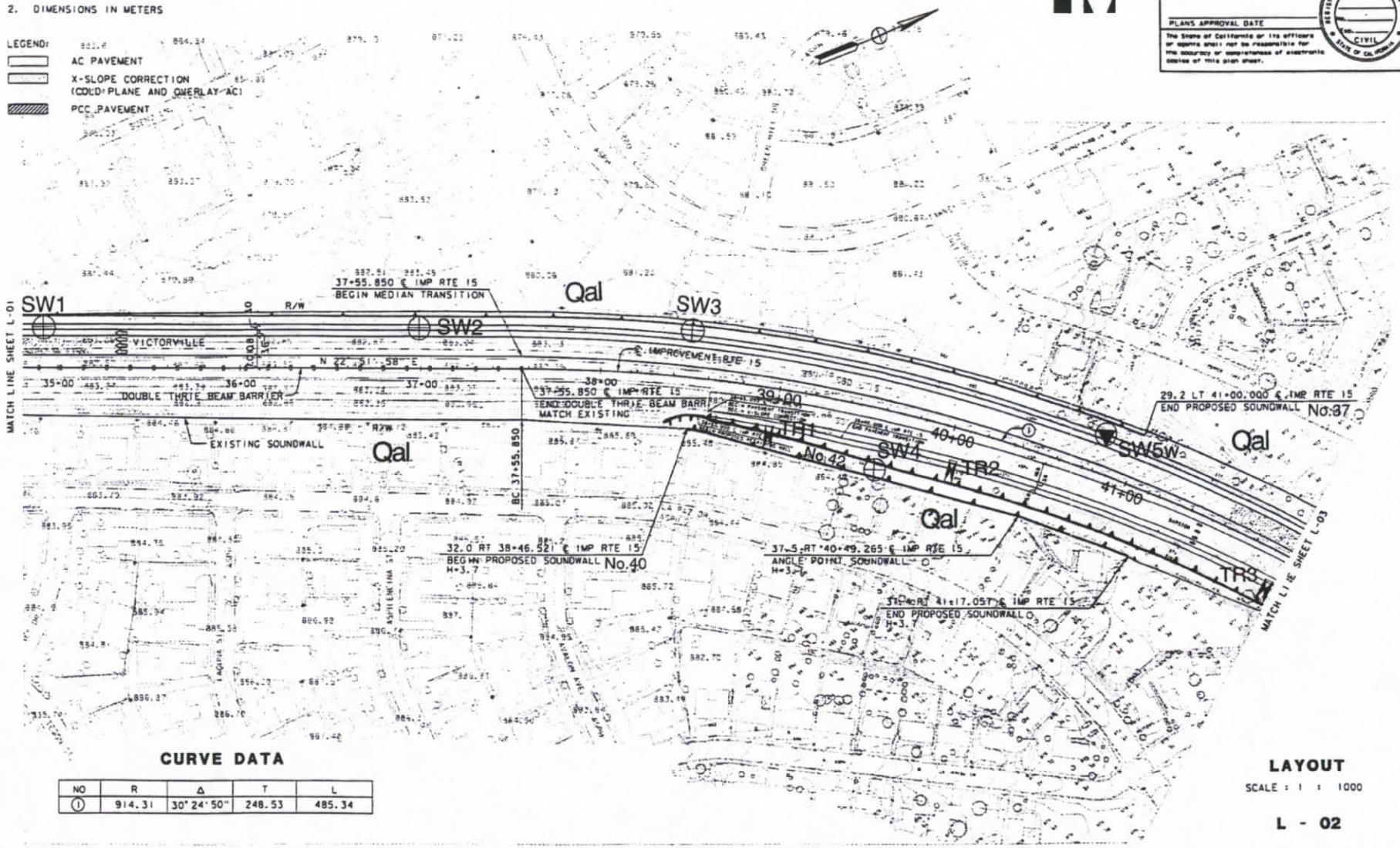
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT



CURVE DATA

NO	R	Δ	T	L
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LAYOUT

SCALE : 1 : 1000

L - 02

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE

REVISED BY

DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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CU 08222

EA 355510

LAST REVISION 08-28-98

DATE PLOTTED => 16 OCT 1999
TIME PLOTTED => 12:31:10

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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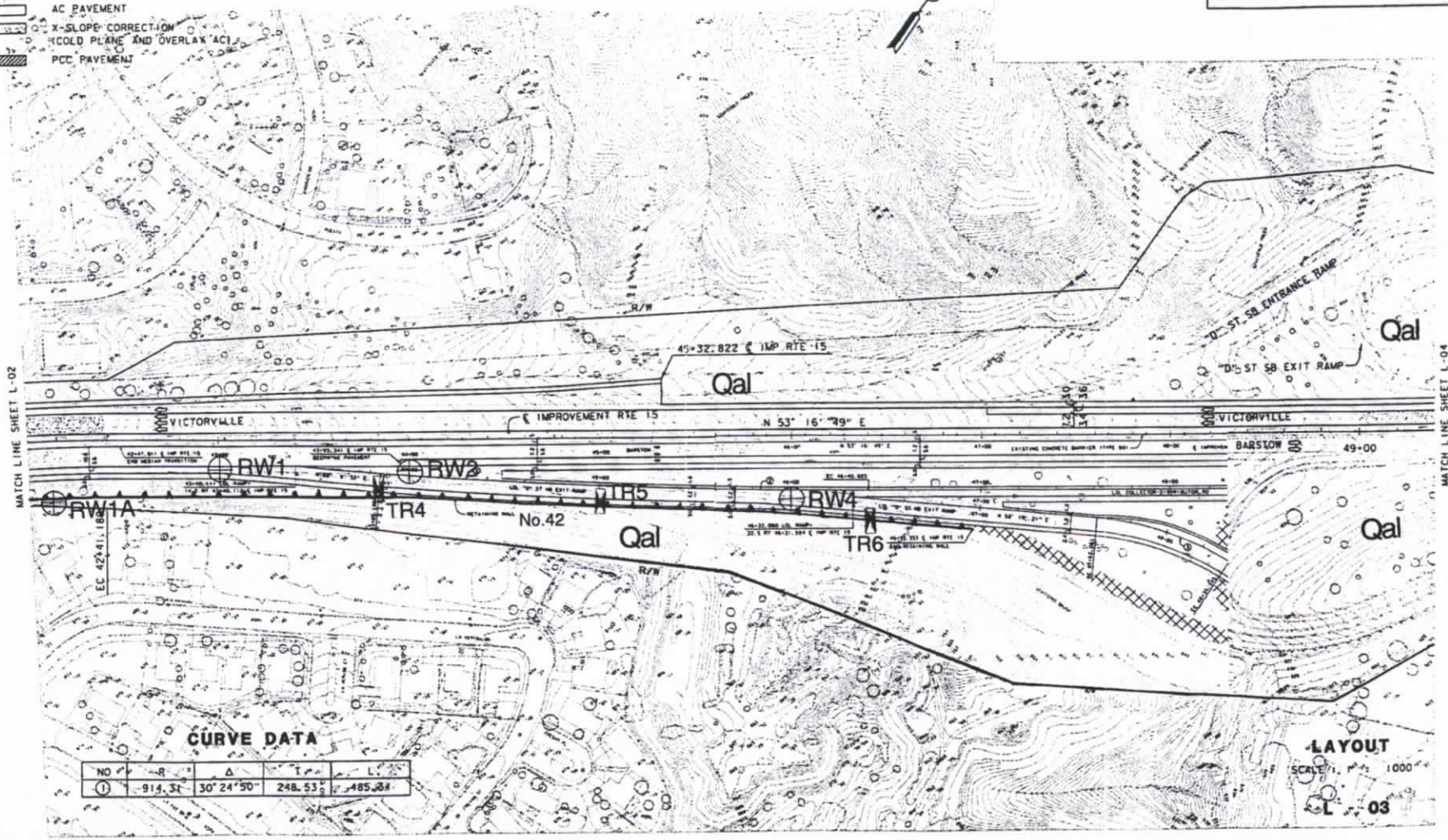
NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY ACI)
- PCC PAVEMENT



CURVE DATA

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LAYOUT

SCALE 1 : 1000

L - 03

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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CU 08222

EA 355510

DATE PLOTTED => 16 OCT 1999
TIME PLOTTED => 13:24:16

08-28-98

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBd	15	67.4/113.6		

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PLANS APPROVAL DATE

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NOTE :

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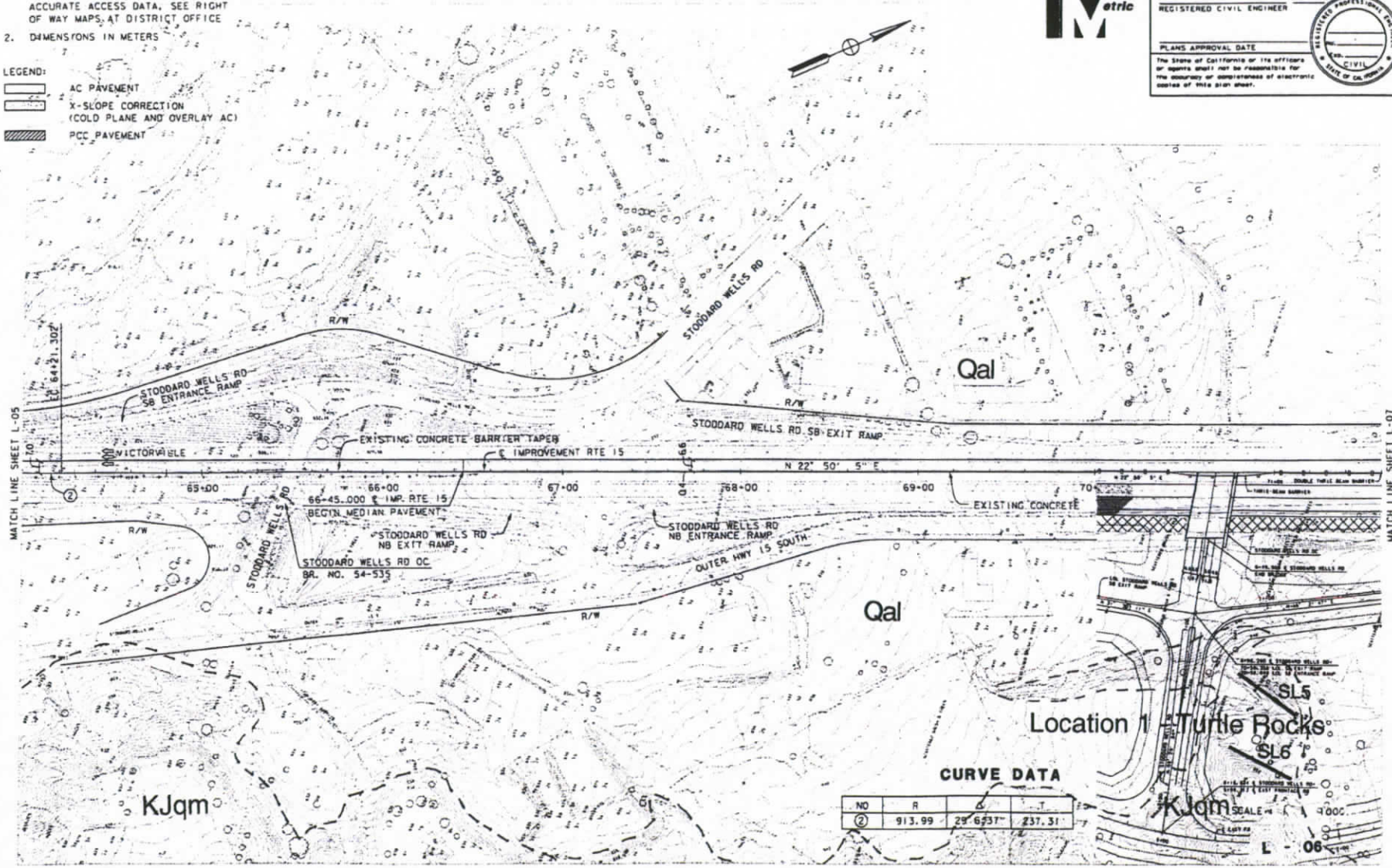
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT



CURVE DATA

NO	R	Δ	T
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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY | CHECKED BY | DATE | REVISED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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CU 08222

EA 355510

LAST REVISION 08-28-98

DATE PLOTTED => 16 OCT 1999
TIME PLOTTED => 12:53:13

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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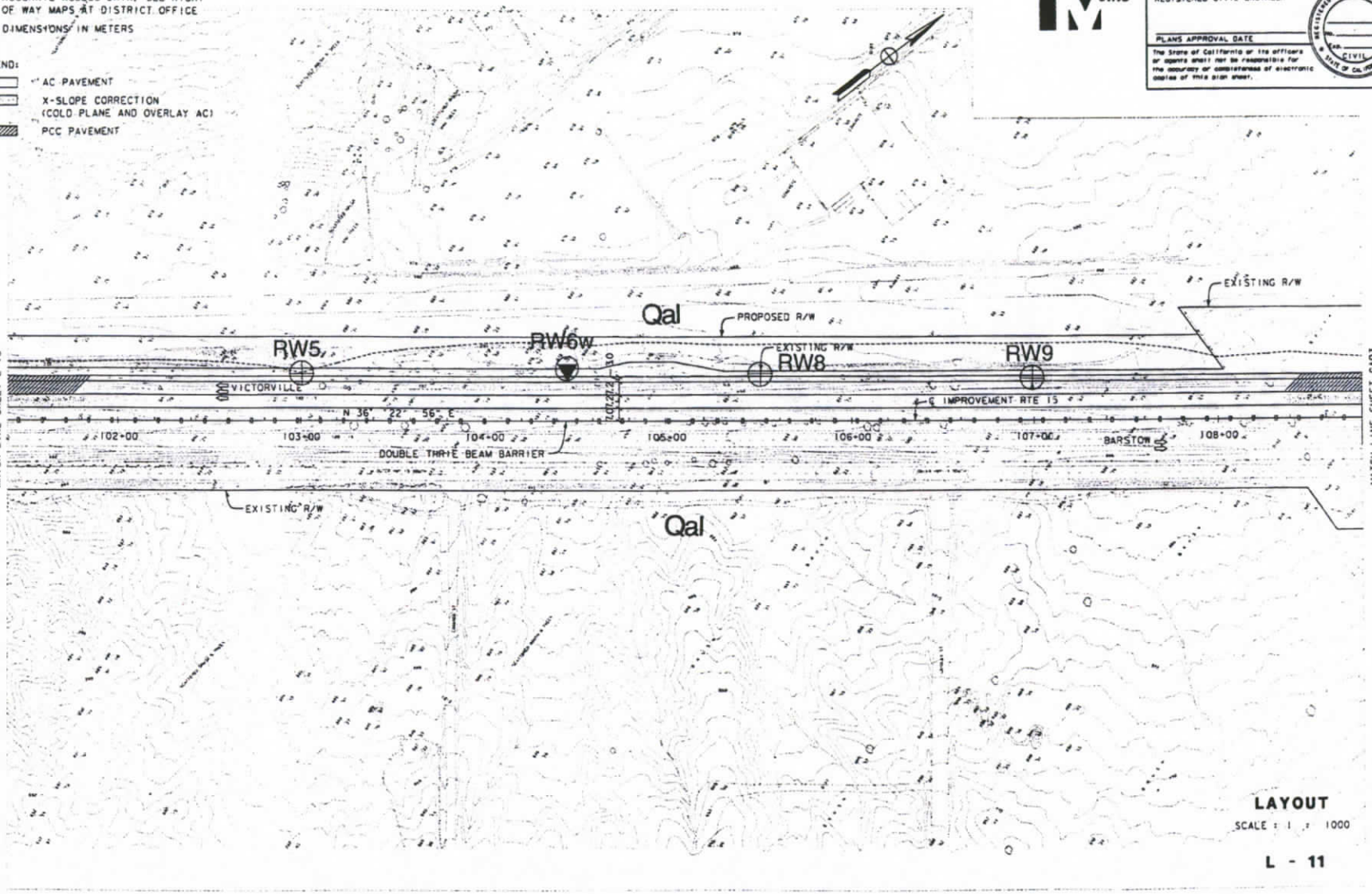
Caltrans Metric

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT



LAYOUT

SCALE : 1 : 1000

L - 11

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

CHECKED BY

PROJECT ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 08-29-08

DATE PLOTTED => 14 OCT 1999

TIME PLOTTED => 17:29:06

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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DGN FILE => ...\111.dgn

CU 08222

EA 355510

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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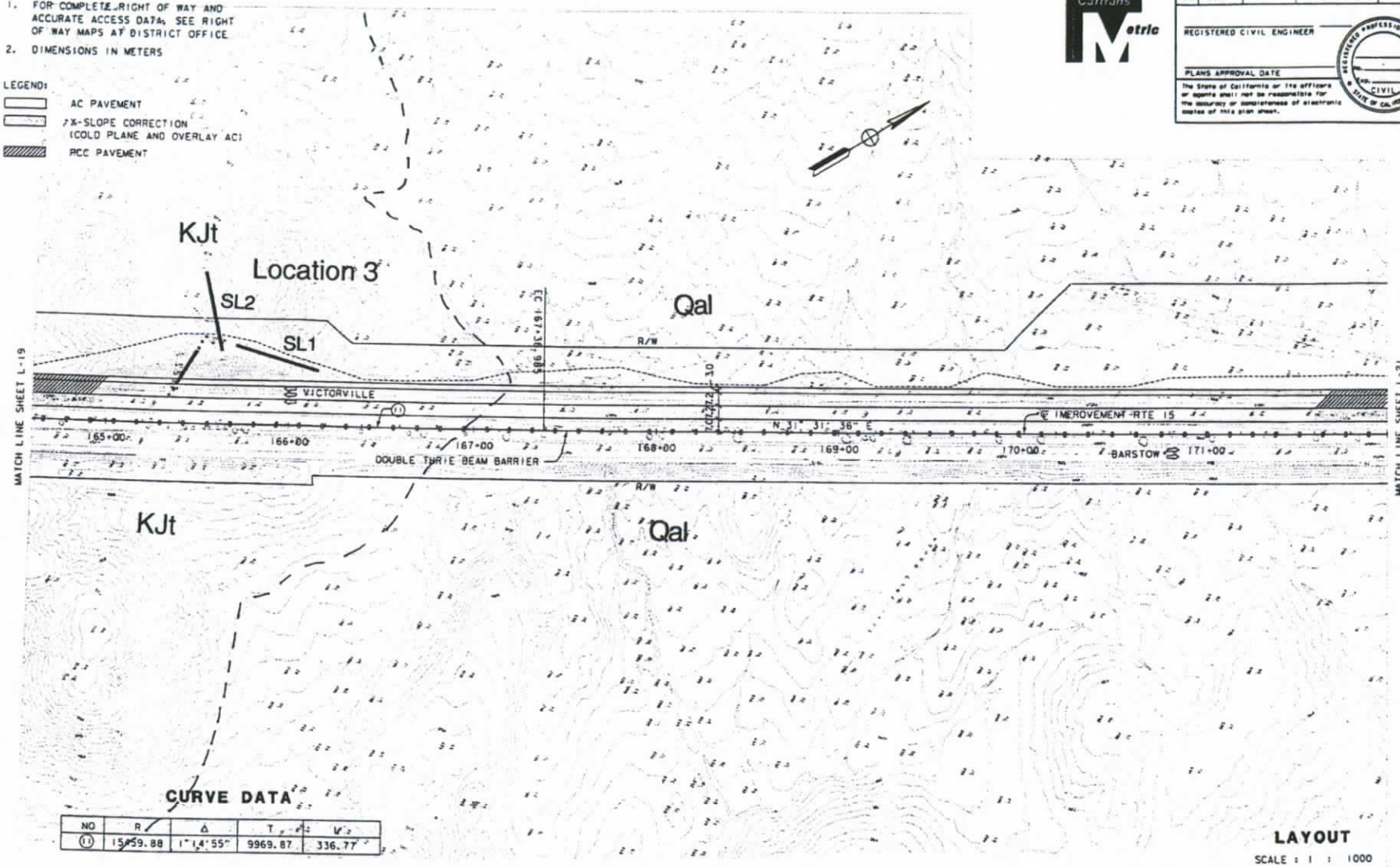
Caltrans Metric

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE.
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- 2% SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT



CURVE DATA

NO	R	Δ	T	L
11	15459.88	1°14'55"	9969.87	336.77

LAYOUT

SCALE : 1 : 1000

L - 20

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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DGN FILE => ...\120.dgn

CU 08222

EA 355510

DATE PLOTTED => 14 OCT 1999
TIME PLOTTED => 15:47:16

LAST REVISION 08-28-98

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE.
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- TO BE CONSTRUCTED PER CONTRACT 08-355524

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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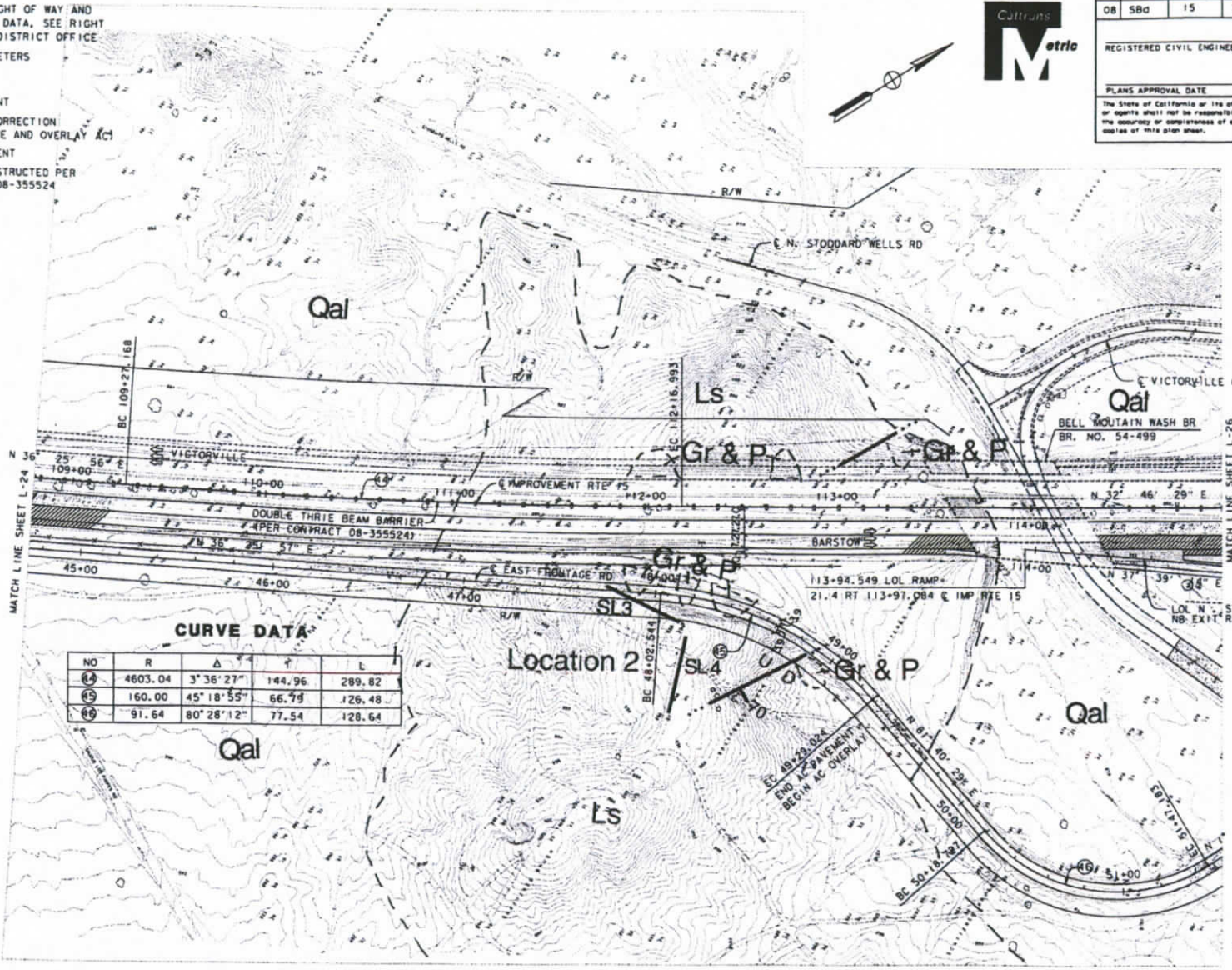

CURVE DATA

NO	R	Δ	T	L
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15	160.00	45°18'55"	66.79	126.48
16	91.64	80°28'12"	77.54	128.64

LAYOUT

SCALE : 1 : 1000

L - 25

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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PROJECT ENGINEER

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FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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CU 08222

EA 355501

LAST REVISION 08-28-98

DATE PLOTTED => 08 OCT 1999
TIME PLOTTED => 10:02:37

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER CIVIL STATE OF CALIFORNIA

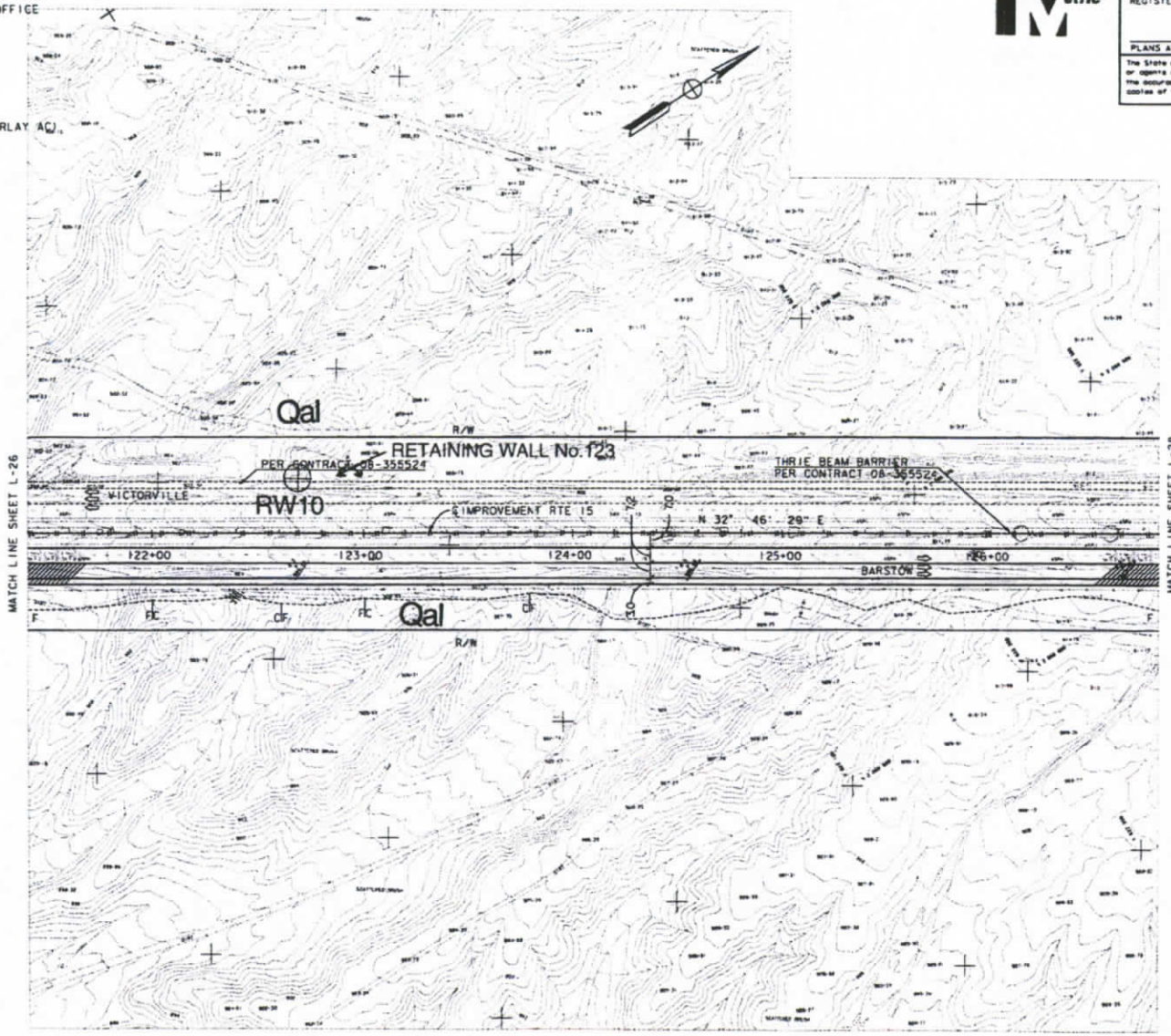
Caltrans Metric

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY ACJ.)
- PCC PAVEMENT
- OBLITERATE ROADWAY



LAYOUT

SCALE : 1 : 1000

L - 27

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

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DGN FILE => $REQUEST

CU 08222

EA 355501

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

08-28-98

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

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PLANS APPROVAL DATE

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NOTE :

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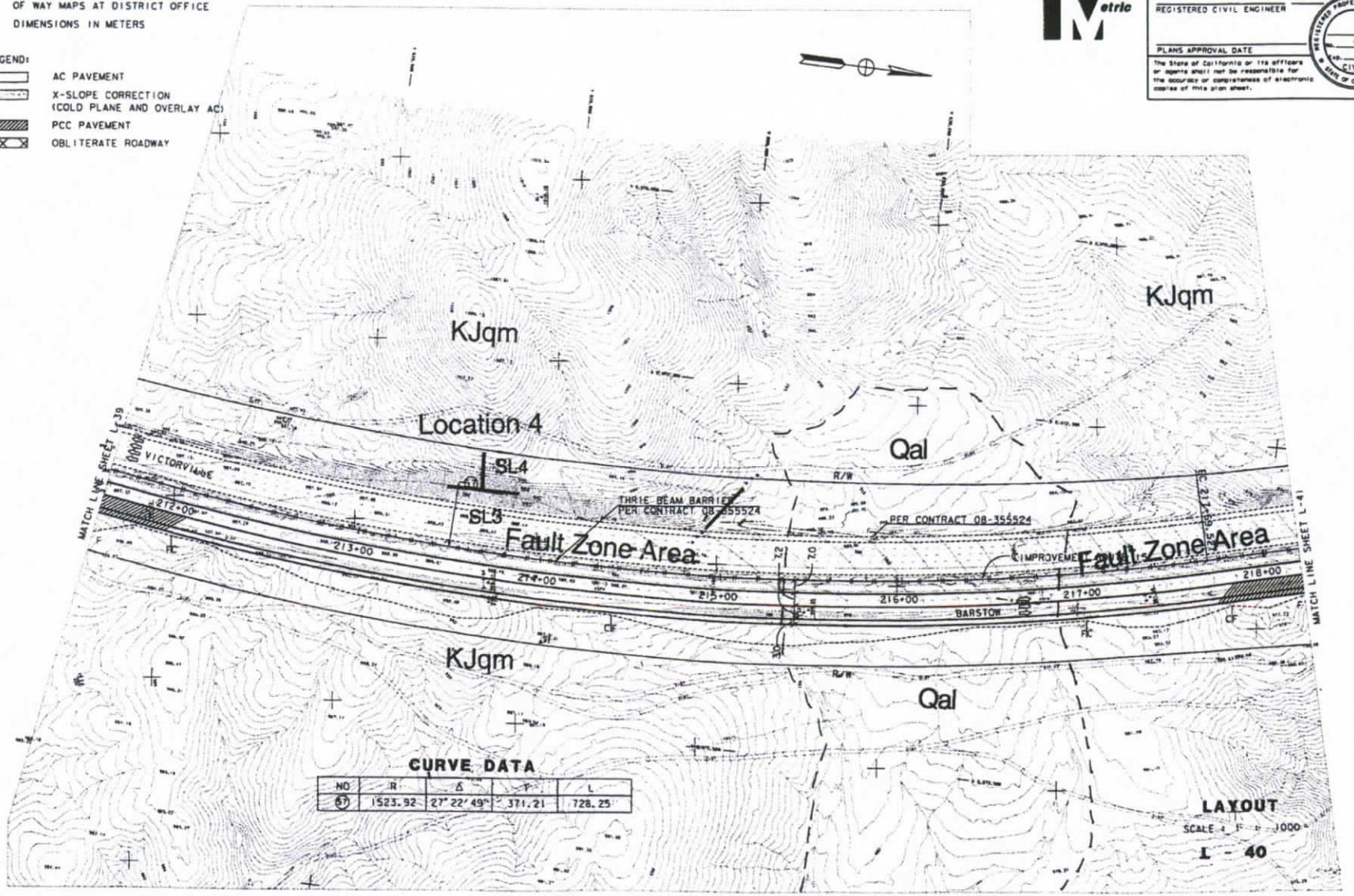
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



CURVE DATA

NO	R	Δ	T	L
67	1523.92	27° 22' 49"	371.21	728.25

LAYOUT

SCALE : 1" = 1000'

L - 40

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE | REVISED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => $USER
DGN FILE => $REQUEST

CU 08222

EA 355501

DATE PLOTTED => $DATE

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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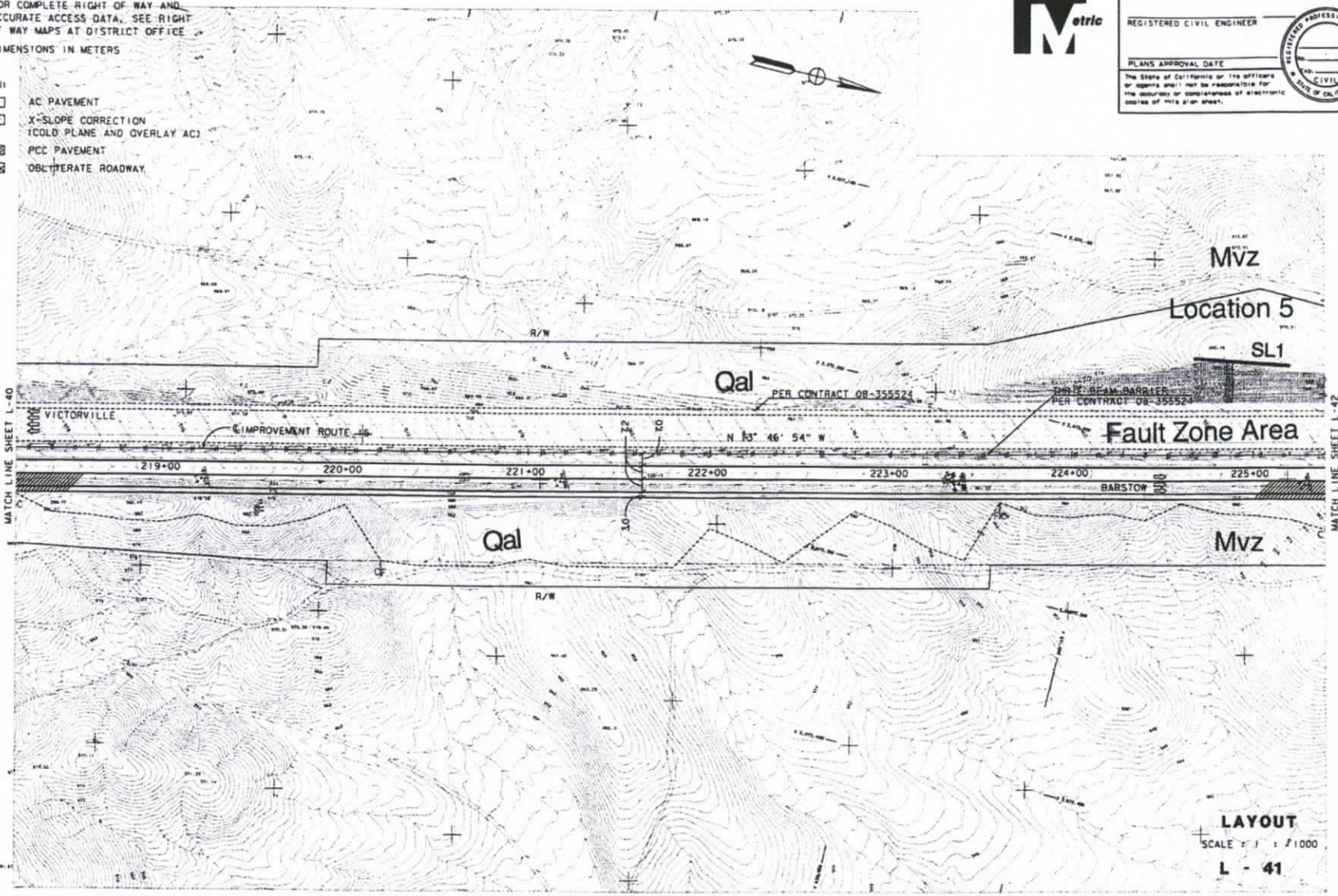
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



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Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

CHECKED BY

DATE

REVISED BY

DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => $USER
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CU 08222

EA 355501

DATE PLOTTED => $DATE

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

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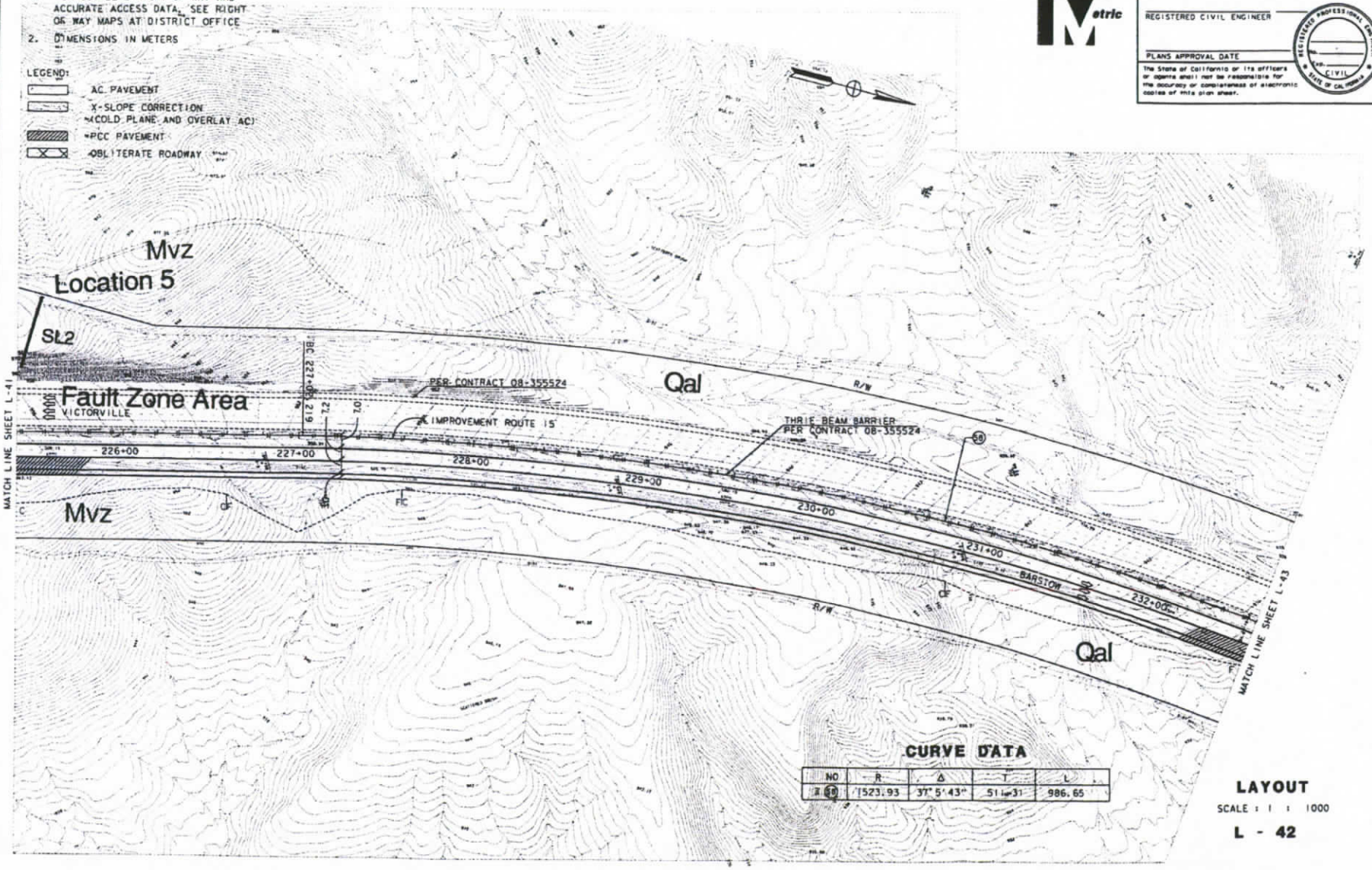
LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



CURVE DATA

NO	R	Δ	T	L
1 (50)	1523.93	37° 5' 43"	511.31	986.65

LAYOUT

SCALE : 1 : 1000

L - 42

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY

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DATE REVISED BY

DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => $USER
DGN FILE => $REQUEST

CU 08222

EA 355501

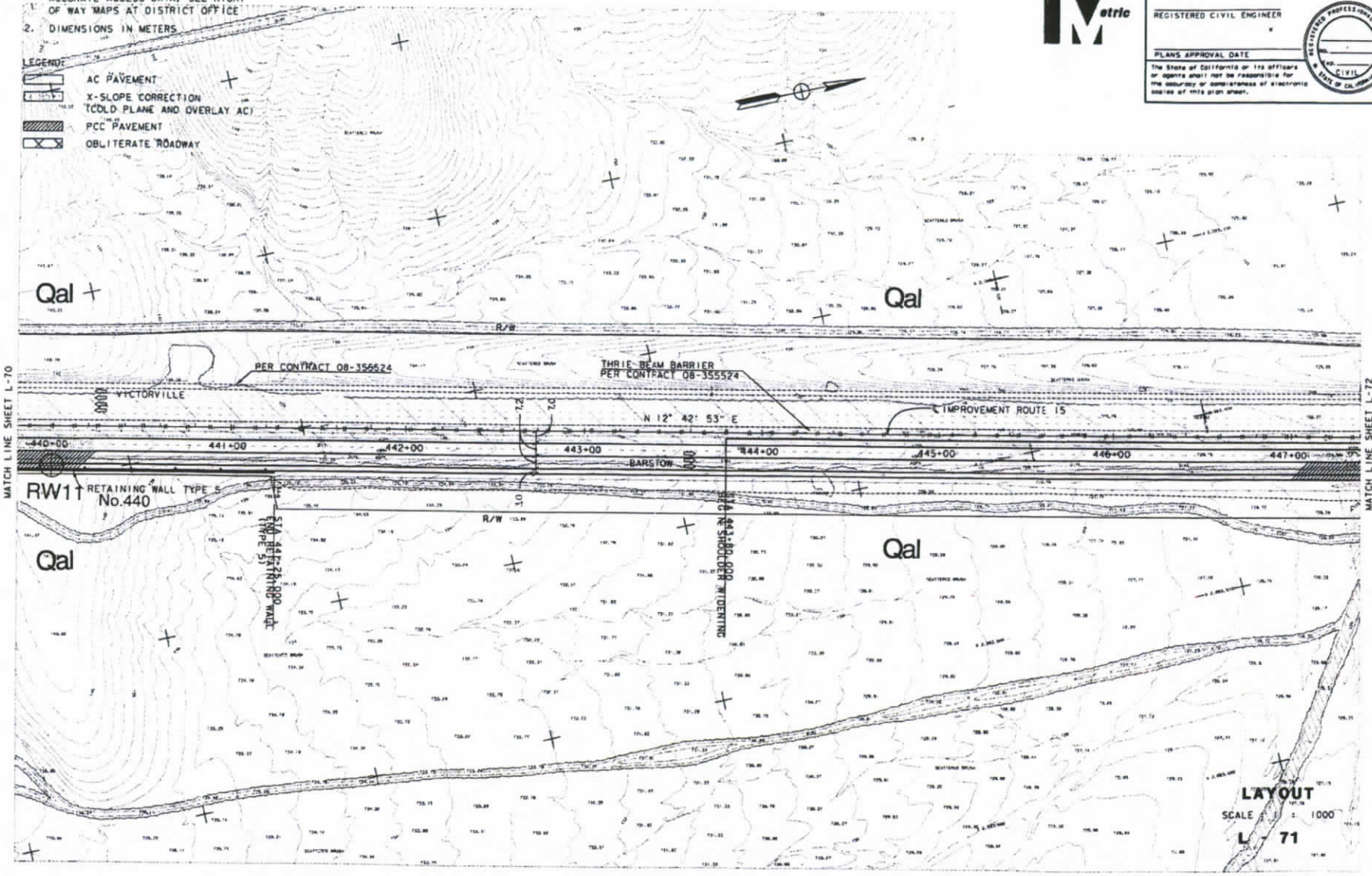
DATE PLOTTED => $DATE

NOTE :

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY MAPS AT DISTRICT OFFICE
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	156	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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PROJECT ENGINEER AHMAD SHAH

CALCULATED/DESIGNED BY | DATE | REVISED BY

CHECKED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => $USER
DGN FILE => $REQUEST

CU 08222

EA 355501

LAST REVISION 08-28-98

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
08	SBd	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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Caltrans Metric

NOTE :
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2. DIMENSIONS IN METERS

LEGEND:
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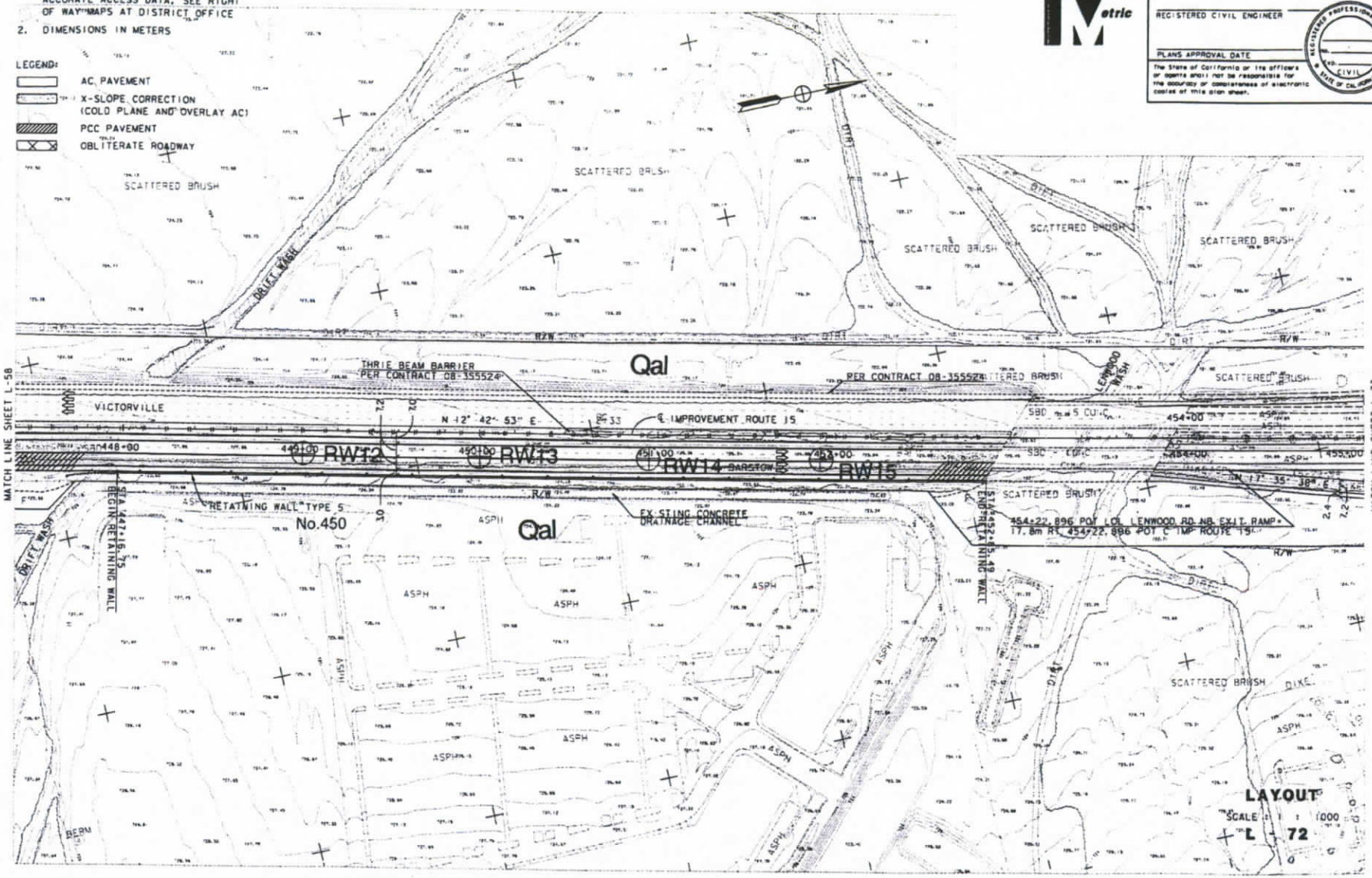
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY | CHECKED BY | DATE | REVISED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

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DGN FILE => $REQUEST

CU 08222

EA 355501

DATE PLOTTED => $DATE

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
08	SBD	15	67.4/113.6		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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Caltrans Metric

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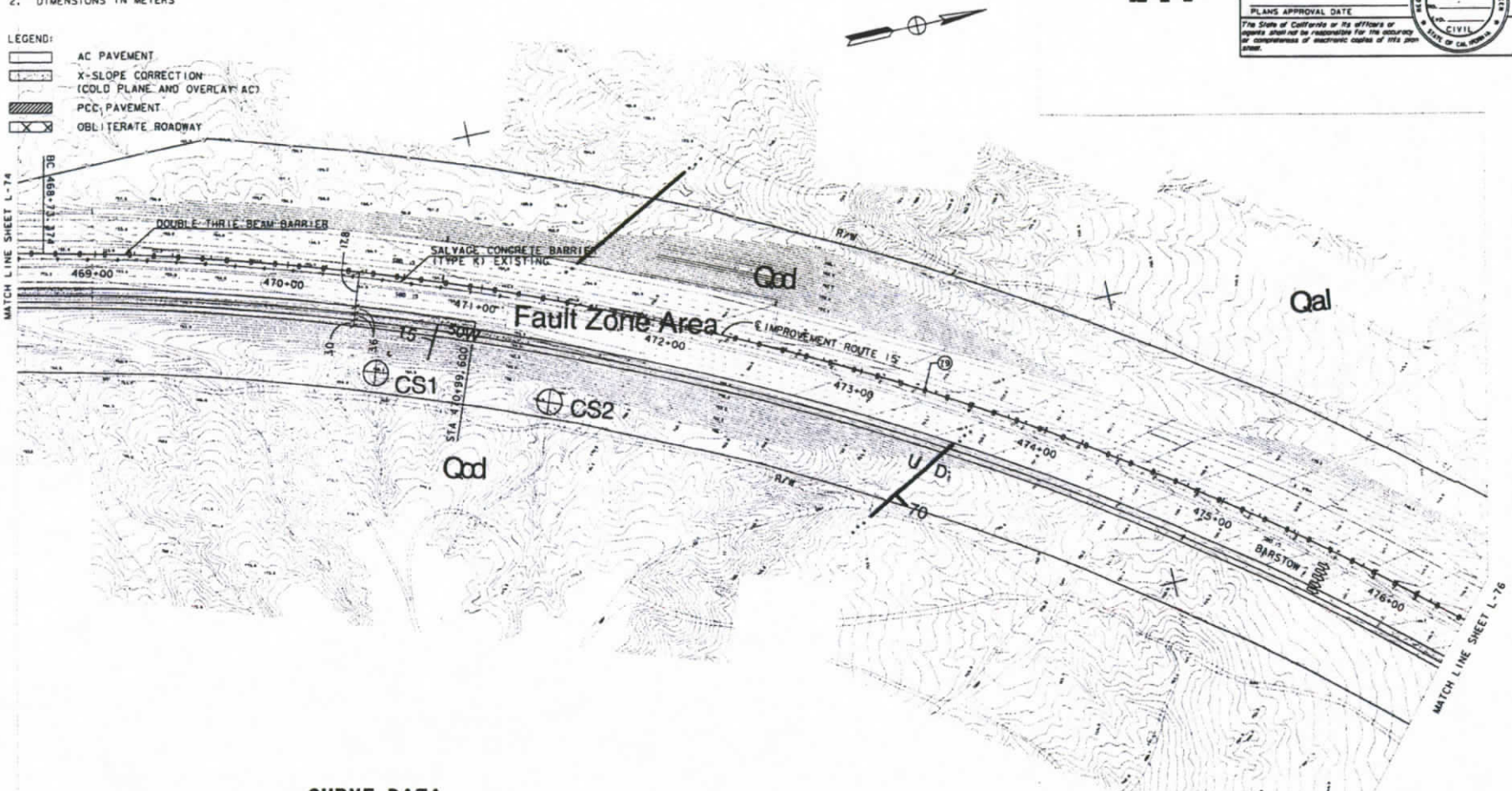
2. DIMENSIONS IN METERS

LEGEND:

- AC PAVEMENT
- X-SLOPE CORRECTION (COLD PLANE AND OVERLAY AC)
- PCC PAVEMENT
- OBLITERATE ROADWAY



CURVE DATA

NO	R	Δ	T	L
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LAYOUT
SCALE 1:1000
L-75

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/DESIGNED BY | CHECKED BY | DATE | REVISED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 20 40 60 80

USERNAME => $USER
DGN FILE => $REQUEST

CU 08222

EA 355501

LAST REVISION | DATE PLOTTED => $DATE

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Grading Factor for Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing a Grading Factor for the purpose of calculating material quantities on the Interstate 15 (I-15) Widening Project in Victorville, California.

Grading Factors relate the in place volume of material to be excavated to the in place volume of material after placement as fill. The factors are defined as in place volume of compacted fill (V_{fill}) divided by in place volume of material to be excavated (V_{exc}).

$$G_f = V_{fill}/V_{exc}$$

Grading Factors may be determined by dividing the in place density of material to be excavated (γ_{exc}) divided by the in place density of compacted fill (γ_{fill}).

$$G_f = \gamma_{exc}/\gamma_{fill}$$

The freeway widening project will generate borrow material primarily from cuts in native alluvial soil west of D Street. The borrow material will be placed as embankment fill at nearby locations.

On January 29, 2014, OGDS2 staff and the Caltrans District 8 Materials Testing Laboratory in Victorville conducted nuclear density tests to determine a grading factor for the project. Numerous tests were performed within in-situ alluvium at locations west of D Street to determine the in place density of material to be excavated (γ_{exc}). Several more tests were performed within embankment fill near D Street to determine the in place density of compacted fill (γ_{fill}). The relative position and composition of the embankment fill near D Street suggests that it was derived from the alluvium west of D Street. The approximate locations of the nuclear density test conducted are depicted on Attachment 1. Nuclear density test results from the in-situ alluvium and embankment fill are included in Table 1 and Table 2, respectively.

The average dry density of the in-situ alluvium was compared to the average dry density of the embankment fill. In this manner, a Grading Factor of 0.93 was determined for the bulk of the borrow material that will be generated on the project.

Table 1: Nuclear Density Test Results from Alluvium

Location	γ_{dry} (g/cm^3)	γ_{wet} (g/cm^3)
1	1.68	1.85
2	1.76	1.81
3	1.59	1.66
4	1.61	1.73
5	1.81	1.91
6	1.85	1.91
7	1.61	1.64
8	1.72	1.82
Average	1.70	1.79

Table 2: Nuclear Density Test Results from Embankment Fill

Location	γ_{dry} (g/cm^3)	γ_{wet} (g/cm^3)
9	1.79	1.86
10	1.84	1.89
11	1.88	1.94
12	1.81	1.87
Average	1.83	1.89

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

ATTACHMENTS:
Attachment 1: Project Layout Plans (L-3, L-5, and L-8)

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

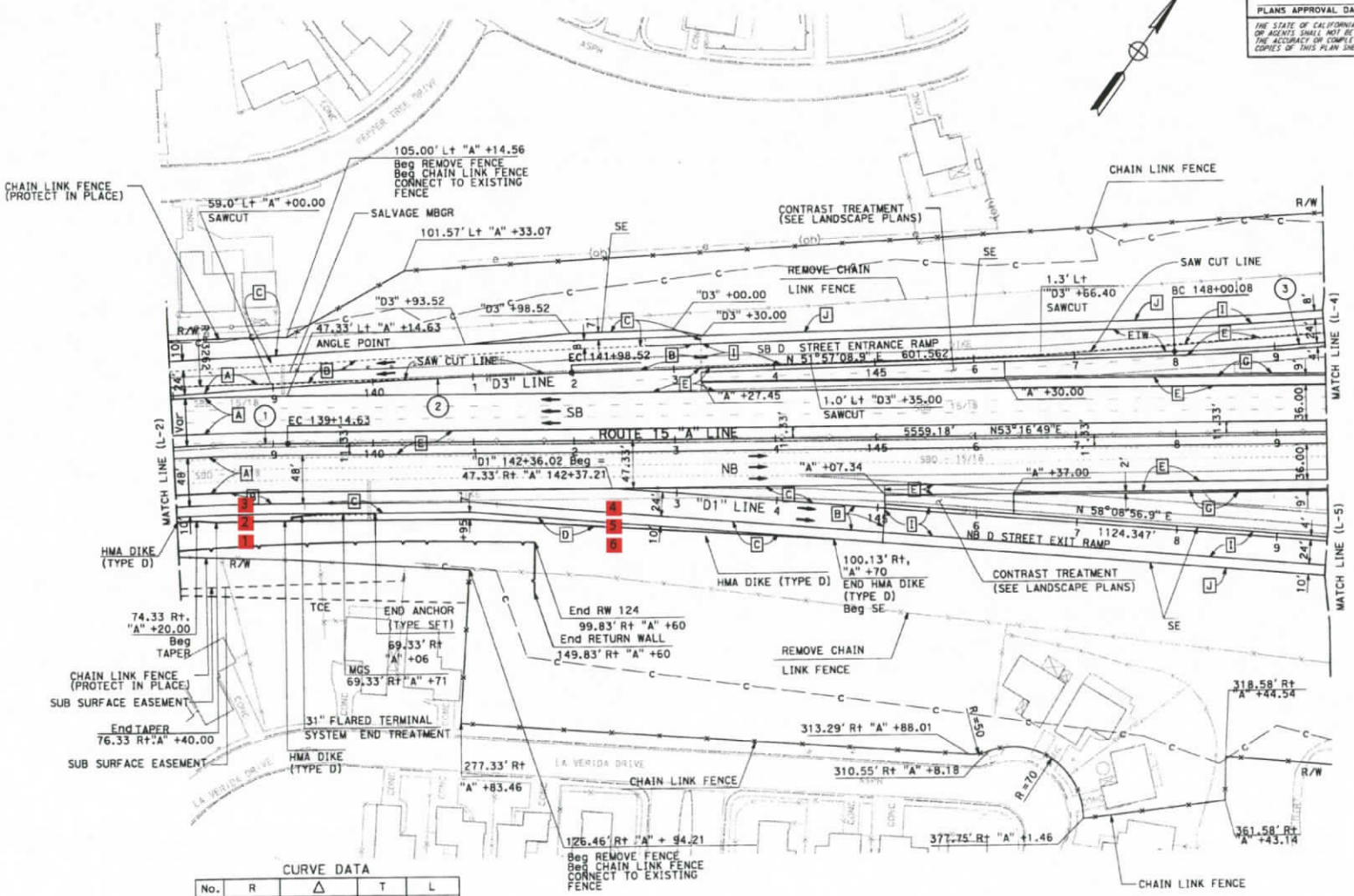
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

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3	3000.00'	3°11'46"	83.70'	167.35'

= Nuclear Density Test Location

LAYOUT
SCALE: 1"=50'
L-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR: GEORGE MORNIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086ea003.dgn
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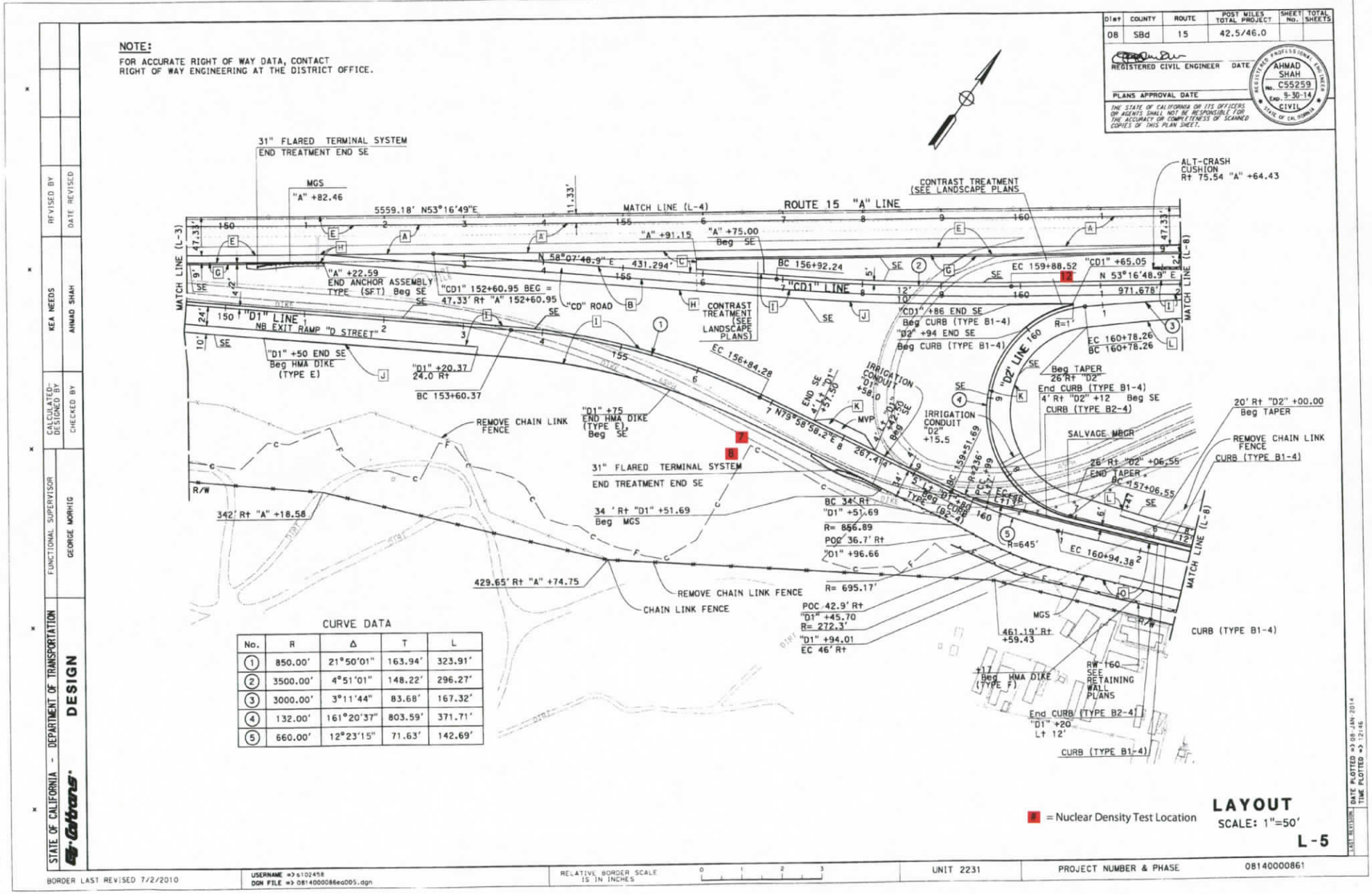
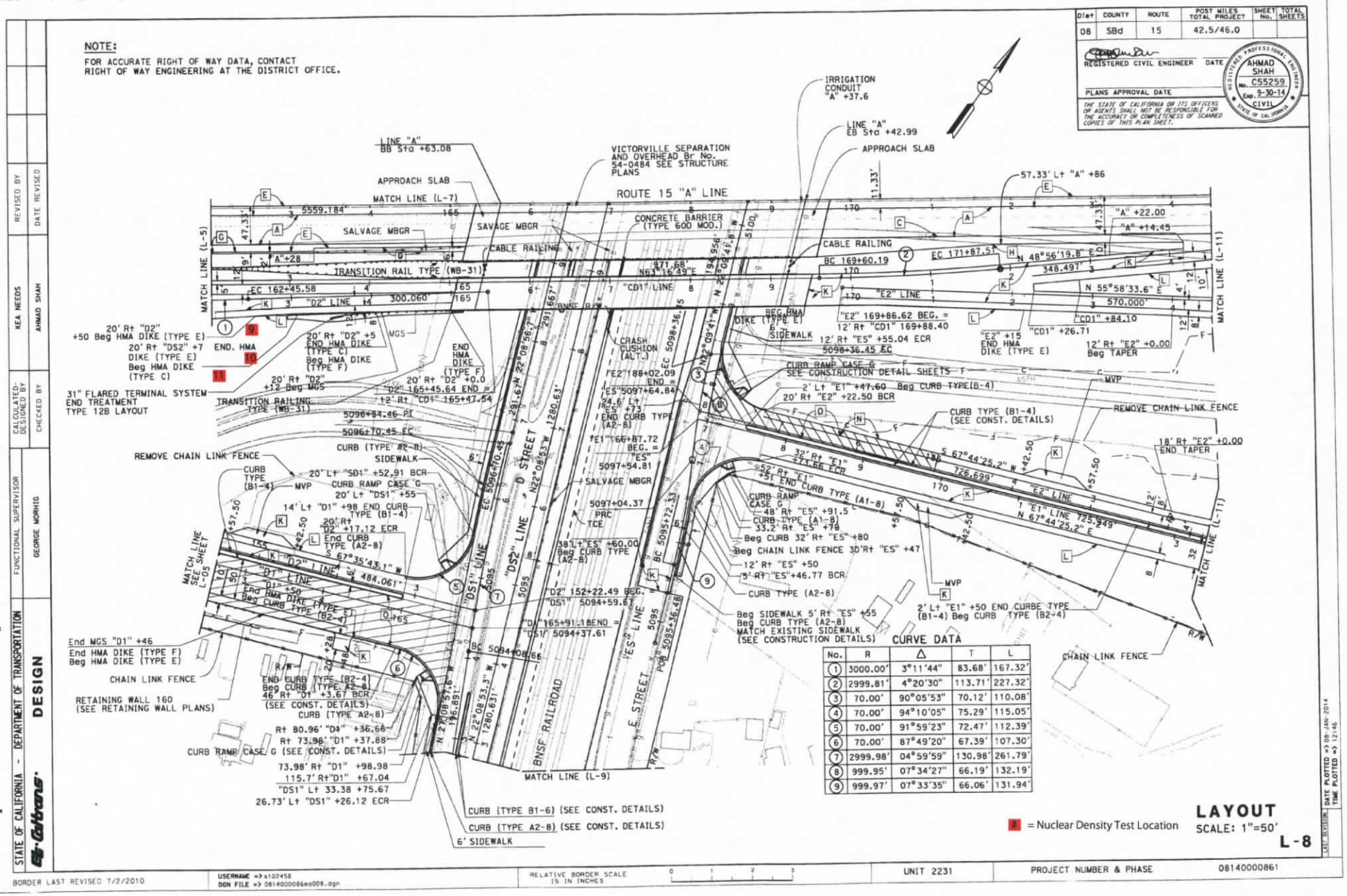
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
LAST REVISION
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:46


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
31" FLARED TERMINAL SYSTEM
END TREATMENT END SE
MGS
"A" +82.46
5559.18' N53°16'49"E
MATCH LINE (L-4)
ROUTE 15 "A" LINE
CONTRAST TREATMENT (SEE LANDSCAPE PLANS
ALT-CRASH CUSHION Rt 75.54 "A" +64.43
"A" +91.15
"A" +75.00 Beg SE
N 58°07'48.9" E
431.294'
BC 156+92.24
EC 159+88.52
"CD1" +65.05
N 53°16'48.9" E
971.678'
"A" +22.59
END ANCHOR ASSEMBLY TYPE (SFT) Beg SE
"CD1" 152+60.95 BEG = 47.33' Rt "A" 152+60.95
"CD" ROAD
"CD1" LINE
"CD1" +86 END SE
Beg CURB (TYPE B1-4)
"D2" +94 END SE
Beg CURB (TYPE B1-4)
EC 160+78.26
BC 160+78.26
MATCH LINE (L-3)
MATCH LINE (L-8)
"D1" LINE
NB EXIT RAMP "D STREET"
"D1" +50 END SE
Beg HMA DIKE (TYPE E)
"D1" +20.37
24.0 Rt
BC 153+60.37
EC 156+84.28
"D1" +75
END HMA DIKE (TYPE E)
Beg SE
REMOVE CHAIN LINK FENCE
31" FLARED TERMINAL SYSTEM
END TREATMENT END SE
34 ' Rt "D1" +51.69
Beg MGS
342' Rt "A" +18.58
429.65' Rt "A" +74.75
REMOVE CHAIN LINK FENCE
CHAIN LINK FENCE
BC 34' Rt
"D1" +51.69
R= 856.89
POC 36.7' Rt
"D1" +96.66
R= 695.17'
POC 42.9' Rt
"D1" +45.70
R= 272.3'
"D1" +94.01
EC 46' Rt
IRRIGATION CONDUIT "D1" +58.0
IRRIGATION CONDUIT "D2" +15.5
MVP
"D2" LINE
Beg TAPER 26' Rt "D2"
End CURB (TYPE B1-4)
4' Rt "D2" +12 Beg SE
CURB (TYPE B2-4)
SALVAGE MBGR
26' Rt "D2" +06.55
END TAPER
BC 157+06.55
R=645'
EC 160+94.38
20' Rt "D2" +00.00
Beg TAPER
REMOVE CHAIN LINK FENCE
CURB (TYPE B1-4)
MGS
461.19' Rt +59.43
+17
Beg HMA DIKE (TYPE F)
RW 160 SEE RETAINING WALL PLANS
End CURB (TYPE B2-4)
"D1" +20
Lt 12'
CURB (TYPE B1-4)
CURB (TYPE B1-4)
R/W
= Nuclear Density Test Location
LAYOUT
SCALE: 1"=50'
L-5
CURVE DATA
No. R Δ T L
1 850.00' 21°50'01" 163.94' 323.91'
2 3500.00' 4°51'01" 148.22' 296.27'
3 3000.00' 3°11'44" 83.68' 167.32'
4 132.00' 161°20'37" 803.59' 371.71'
5 660.00' 12°23'15" 71.63' 142.69'
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
AHMAD SHAH C55259 EXP. 9-30-14 CIVIL STATE OF CALIFORNIA
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORRIS
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => b102458
DGN FILE => 0814000086ea005.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46



CURVE DATA

No.	R	Δ	T	L
1	3000.00'	3°11'44"	83.68'	167.32'
2	2999.81'	4°20'30"	113.71'	227.32'
3	70.00'	90°05'53"	70.12'	110.08'
4	70.00'	94°10'05"	75.29'	115.05'
5	70.00'	91°59'23"	72.47'	112.39'
6	70.00'	87°49'20"	67.39'	107.30'
7	2999.98'	04°59'59"	130.98'	261.79'
8	999.95'	07°34'27"	66.19'	132.19'
9	999.97'	07°33'35"	66.06'	131.94'

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Subsurface Conditions at Four Proposed Pipe Jacking Locations on the Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing descriptions of subsurface conditions that will be encountered at four (4) proposed pipe jacking locations on the Interstate 15 (I-15) Widening Project in Victorville, California. The pipe jacking locations are depicted on the attached Drainage and Sanitary Sewer plans and are listed in Table 1.

No subsurface investigation was conducted specifically for this memorandum. Pertinent site information was gathered from published information, previously issued geotechnical reports, as-built plans, and site reconnaissance. The subsurface soil conditions anticipated to be encountered at each proposed pipe jacking location are described in Table 1.

The evaluations contained in this memorandum are based on the information discovered and data gathered. If conditions are encountered during the project that appear to differ from the conditions conveyed in this memorandum, or if construction difficulties related to soil conditions are encountered, a representative of OGDS2 should be consulted to assist with the assessment of the prevailing geotechnical conditions and to assist in formulating appropriate strategies to facilitate project completion.

Should project design features vary significantly from those described in this memorandum an updated memorandum should be prepared by OGDS2 to address the geotechnical considerations related to those features.

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

Table 1: Subsurface Soil Conditions at Proposed Pipe Jacking Locations

Approximate "A" Line Station	Facility	Approximate Lowest Elevation of Pipe (ft. MSL)	Soil Description Along Pipe Alignment	Groundwater
141+50	48-inch Alternative Pipe Culvert	2,820	Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel, and hard lean clay.	None
213+50	24-inch Steel Casing for Sanitary Sewer	2,691.5	Flood Plain Alluvium comprised of loose to very dense interbedded silty sand, clayey sand, sand with gravel and cobbles.	Measured at 2,683 and 2,684 ft. MSL in 1956 and 2013. May be higher due to seasonal rainfall, recent storm events, or water level in the nearby Mojave river.
238+50	2 (two) 60-inch Alternative Pipe Culverts	2,777	Contact between Older Alluvium and medium dense Embankment Fill derived from Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel and occasional cobbles, and hard lean clay.	None
249+10	2 (two) 60-inch Alternative Pipe Culverts	2,805	Contact between Older Alluvium and medium dense Embankment Fill derived from Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel and occasional cobbles, and hard lean clay.	None

ATTACHMENTS:
Attachment 1: Drainage Plans D-3, D-18, and D-19
Attachment 2: Sanitary Sewer Plan SS-5

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	

NOTES

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. *: SEE DRAINAGE DETAIL SHEETS.

CURVE DATA

No.	R	Δ	T	L
1	3000.00'	2°09'44"	56.61'	113.21'
2	45.00'	43°33'04"	17.98'	34.20'
3	45.00'	90°00'00"	45.00'	70.69'
4	60.00'	88°40'20"	58.63'	92.86'

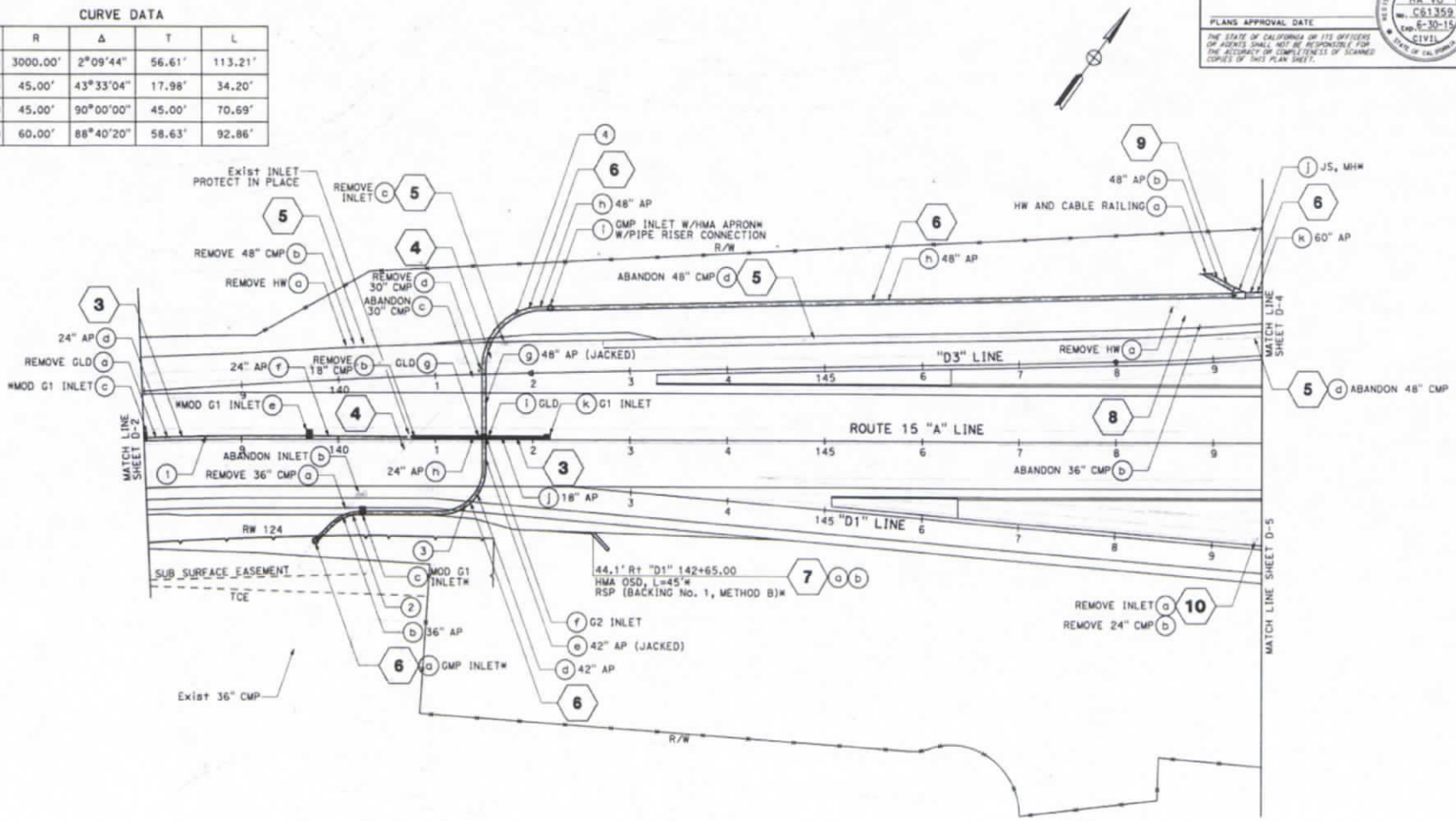
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER HA VU No. C61359 Exp. 6-30-15 CIVIL STATE OF CALIFORNIA



THIS PLAN ACCURATE FOR DRAINAGE ONLY

DRAINAGE PLAN

SCALE 1" = 50'

D-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR GEORGE MORHIG

CALCULATED-DESIGNED BY HA VU

CHECKED BY

REVISED BY

DATE REVISED

BORDER LAST REVISED 7/2/2010

USERNAME => s128957
DGN FILE => 08140000861d003.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 2231

PROJECT NUMBER & PHASE 08140000861

LAST REVISION 00-00-00

DATE PLOTTED => 13-NOV-2013
TIME PLOTTED => 13:03

NOTES

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. #: SEE DRAINAGE DETAIL SHEETS.

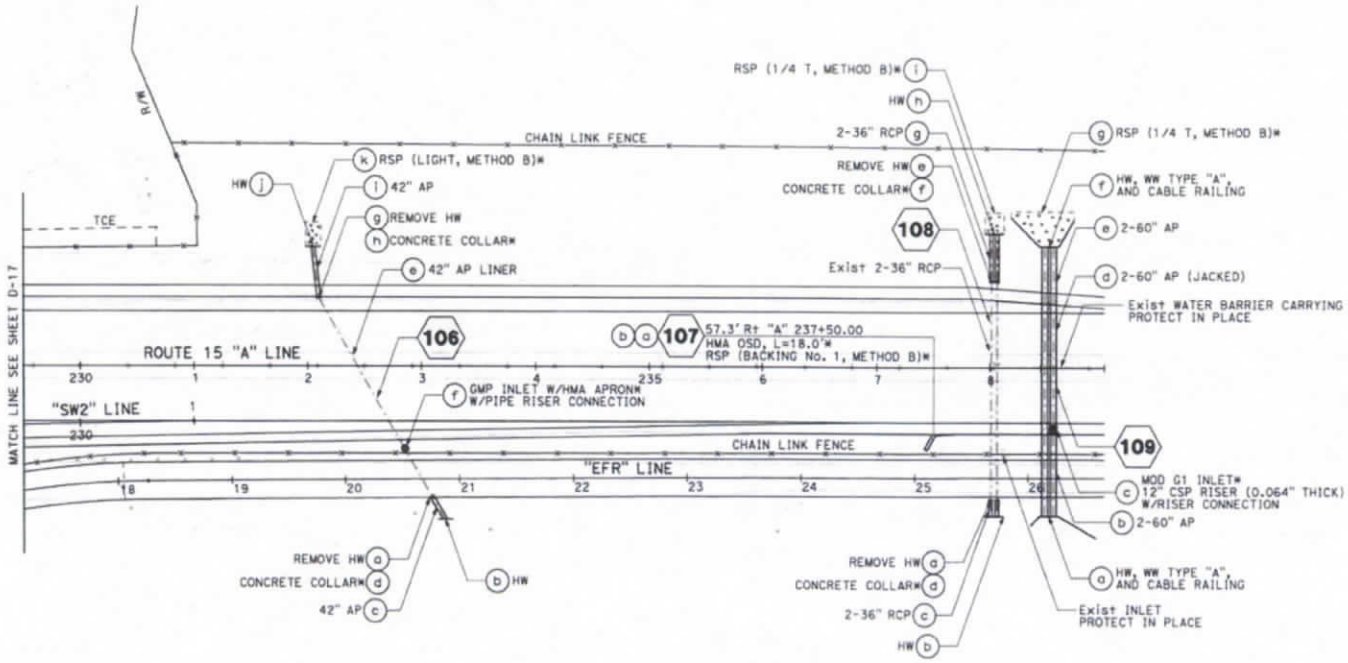
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER HA VU No. C61359 Exp. 6-30-15 CIVIL STATE OF CALIFORNIA



THIS PLAN ACCURATE FOR DRAINAGE ONLY

DRAINAGE PLAN

SCALE 1" = 50'

D-18

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR GEORGE MORHIG

CALCULATED-DESIGNED BY HA VU

CHECKED BY

REVISED BY

DATE REVISED

LAST REVISION 00-00-00

DATE PLOTTED => 13-NOV-2013

TIME PLOTTED => 13:27

BORDER LAST REVISED 1/2/2010

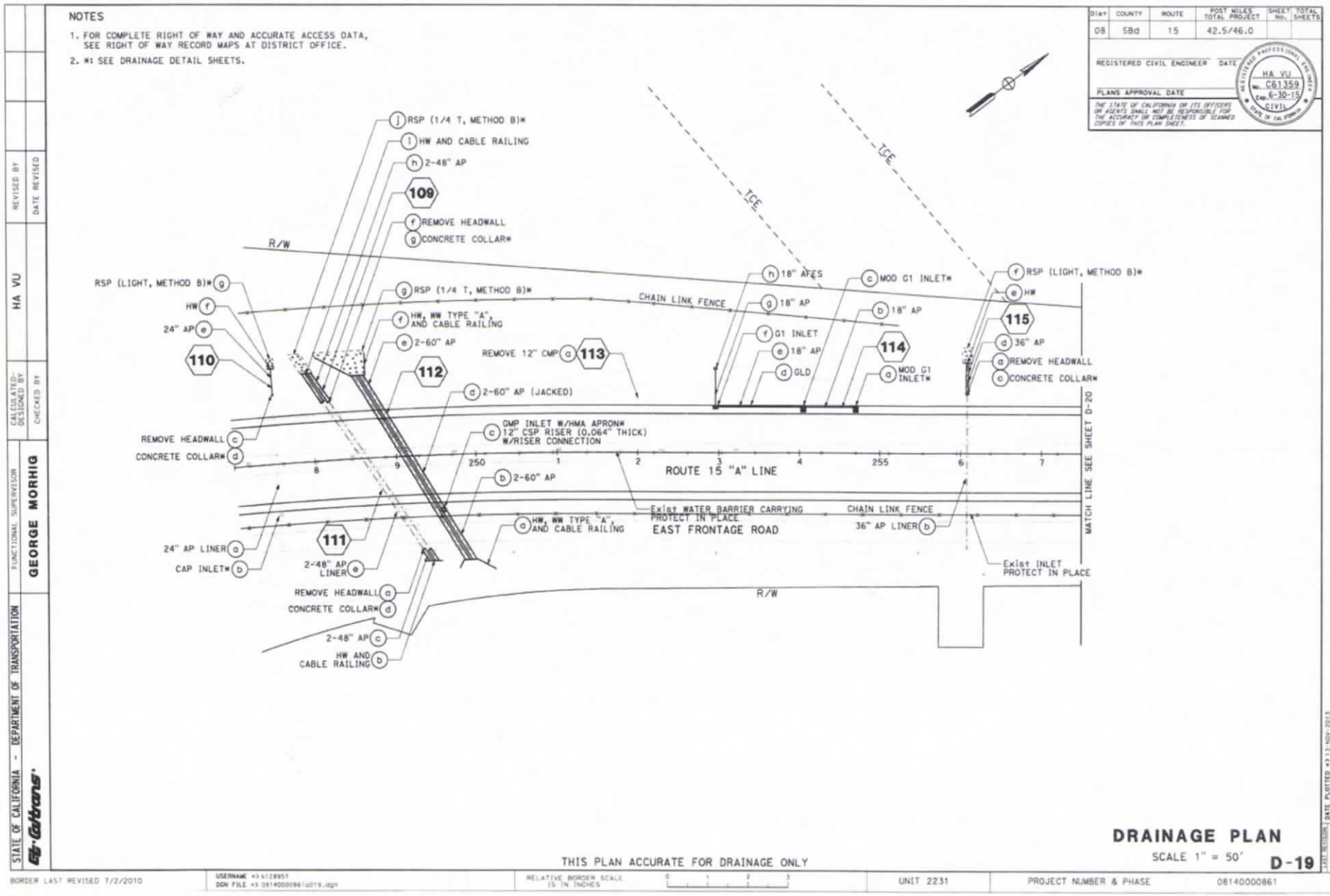
USERNAME => s128957

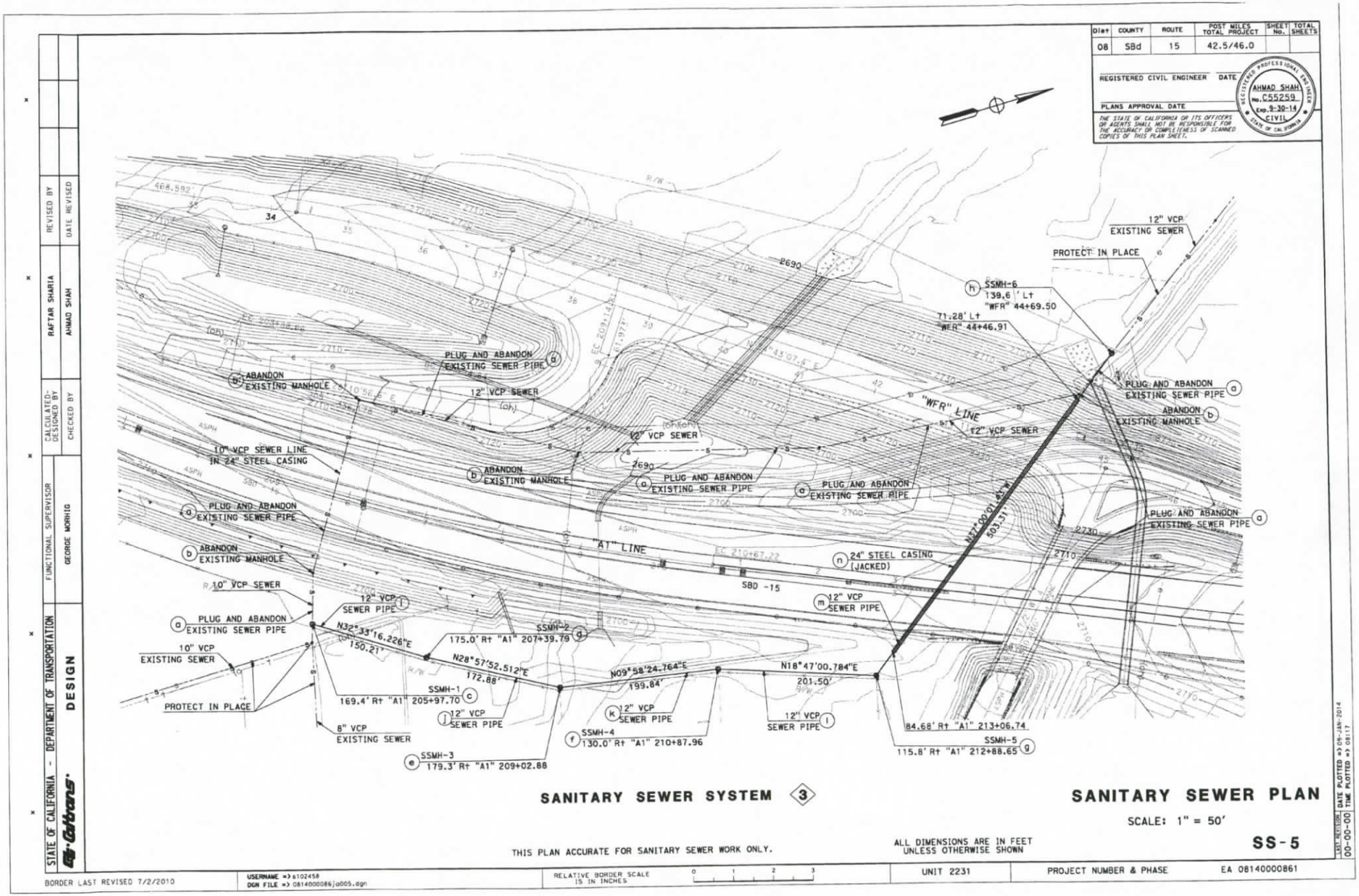
DGN FILE => 08140000861d018.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 2231

PROJECT NUMBER & PHASE 08140000861


NOTES
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. #: SEE DRAINAGE DETAIL SHEETS.
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
HA VU C61359 6-30-15 CIVIL
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
RSP (1/4 T, METHOD B)#
HW AND CABLE RAILING
2-48" AP
109
REMOVE HEADWALL
CONCRETE COLLAR#
R/W
TCE
TCE
RSP (LIGHT, METHOD B)#
HW
24" AP
110
RSP (1/4 T, METHOD B)#
HW, WW TYPE "A", AND CABLE RAILING
2-60" AP
112
REMOVE 12" CMP
113
2-60" AP (JACKED)
CHAIN LINK FENCE
18" ATES
18" AP
G1 INLET
18" AP
GLD
MOD G1 INLET#
18" AP
114
MOD G1 INLET#
RSP (LIGHT, METHOD B)#
HW
115
36" AP
REMOVE HEADWALL
CONCRETE COLLAR#
REMOVE HEADWALL
CONCRETE COLLAR#
CMP INLET W/HMA APRON#
12" CSP RISER (0.064" THICK)
W/RISER CONNECTION
250
1
2
3
4
255
6
7
8
9
ROUTE 15 "A" LINE
2-60" AP
Exist WATER BARRIER CARRYING
PROTECT IN PLACE
EAST FRONTAGE ROAD
HW, WW TYPE "A", AND CABLE RAILING
CHAIN LINK FENCE
36" AP LINER
MATCH LINE SEE SHEET D-20
24" AP LINER
CAP INLET#
111
2-48" AP LINER
REMOVE HEADWALL
CONCRETE COLLAR#
2-48" AP
HW AND CABLE RAILING
Exist INLET
PROTECT IN PLACE
R/W
THIS PLAN ACCURATE FOR DRAINAGE ONLY
DRAINAGE PLAN
SCALE 1" = 50'
D-19
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
FUNCTIONAL SUPERVISOR
GEORGE MORHIG
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED
HA VU
BORDER LAST REVISED 7/2/2010
USERNAME
DGN FILE
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
DATE PLOTTED
TIME PLOTTED
00-00-00


Dist 08
COUNTY SBd
ROUTE 15
POST MILES TOTAL PROJECT 42.5/46.0
SHEET No.
TOTAL SHEETS
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL
STATE OF CALIFORNIA
REVISED BY
DATE REVISED
RAFTAR SHARIA
AHMAD SHAH
CALCULATED-DESIGNED BY
CHECKED BY
FUNCTIONAL SUPERVISOR
GEORGE MORRIG
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
DESIGN
12" VCP EXISTING SEWER
PROTECT IN PLACE
SSMH-6 139.6' Lt "WFR" 44+69.50
71.28' Lt "WFR" 44+46.91
PLUG AND ABANDON EXISTING SEWER PIPE
ABANDON EXISTING MANHOLE
"WFR" LINE
12" VCP SEWER
10" VCP SEWER LINE IN 24" STEEL CASING
"A1" LINE
24" STEEL CASING (JACKED)
N37°00'01.45"W 503.31'
SBD -15
10" VCP SEWER
12" VCP SEWER PIPE
N32°33'16.226"E 150.21'
175.0' Rt "A1" 207+39.79
SSMH-2
N28°57'52.512"E 172.88'
N09°58'24.764"E 199.84'
N18°47'00.784"E 201.50'
169.4' Rt "A1" 205+97.70
SSMH-1
8" VCP EXISTING SEWER
SSMH-3 179.3' Rt "A1" 209+02.88
SSMH-4 130.0' Rt "A1" 210+87.96
84.68' Rt "A1" 213+06.74
SSMH-5 115.8' Rt "A1" 212+88.65
SANITARY SEWER SYSTEM 3
SANITARY SEWER PLAN
SCALE: 1" = 50'
SS-5
THIS PLAN ACCURATE FOR SANITARY SEWER WORK ONLY.
ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN
LAST REVISION 00-00-00
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 08:17
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USERNAME => s102458
DGN FILE => 08140000861a005.dgn
RELATIVE BORDER SCALE IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
EA 08140000861

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Foundation and Cut Slope Soil Conditions at Retaining Wall No. 160 and Retaining Wall No. 163 on the Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing descriptions of soil conditions that exist at the planned locations of Retaining Wall No. 160 and Retaining Wall No. 163 on the Interstate 15 (I-15) Widening Project in Victorville, California. The proposed retaining walls will retain cuts in the southwest and northwest quadrants of the I-15/D Street Interchange.

Due to project schedule and resource constraints, no subsurface investigation was conducted specifically for this memorandum; therefore, no Log-of-Test-Boring (LOTB) have been prepared for Retaining Wall No. 160 and Retaining Wall No. 163. Pertinent site information was gathered from published information, previously issued geotechnical reports, as-built plans, project plans, and site reconnaissance.

The project site geology is exposed in existing cut slopes along I-15 west of D Street. The soil observed in the cut slopes consists of Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel, and hard lean clay. LOTB have been prepared for Retaining Wall No. 124. These LOTB represent soil conditions that are typical of the Older Alluvium west of D Street; therefore, the anticipated soil conditions and interbedded stratigraphy at Retaining Wall No. 160 and Retaining Wall No. 163 are represented by the Retaining Wall No. 124 LOTB.

The evaluations contained in this memorandum are based on the information discovered and data gathered. If conditions are encountered during the project that appear to differ from the conditions conveyed in this memorandum, or if construction difficulties related to soil conditions are encountered, a representative of OGDS2 should be consulted to assist with the assessment of the prevailing geotechnical conditions and to assist in formulating appropriate strategies to facilitate project completion.

Should project design features vary significantly from those described in this memorandum an updated memorandum should be prepared by OGDS2 to address the geotechnical considerations related to those features.

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

ATTACHMENTS:
Attachment 1: Layout Plans L- through L-8
Attachment 2: Retaining Wall No. 124 Log of Test Boring

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

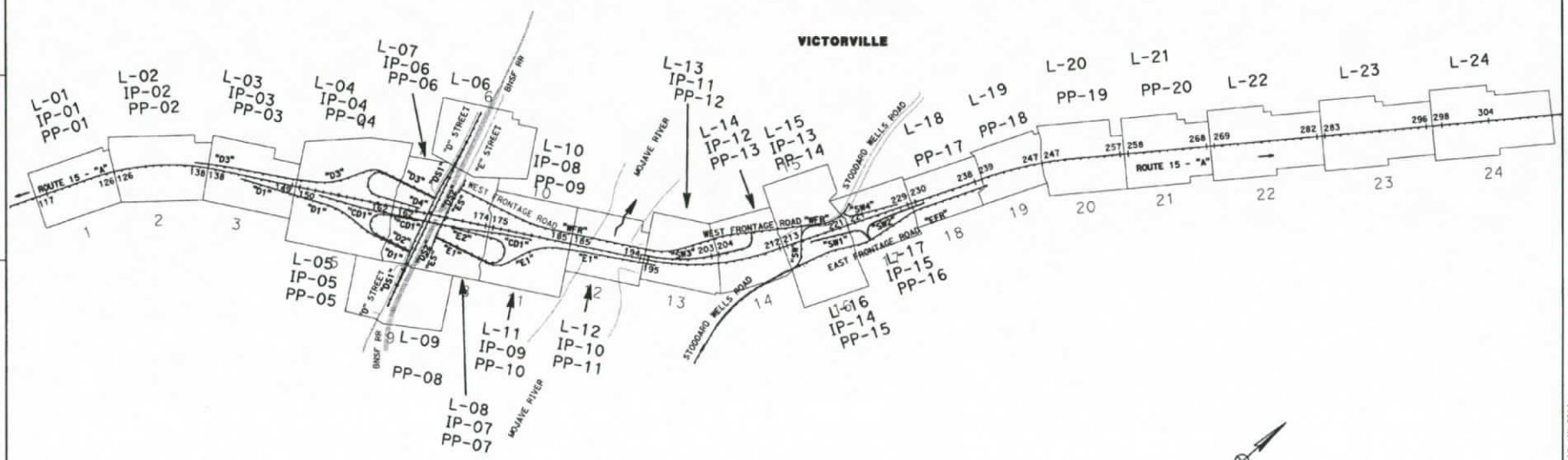
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

ALIGNMENT DESCRIPTION

"A" LINE	C/L IMPROVEMENT I-15	"SW1" LINE	LOL NB STODDARD WELLS RD EXIT RAMP
"D1" LINE	LOL NB D ST EXIT RAMP		
"D2" LINE	LOL NB D ST ENTRANCE RAMP	"SW2" LINE	LOL NB STODDARD WELLS RD ENTRANCE RAMP
"D3" LINE	LOL SB D ST ENTRANCE RAMP		
"D4" LINE	LOL SB D ST EXIT RAMP	"SW3" LINE	LOL SB STODDARD WELLS RD ENTRANCE RAMP
"DS1" LINE	LOL EB D ST		
"DS2" LINE	LOL WB D ST	"SW4" LINE	LOL SB STODDARD WELLS RD EXIT RAMP
"ES" LINE	LOL E ST		
"E1" LINE	LOL NB E ST EXIT RAMP	"SW" LINE	LOL STODDARD WELLS RD OVERCROSSING
"E2" LINE	LOL NB E ST ENTRANCE RAMP		
"CD" LINE	LOL NB COLLECTOR DISTRIBUTOR	"EFR" LINE	LOL EAST FRONTAGE ROAD
"CD" LINE	LOL NB COLLECTOR DISTRIBUTOR	"WFR" LINE	LOL WEST FRONTAGE ROAD



NO SCALE

KEY MAP AND LINE INDEX

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LAYOUT

SCALE: 1"=50'

K-01 L-

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR: GEORGE MORRIG

CALCULATED-DESIGNED BY: RAFTAR SHARIA

CHECKED BY: AHMAD SHAH

REVISED BY

DATE REVISED

LAST REVISION DATE PLOTTED => 10-JAN-2014 TIME PLOTTED => 08:46

00-00-00

BORDER LAST REVISED 7/2/2010

USERNAME => s128764
DGN FILE => 08140000861a001.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 2231

PROJECT NUMBER & PHASE 08140000861

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 EXP. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTES:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. FOR COMPLETE RETAINING WALL & SOUND WALL DETAILS SEE RETAINING WALL AND SOUNDWALL PLANS.
3. FOR COMPLETE CURB(S), CURB RAMP(S), SIDEWALK(S) CONCRETE BARRIER(S), CRASH CUSHION(S), SEE CONSTRUCTION DETAILS.
4. FOR HMA DIKE AND SAFETY EDGE LIMIT SEE QUANTITY SHEETS.
5. CHAIN LINK FENCE TO BE H=6'0"

ABBREVIATIONS:

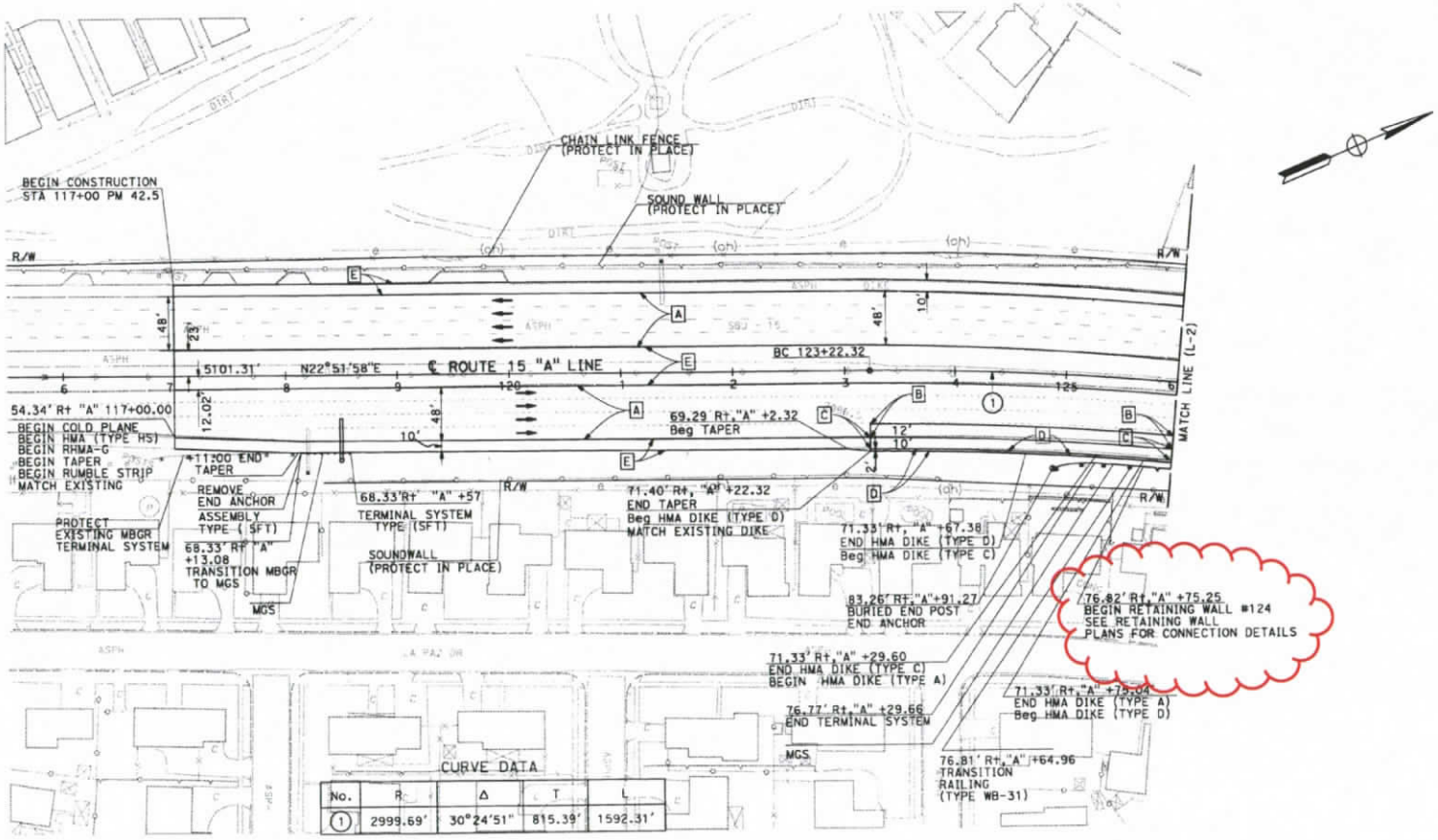
SE - SAFETY EDGE

LEGEND:

TEMPORARY CONSTRUCTION EASEMENT

RAMP TERMINI

[X] SEE TYPICAL CROSS SECTION FOR STRUCTURAL SECTION TYPE



No.	R	Δ	T	L
1	2999.69'	30°24'51"	815.39'	1592.31'

LAYOUT
SCALE: 1"=50'
L-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN

FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY / DATE REVISED

LAST REVISION / DATE PLOTTED => 06-JAN-2014 / TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010 | USERNAME => s102458 DGN FILE => 0814000086ea001.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2231 | PROJECT NUMBER & PHASE 08140000861

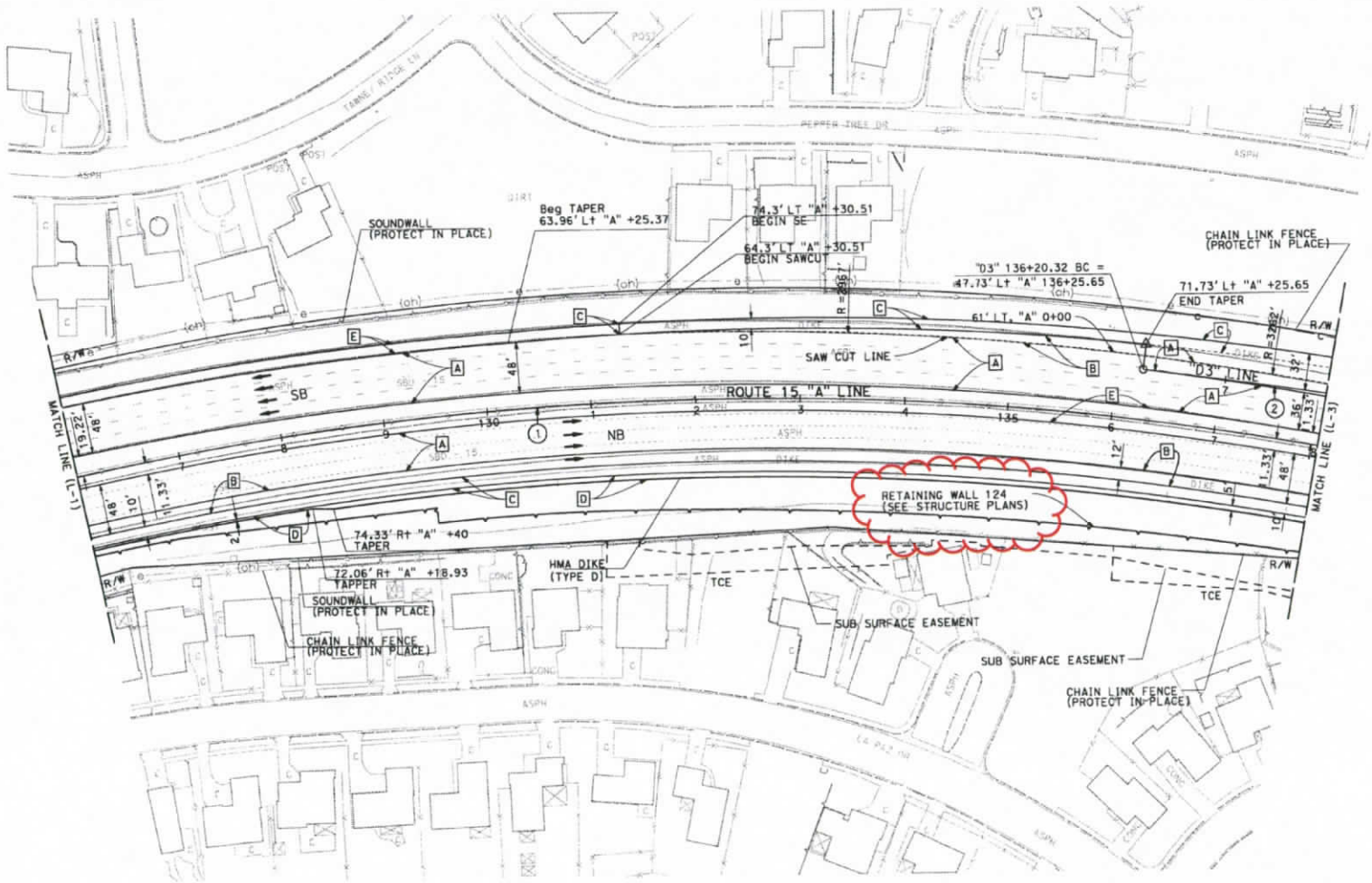
NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

NO	R	Δ	T	L
1	3000.00'	30°24'51"	815.39'	1592.31'
2	8202.87'	4°02'19"	289.22'	578.20'

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA



LAYOUT
SCALE: 1"=50'
L-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED

DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000861a0002.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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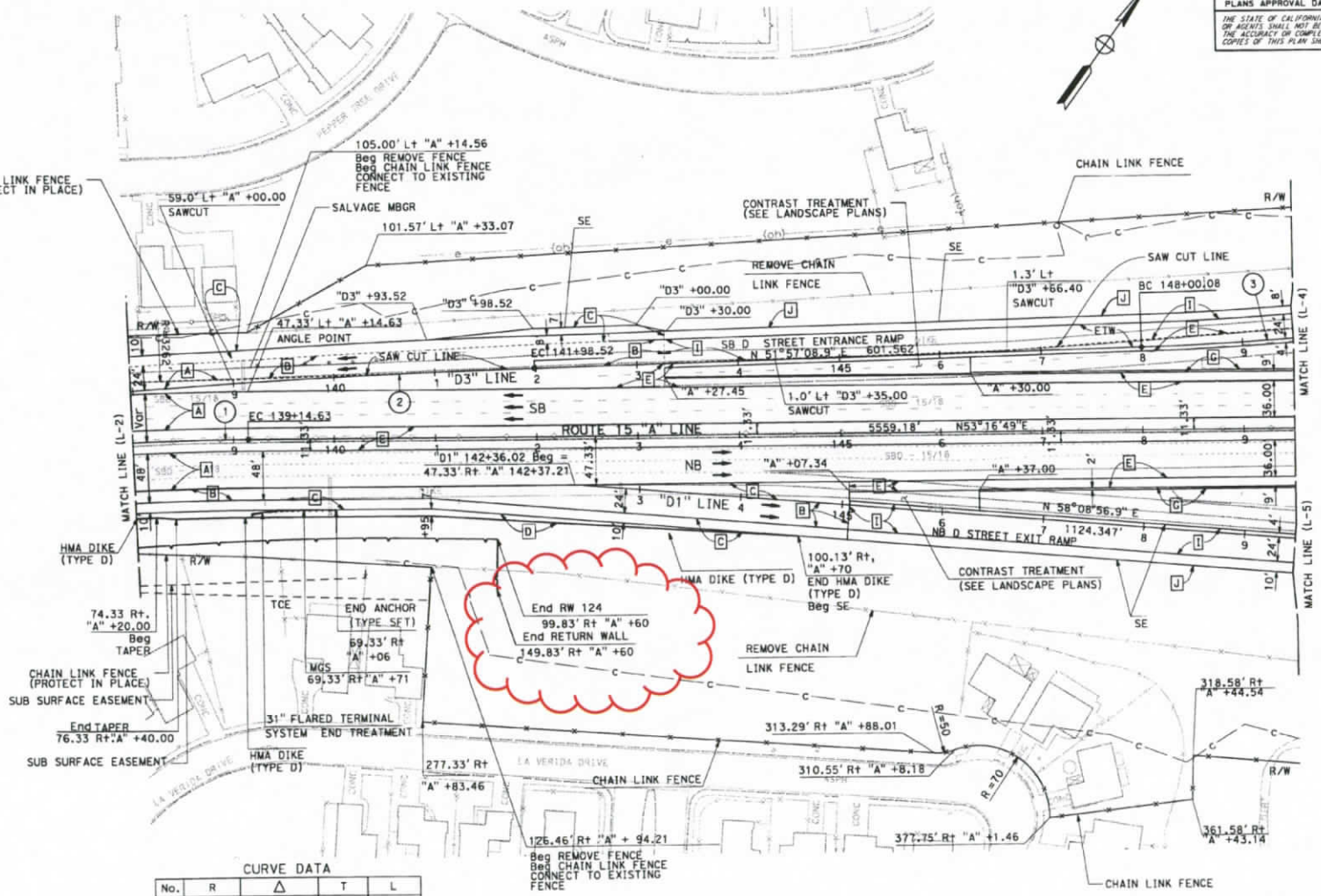
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

No.	R	Δ	T	L
1	3000.00'	30°24'51"	815.39'	1592.31'
2	8202.87'	4°02'19"	289.22'	578.20'
3	3000.00'	3°11'46"	83.70'	167.35'

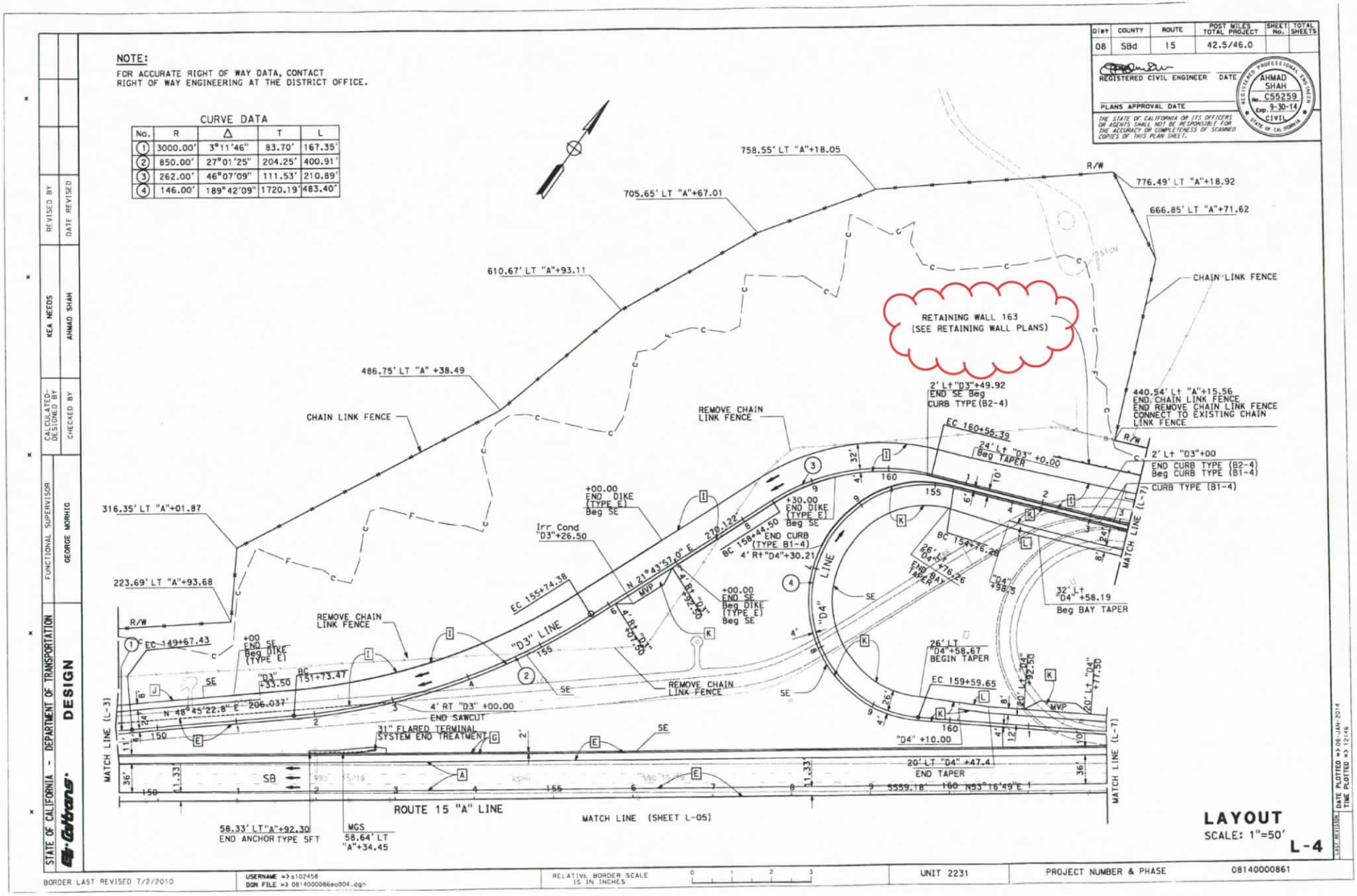
LAYOUT
SCALE: 1"=50'
L-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN

FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY / DATE REVISED

LAST REVISION DATE PLOTTED => 08-JAN-2014 TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010 | USERNAME => s102458 DGN FILE => 08140000086ea003.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2231 | PROJECT NUMBER & PHASE 08140000861


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
CURVE DATA
No. R Δ T L
1 3000.00' 3°11'46" 83.70' 167.35'
2 850.00' 27°01'25" 204.25' 400.91'
3 262.00' 46°07'09" 111.53' 210.89'
4 146.00' 189°42'09" 1720.19' 483.40'
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
758.55' LT "A"+18.05
705.65' LT "A"+67.01
610.67' LT "A"+93.11
486.75' LT "A" +38.49
316.35' LT "A"+01.87
223.69' LT "A"+93.68
776.49' LT "A"+18.92
666.85' LT "A"+71.62
CHAIN LINK FENCE
RETAINING WALL 163
(SEE RETAINING WALL PLANS)
REMOVE CHAIN LINK FENCE
2' Lt "D3"+49.92
END SE Beg
CURB TYPE (B2-4)
440.54' Lt "A"+15.56
END CHAIN LINK FENCE
END REMOVE CHAIN LINK FENCE
CONNECT TO EXISTING CHAIN LINK FENCE
EC 160+55.39
24' Lt "D3" +0.00
Beg TAPER
2' Lt "D3"+00
END CURB TYPE (B2-4)
Beg CURB TYPE (B1-4)
CURB TYPE (B1-4)
+00.00
END DIKE
(TYPE E)
Beg SE
+30.00
END DIKE
(TYPE E)
Beg SE
Irr Cond
"D3"+26.50
BC 158+44.50
END CURB
(TYPE B1-4)
4' Rt "D4"+30.21
N 21°43'57.0" E 270.122'
EC 155+74.38
"D3" LINE
"D4" LINE
BC 154+76.26
26' Lt "D4" +76.26
END BAY TAPER
"D4" +98.3
32' Lt "D4" +58.19
Beg BAY TAPER
MATCH LINE (L-7)
EC 149+67.43
+00
END SE
Beg DIKE
(TYPE E)
"D3" +33.50
BC 151+73.47
N 48°45'22.8" E 206.037'
4' RT "D3" +00.00
END SAWCUT
31" FLARED TERMINAL
SYSTEM END TREATMENT
26' LT
"D4"+58.67
BEGIN TAPER
EC 159+59.65
"D4" +10.00
20' LT "D4" +47.4
END TAPER
N53°16'49"E
MATCH LINE (L-3)
SB
ROUTE 15 "A" LINE
MATCH LINE (SHEET L-05)
58.33' LT "A"+92.30
END ANCHOR TYPE SFT
MGS
58.64' LT
"A"+34.45
LAYOUT
SCALE: 1"=50'
L-4
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR
GEORGE MORHIG
CALCULATED-DESIGNED BY
KEA NEEDS
CHECKED BY
AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000086ec004.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

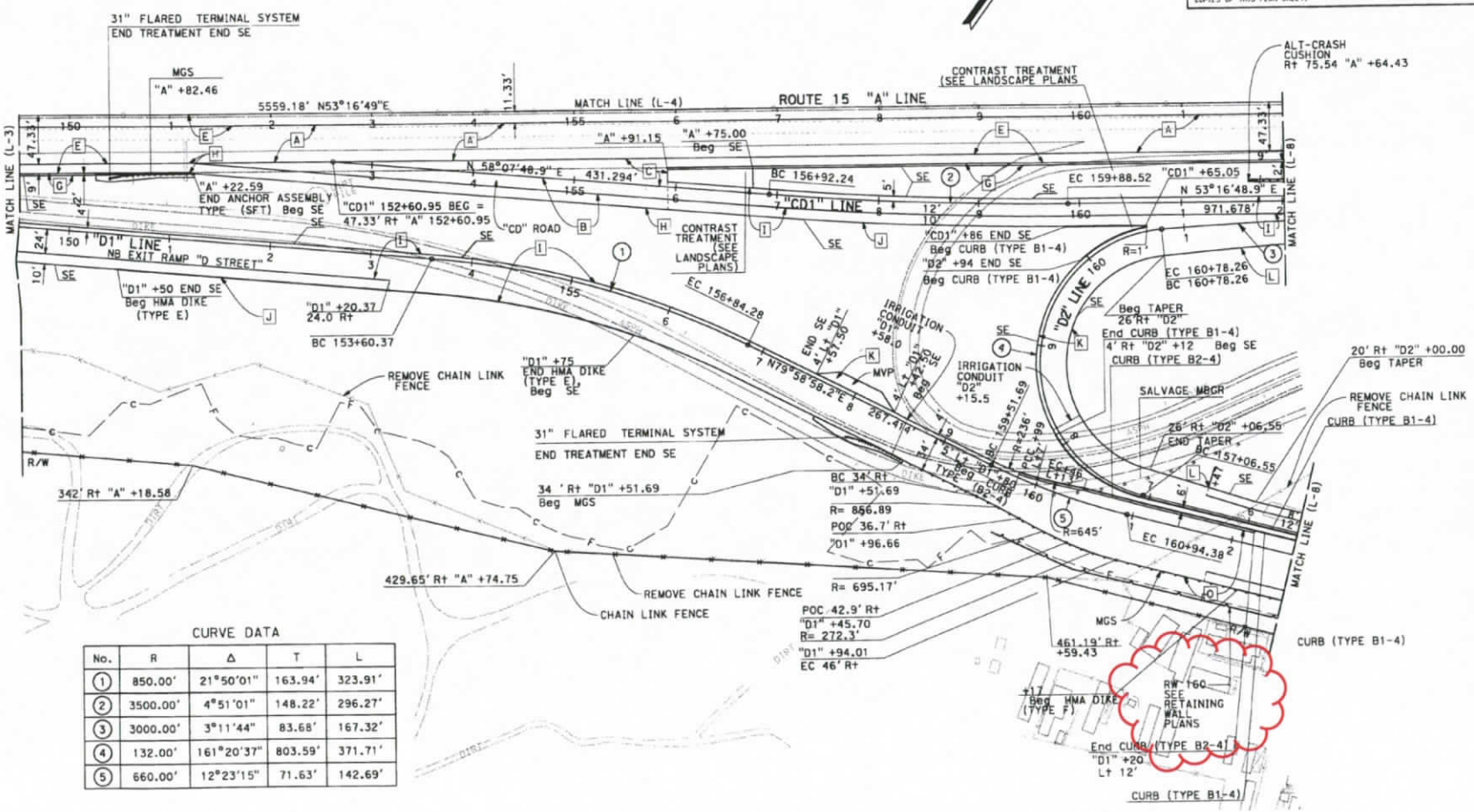
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



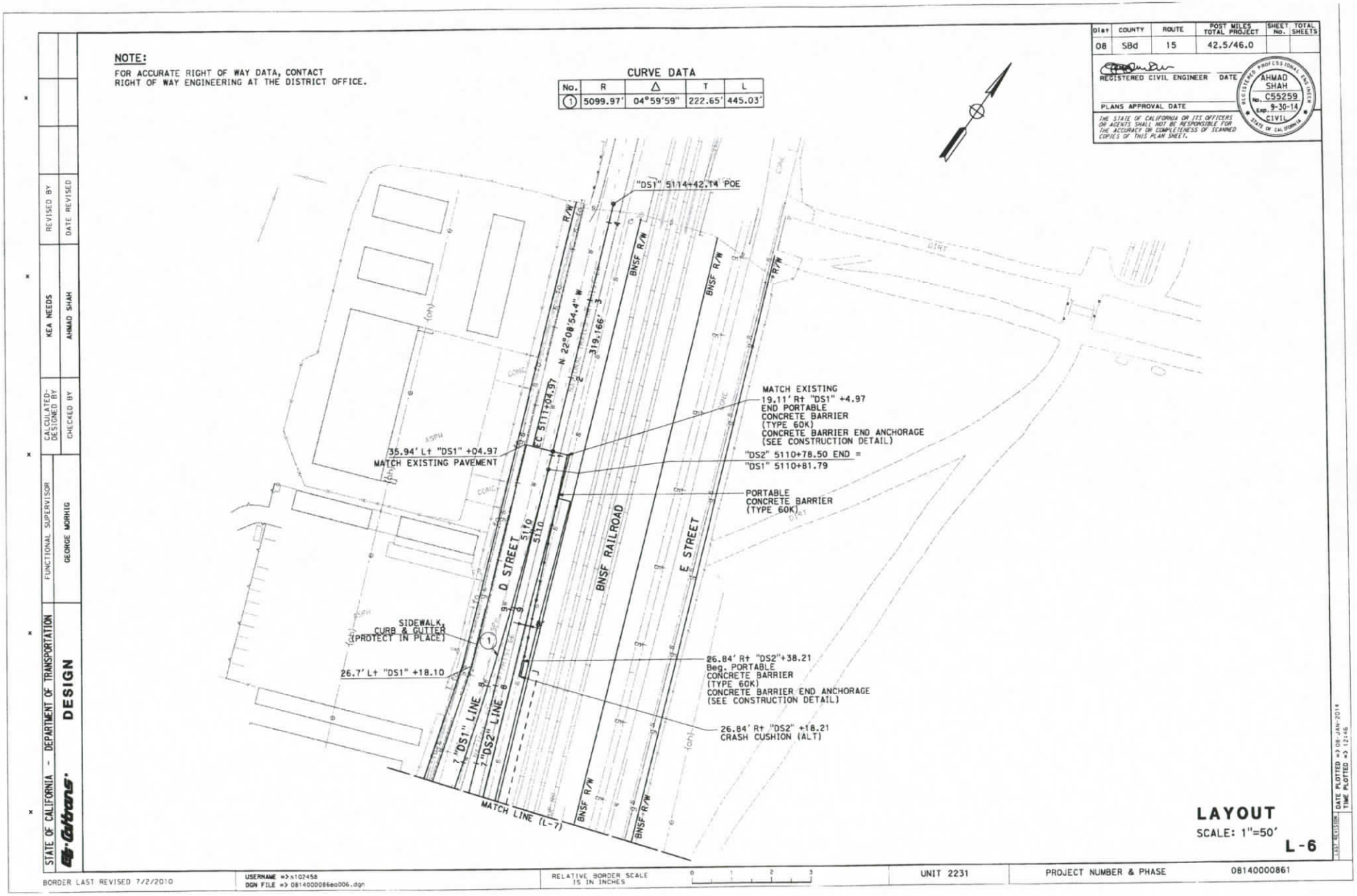
CURVE DATA

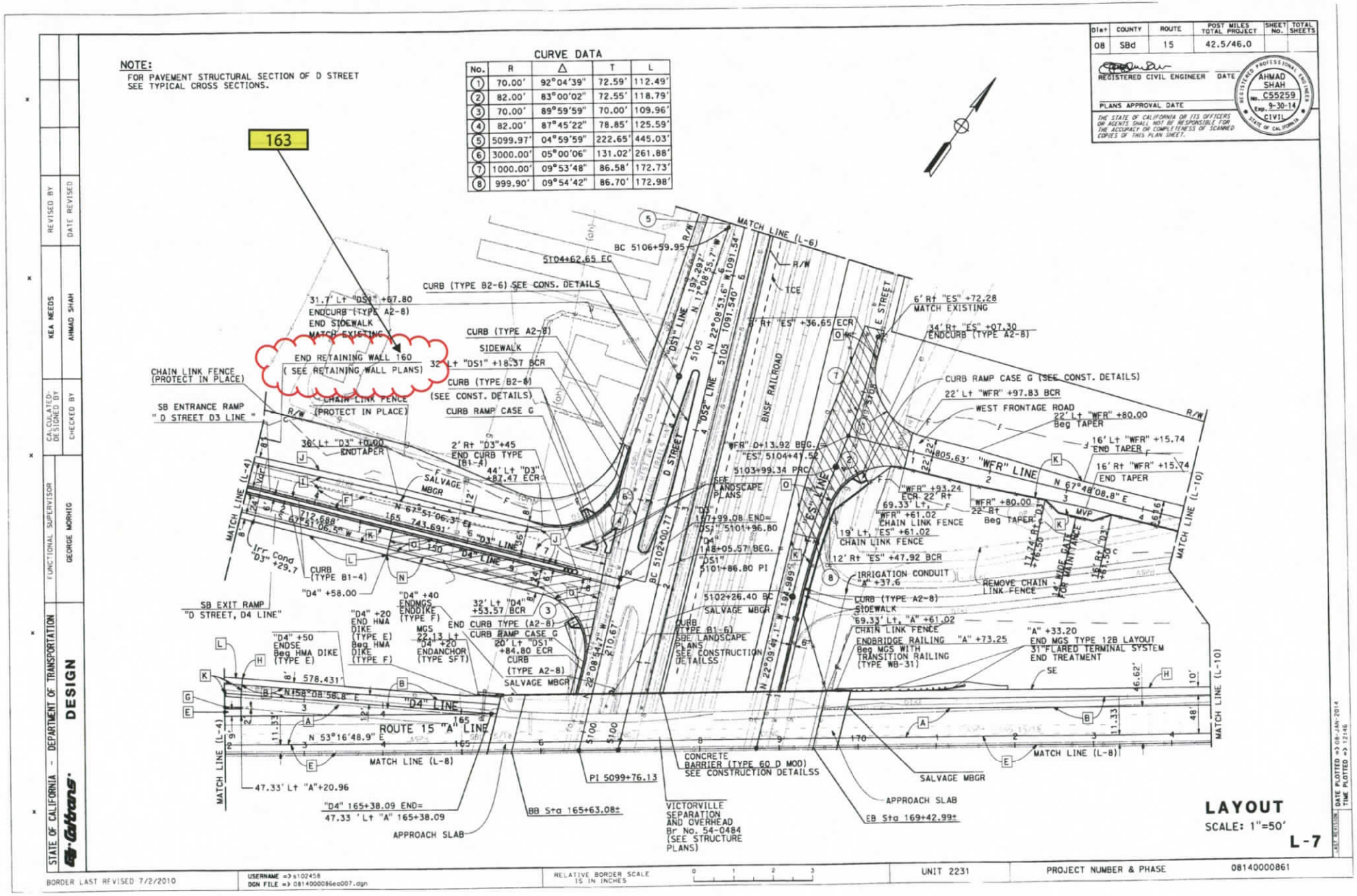
No.	R	Δ	T	L
1	850.00'	21°50'01"	163.94'	323.91'
2	3500.00'	4°51'01"	148.22'	296.27'
3	3000.00'	3°11'44"	83.68'	167.32'
4	132.00'	161°20'37"	803.59'	371.71'
5	660.00'	12°23'15"	71.63'	142.69'

LAYOUT
SCALE: 1"=50'
L-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000086ea005.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
CURVE DATA
No. R Δ T L
1 5099.97' 04°59'59" 222.65' 445.03'
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
AHMAD SHAH C55259 9-30-14 CIVIL
"DS1" 5114+42.14 POE
N 22°08'54.4" W
319.166'
EC 5111+04.97
MATCH EXISTING 19.11' Rt "DS1" +4.97 END PORTABLE CONCRETE BARRIER (TYPE 60K) CONCRETE BARRIER END ANCHORAGE (SEE CONSTRUCTION DETAIL)
"DS2" 5110+78.50 END = "DS1" 5110+81.79
PORTABLE CONCRETE BARRIER (TYPE 60K)
35.94' Lt "DS1" +04.97 MATCH EXISTING PAVEMENT
D STREET
BNSF RAILROAD
E STREET
BNSF R/W
SIDEWALK, CURB & GUTTER (PROTECT IN PLACE)
26.7' Lt "DS1" +18.10
26.84' Rt "DS2"+38.21 Beg. PORTABLE CONCRETE BARRIER (TYPE 60K) CONCRETE BARRIER END ANCHORAGE (SEE CONSTRUCTION DETAIL)
26.84' Rt "DS2" +18.21 CRASH CUSHION (ALT)
"DS1" LINE
"DS2" LINE
MATCH LINE (L-7)
LAYOUT
SCALE: 1"=50'
L-6
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORRIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086ea006.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

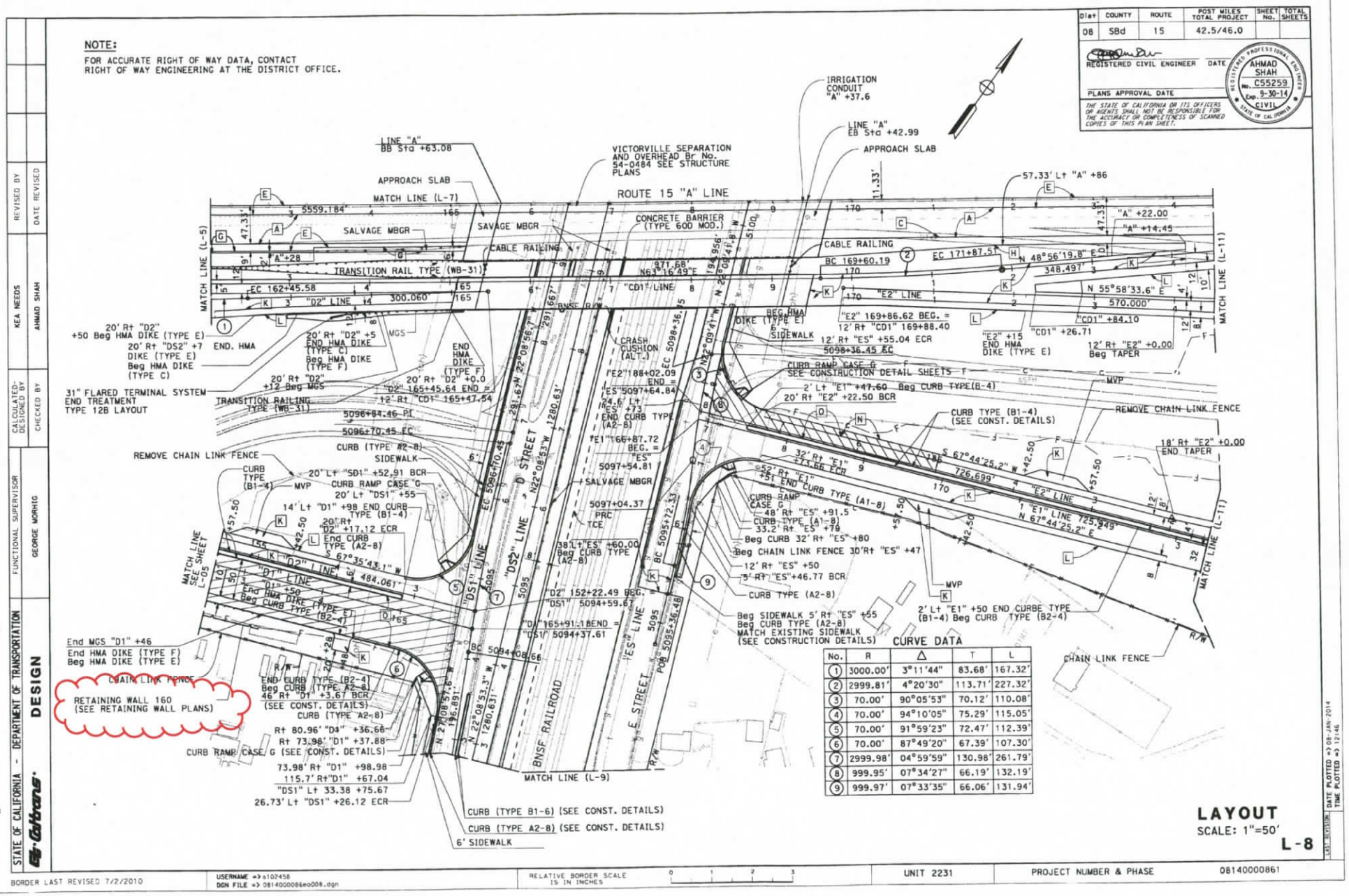


CURVE DATA

No.	R	Δ	T	L
1	70.00'	92°04'39"	72.59'	112.49'
2	82.00'	83°00'02"	72.55'	118.79'
3	70.00'	89°59'59"	70.00'	109.96'
4	82.00'	87°45'22"	78.85'	125.59'
5	5099.97'	04°59'59"	222.65'	445.03'
6	3000.00'	05°00'06"	131.02'	261.88'
7	1000.00'	09°53'48"	86.58'	172.73'
8	999.90'	09°54'42"	86.70'	172.98'

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
Dist | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No. | TOTAL SHEETS
08 | SBd | 15 | 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
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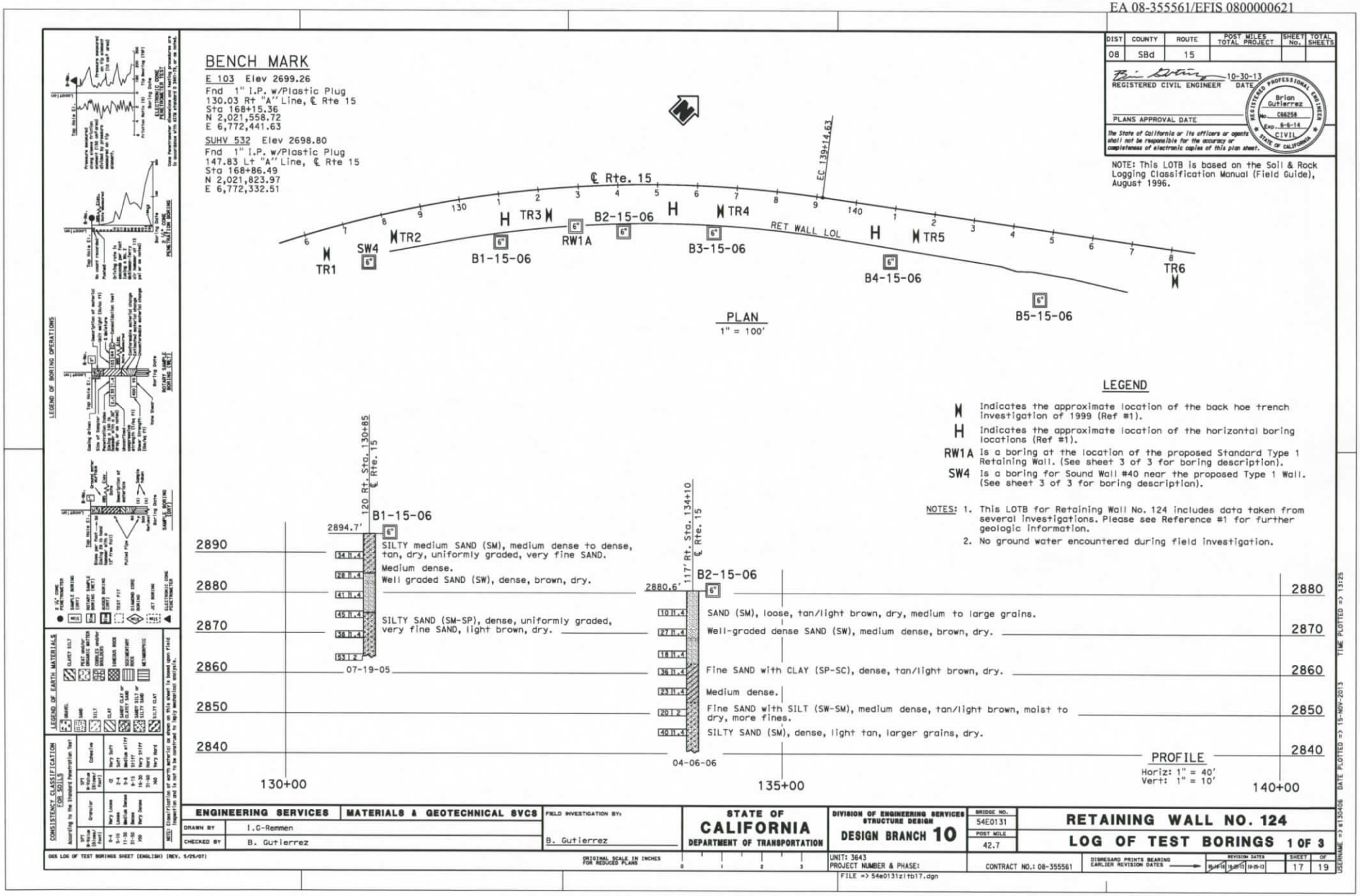
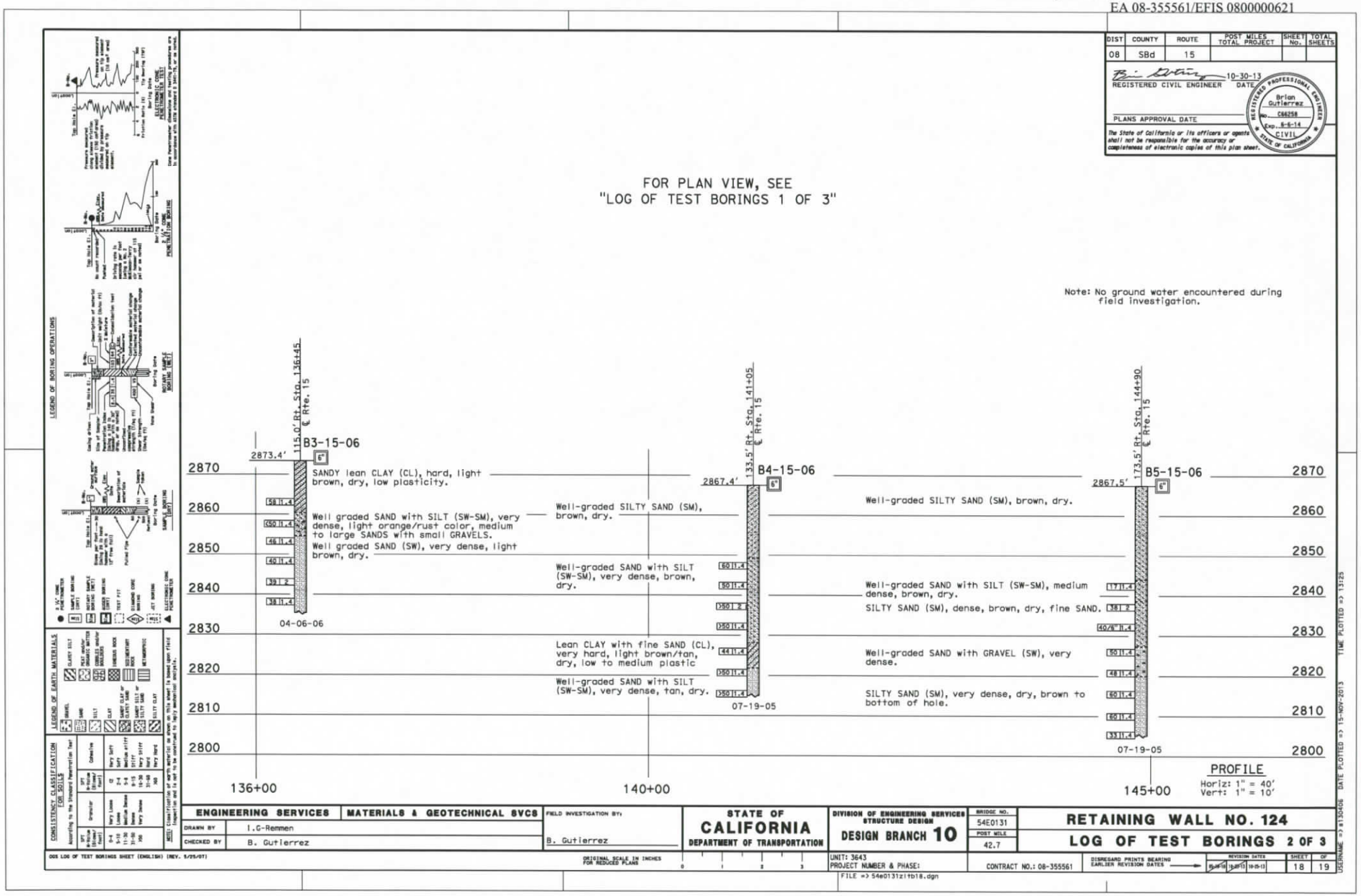
AHMAD SHAH
C55259
9-30-14
CIVIL
STATE OF CALIFORNIA
ROUTE 15 "A" LINE
IRRIGATION CONDUIT "A" +37.6
LINE "A" EB Sta +42.99
APPROACH SLAB
LINE "A" BB Sta +63.08
VICTORVILLE SEPARATION AND OVERHEAD Br No. 54-0484 SEE STRUCTURE PLANS
CONCRETE BARRIER (TYPE 60D MOD.)
SALVAGE MBGR
CABLE RAILING
TRANSITION RAIL TYPE (WB-31)
MATCH LINE (L-5)
MATCH LINE (L-11)
MATCH LINE (L-9)
MATCH LINE SEE SHEET L-05
"D2" LINE
"D1" LINE
"DS1" LINE
"DS2" LINE
"ES" LINE
"E1" LINE
"E2" LINE
D STREET
E STREET
BNSF RAILROAD
BNSF R/W
CHAIN LINK FENCE
REMOVE CHAIN LINK FENCE
RETAINING WALL 160 (SEE RETAINING WALL PLANS)
31" FLARED TERMINAL SYSTEM END TREATMENT TYPE 12B LAYOUT
CURB (TYPE B1-6) (SEE CONST. DETAILS)
CURB (TYPE A2-8) (SEE CONST. DETAILS)
6' SIDEWALK
CURB TYPE (B1-4) (SEE CONST. DETAILS)
CURB RAMP CASE G SEE CONSTRUCTION DETAIL SHEETS
MATCH EXISTING SIDEWALK (SEE CONSTRUCTION DETAILS)
CURVE DATA
No. | R | Δ | T | L
1 | 3000.00' | 3°11'44" | 83.68' | 167.32'
2 | 2999.81' | 4°20'30" | 113.71' | 227.32'
3 | 70.00' | 90°05'53" | 70.12' | 110.08'
4 | 70.00' | 94°10'05" | 75.29' | 115.05'
5 | 70.00' | 91°59'23" | 72.47' | 112.39'
6 | 70.00' | 87°49'20" | 67.39' | 107.30'
7 | 2999.98' | 04°59'59" | 130.98' | 261.79'
8 | 999.95' | 07°34'27" | 66.19' | 132.19'
9 | 999.97' | 07°33'35" | 66.06' | 131.94'
LAYOUT
SCALE: 1"=50'
L-8
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000861eo008.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE 08140000861


DIST 08
COUNTY SBd
ROUTE 15
POST MILES TOTAL PROJECT
SHEET No.
TOTAL SHEETS
REGISTERED CIVIL ENGINEER
10-30-13
DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.
BENCH MARK
E 103 Elev 2699.26
Fnd 1" I.P. w/Plastic Plug
130.03 Rt "A" Line, ℄ Rte 15
Sta 168+15.36
N 2,021,558.72
E 6,772,441.63
SUHV 532 Elev 2698.80
Fnd 1" I.P. w/Plastic Plug
147.83 Lt "A" Line, ℄ Rte 15
Sta 168+86.49
N 2,021,823.97
E 6,772,332.51
℄ Rte. 15
EC 139+14.63
RET WALL LOL
TR1
SW4
TR2
TR3
B1-15-06
RW1A
B2-15-06
B3-15-06
TR4
TR5
B4-15-06
B5-15-06
TR6
PLAN
1" = 100'
LEGEND
Indicates the approximate location of the back hoe trench investigation of 1999 (Ref #1).
Indicates the approximate location of the horizontal boring locations (Ref #1).
RW1A Is a boring at the location of the proposed Standard Type 1 Retaining Wall. (See sheet 3 of 3 for boring description).
SW4 Is a boring for Sound Wall #40 near the proposed Type 1 Wall. (See sheet 3 of 3 for boring description).
NOTES: 1. This LOTB for Retaining Wall No. 124 includes data taken from several investigations. Please see Reference #1 for further geologic information.
2. No ground water encountered during field investigation.
120 Rt. Sta. 130+85 ℄ Rte. 15
B1-15-06
2894.7'
SILTY medium SAND (SM), medium dense to dense, tan, dry, uniformly graded, very fine SAND.
Medium dense.
Well graded SAND (SW), dense, brown, dry.
SILTY SAND (SM-SP), dense, uniformly graded, very fine SAND, light brown, dry.
07-19-05
117' Rt. Sta. 134+10 ℄ Rte. 15
B2-15-06
2880.6'
SAND (SM), loose, tan/light brown, dry, medium to large grains.
Well-graded dense SAND (SW), medium dense, brown, dry.
Fine SAND with CLAY (SP-SC), dense, tan/light brown, dry.
Medium dense.
Fine SAND with SILT (SW-SM), medium dense, tan/light brown, moist to dry, more fines.
SILTY SAND (SM), dense, light tan, larger grains, dry.
04-06-06
2890
2880
2870
2860
2850
2840
130+00
135+00
140+00
PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION FOR SOILS
ENGINEERING SERVICES
MATERIALS & GEOTECHNICAL SVCS
DRAWN BY I.G-Remmen
CHECKED BY B. Gutierrez
FIELD INVESTIGATION BY: B. Gutierrez
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH 10
BRIDGE NO. 54E0131
POST MILE 42.7
RETAINING WALL NO. 124
LOG OF TEST BORINGS 1 OF 3
UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561
SHEET 17 OF 19
FILE => 54e0131zltb17.dgn
USERNAME => s130406 DATE PLOTTED => 15-NOV-2013 TIME PLOTTED => 13:25


DIST 08
COUNTY SBd
ROUTE 15
POST MILES TOTAL PROJECT
SHEET No.
TOTAL SHEETS
REGISTERED CIVIL ENGINEER
10-30-13
DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
REGISTERED PROFESSIONAL ENGINEER
Brian Gutierrez
No. C66258
Exp. 6-6-14
CIVIL
STATE OF CALIFORNIA
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 3"
Note: No ground water encountered during field investigation.
115.0' Rt. Sta. 136+45
℄ Rte. 15
B3-15-06
2873.4'
6"
SANDY lean CLAY (CL), hard, light brown, dry, low plasticity.
Well graded SAND with SILT (SW-SM), very dense, light orange/rust color, medium to large SANDS with small GRAVELS.
Well graded SAND (SW), very dense, light brown, dry.
04-06-06
133.5' Rt. Sta. 141+05
℄ Rte. 15
B4-15-06
2867.4'
Well-graded SILTY SAND (SM), brown, dry.
Well-graded SAND with SILT (SW-SM), very dense, brown, dry.
Lean CLAY with fine SAND (CL), very hard, light brown/tan, dry, low to medium plastic
Well-graded SAND with SILT (SW-SM), very dense, tan, dry.
07-19-05
173.5' Rt. Sta. 144+90
℄ Rte. 15
B5-15-06
2867.5'
Well-graded SILTY SAND (SM), brown, dry.
Well-graded SAND with SILT (SW-SM), medium dense, brown, dry.
SILTY SAND (SM), dense, brown, dry, fine SAND.
Well-graded SAND with GRAVEL (SW), very dense.
SILTY SAND (SM), very dense, dry, brown to bottom of hole.
07-19-05
2870
2860
2850
2840
2830
2820
2810
2800
136+00
140+00
145+00
PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION FOR SOILS
ENGINEERING SERVICES
MATERIALS & GEOTECHNICAL SVCS
DRAWN BY I.G-Remmen
CHECKED BY B. Gutierrez
FIELD INVESTIGATION BY: B. Gutierrez
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 10
BRIDGE NO. 54E0131
POST MILE 42.7
RETAINING WALL NO. 124
LOG OF TEST BORINGS 2 OF 3
UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561
DISREGARD PRINTS BEARING EARLIER REVISION DATES
SHEET 18 OF 19
FILE => 54e0131zltb18.dgn
USERNAME => s130406 DATE PLOTTED => 15-NOV-2013 TIME PLOTTED => 13:25

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

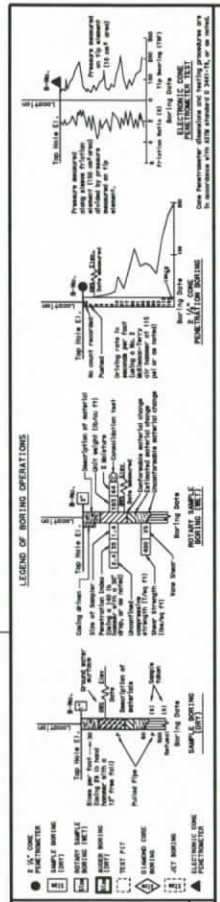
REGISTERED CIVIL ENGINEER 10-30-13 DATE

PLANS APPROVAL DATE

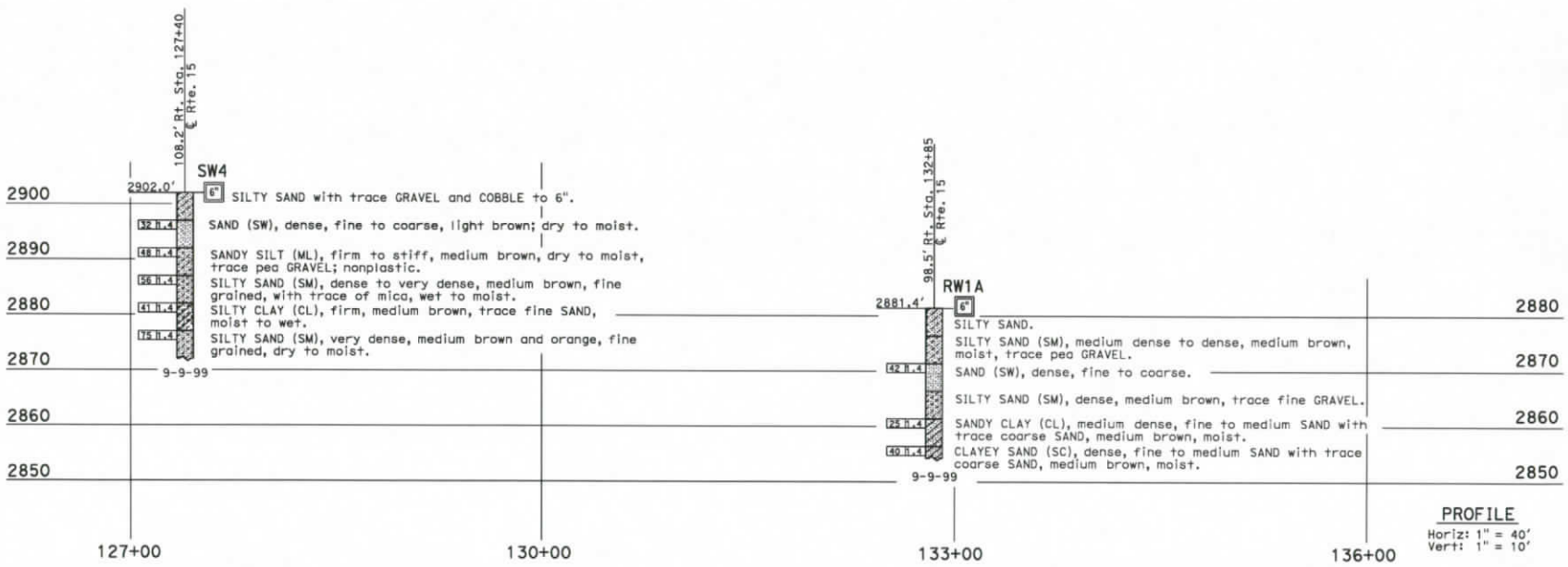
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER Brian Gutierrez No. C66258 Exp. 6-6-14 CIVIL STATE OF CALIFORNIA

NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.



FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 3"



ENGINEERING SERVICES	MATERIALS & GEOTECHNICAL SVCS
DRAWN BY	I.C-Remmen
CHECKED BY	B. Gutierrez

FIELD INVESTIGATION BY: B. Gutierrez

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10

BRIDGE NO. 54E0131 POST MILE 42.7

RETAINING WALL NO. 124
LOG OF TEST BORINGS 3 OF 3

DGS LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 5/25/07)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10-25-13

SHEET 19 OF 19

FILE => 54e0131zltb19.dgn

USERNAME => s130406 DATE PLOTTED => 15-NOV-2013 TIME PLOTTED => 13:25

Memorandum

To: MR. MUSTAPHA RAOUF
Office Chief, Design "C"
District 08, 11th Floor
MS # 971

Attention: Mr. Ahmad Shah

Date: January 29, 2010

File: 08-SBD-15-PM 41.9/46.0
08-355561

Retaining Wall #160
Retaining Wall #229

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2

Subject: Foundation Recommendations

As requested, dated October 26, 2009, the Office of Geotechnical Design – South 2, has completed Foundation Recommendations for the proposed Retaining Walls #160 and #229.

This study consisted of as-built information from nearby structures, the Geotechnical Design Report for Route 15 Widening Project, dated February 29, 2000 (GDR), and current subsurface foundation investigations of the Victorville Separation & Overhead (Widen) project, Bridge number 54-0484 and the Stoddard Wells (Replace) project, Bridge number 54-1210. All elevations referenced in this memo are in feet, and are referenced to the 1988 NAVD Datum.

Project / Site Description

The proposed project sites are located in Victorville, near to Interstate 15. The proposed Retaining Wall #160 is located on the "D" Street northbound off ramp. It is approximately 309 ft long, located on the south side of the off ramp between stations 160+00 and 163+09. The proposed Retaining Wall # 229 is located on the Stoddard Wells southbound on ramp. It is approximately 440 ft long, located on the north side of the on ramp, between station 225+20 and 229+60.

Regional Geology

Victorville lies within the Mojave Desert Geomorphic Province. The province can be divided into the West Mojave Subprovince and the East Mojave Subprovince. The divide between the subprovinces is the Mojave River. The subprovinces encompass a wide range of rock types and ages from sedimentary to volcanic and granitic, ranging in ages from the Late Paleozoic, Mesozoic to recent Quaternary ages. The area is characterized by north-west and east-west trending faults, large alluvial plains, internally terminating large drainages, playas, large low relief expanses of hills and mountains comprised of Metamorphic rocks, intrusive granitics, volcanics and alluvium. Rock material exposed within the subprovinces is comprised of intensely to moderately weathered and intensely to moderately fractured crystalline rock. The city of Victorville lies in a relatively flat

sandy alluvium valley. This alluvium is layered with some river gravels interspersed with clayey silts.

Site Geology

Retaining Wall #160
Subsurface data obtained from the Victorville Separation & Overhead (Widen) project indicate the soils are well graded SANDS (SW) inconsistently interlayered with poorly graded SANDS (SP), GRAVELS, SILTS and CLAYS, light grayish brown to brown, medium dense to dense, moist to wet.

Groundwater was reported in all borings performed in the Victorville Separation & Overhead project's 2009 subsurface investigation. Groundwater was encountered at approximate elevation 2692 ft. It is not anticipated that groundwater will be encountered during construction of the retaining wall, however, surface flows may occur due to seasonal rain run off.

Retaining Wall #229
Subsurface data obtained from the Stoddard Wells (Widen) project indicate the soils are fine to coarse well graded SAND (SW) with SILT and trace GRAVELS, yellowish brown, medium dense to dense, moist. Soils overlay monzogranitic Igneous rock; light yellowish grey, moderately soft to hard, moderately fractured, intensely to moderately weathered.

Groundwater was not encountered in the borings performed in the Stoddard Wells project's 2009 subsurface investigation to the explored elevation of 2668 feet. It is not anticipated that groundwater will be encountered during construction of the retaining wall, however, surface flows may occur due to seasonal rain run off.

Corrosion

Information obtained from the GDR indicates that the site soils are not considered corrosive. Normal design techniques and construction may be used.

Foundation Recommendations

Retaining Wall # 160
The following foundation recommendations are for the proposed Retaining Wall #160 as shown on the Geotech Request, plot dated 09/14/2009, and the cross sections plot dated 7/28/2009. The proposed structure may be supported on spread footings at all support locations. Refer to the recommendations provided in the Table below for the minimum footing width for the specified maximum wall height and the recommended Gross Allowable Soil bearing pressure to be used in design. The values shown in the Table below are based on Case III loading. The soil supporting the proposed wall will be a combination of new fill material and original ground material. It is expected that the soil supporting the proposed wall foundations will be dense and capable of supporting standard Type 1 retaining wall for any given wall height shown in the Standard Plans, sheet B3-1. The gross allowable soil bearing pressure will meet or exceed the maximum footing pressure listed for any loading case in the Standard Plans (May 2006).

Retaining Wall #160 Spread Footing Data

Approximate Support Location of Retaining Wall #160 from the "SD-15" Line	Wall Type	Maximum Wall Height	Minimum Footing Width for Max Wall Height	Recommended Soil Bearing Pressures	
				ASD [1]	LFD [2]
				Gross Allowable Soil Bearing Pressure (q_{all})	Ultimate Soil Bearing Pressure (q_{ult}^*)
430 ft Rt. "CL15"160+00 to 510 ft Rt "CL15" 163+09	Type 1	24 ft	13ft 3in	5.8 ksf	N/A

Notes: 1) Allowable Stress Design, (ASD). The Maximum Contact Pressure, (q_{max}), is not to exceed the recommended Gross Allowable Soil Bearing Pressure, (q_{all}). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed 3 times the recommended Gross Allowable Soil Bearing Pressure, (q_{all}).
2) Load Factor Design, (LFD). The Maximum Contact Pressure, (q_{max}), divided by the Strength Reduction Factor, (ϕ), is not to exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*).

Retaining Wall # 229

The following foundation recommendations are for the proposed Retaining Wall #229 as shown on the Geotech Request, plot dated 09/14/2009, and the cross sections plot dated 7/28/2009. The proposed structure may be supported on spread footings at all support locations. Refer to the recommendations provided in the Table below for the minimum footing width for the specified maximum wall height and the recommended Gross Allowable Soil bearing pressure to be used in design. The values shown in the Table below are based on Case I loading. The soil supporting the proposed wall foundations is expected to be dense and capable of supporting any standard Type 1 retaining wall for any given wall height shown in the Standard Plans, sheet B3-1. The gross allowable soil bearing pressure will meet or exceed the maximum footing pressure listed for any loading case in the Standard Plans (May 2006).

Retaining Wall #229 Spread Footing Data

Approximate Support Location of Retaining Wall #229 from the "SD-15" Line	Wall Type	Maximum Wall Height	Minimum Footing Width for Max Wall Height	Recommended Soil Bearing Pressures	
				ASD [1]	LFD [2]
				Gross Allowable Soil Bearing Pressure (q_{all})	Ultimate Soil Bearing Pressure (q_{ult}^*)
88 ft Lt. "CL15"227+60 to 118 ft Lt "CL15" 230+80	Type 1	4 ft	3ft 3in	1.7 ksf	N/A

Notes: 1) Allowable Stress Design, (ASD). The Maximum Contact Pressure, (q_{max}), is not to exceed the recommended Gross Allowable Soil Bearing Pressure, (q_{all}). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed 3 times the recommended Gross Allowable Soil Bearing Pressure, (q_{all}).
2) Load Factor Design, (LFD). The Maximum Contact Pressure, (q_{max}), divided by the Strength Reduction Factor, (ϕ), is not to exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*).

General Notes

1. Should there be any reduction in the minimum spread footing width, or an increase in the wall heights or maximum allowable slope, our Office shall be notified to reevaluate the recommended gross allowable bearing capacity.

2. All support locations are to be plotted on the Log of Test Borings in plan view. The plotting of support locations should be made prior to requesting a foundation review.

Construction Considerations

The footing concrete shall be placed neat against the recompacted soil at the bottom of the footing excavation. If the soils at the bottom of the excavation are disturbed or loosened, they shall be re-compacted to 95% relative density prior to placing any concrete or steel.

The recommendations contained in this report are based on specific project information regarding wall heights, and wall locations that have been provided to Office of Geotechnical Design – South 2, Branch C. If any conceptual changes are made during final project design, our Office should review those changes to determine if the foundation recommendations contained in this report are still applicable.

Any questions regarding the above recommendations should be directed to Gina Pursell, (916) 227-4539, or Shawn Wei, (916) 227-5252, of Office of Geotechnical Design – South 2, Branch C.

Report by: Date:

1/29/10

GINA W. PURSELL, R.C.E. # 54512
Materials & Research Engineer
Office of Geotechnical Design – South 2, Branch C

REGISTERED PROFESSIONAL ENGINEER
GINA W. PURSELL
No. 54512
Exp. 12-31-11
CIVIL
STATE OF CALIFORNIA

c: R.E. Pending File
OGDS2 - SWei
Geology – North
Geology - South

State of California | Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: MUSTAPHA RAOUF- 08
Design C, G & Agreements -
MS 971

Attn: Ahmad Shah

Date: May 17, 2010
File: 08-355560
08- SBd-15
Retaining Wall #124

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services MS 5
Office of Geotechnical Design – South 2, Branch C

Subject: Amended Geotechnical Design Report

As requested by your Office on March 3, 2006, our Office has prepared this Amendment to the previous Geotechnical Design Report (GDR), dated July 28, 2007, for the freeway-widening project along interstate 15 east of Victorville in San Bernardino County. The 2007 GDR was in Metric units and this Amendment is in English units. This Amendment provides geotechnical information and foundation recommendations for the proposed Retaining Wall #124. The following geotechnical information is based on our site investigation, and a review of existing retaining wall and bridge Log of Test Borings (LOTBs) with EA 08-355560 dated between 1956 and 2005. For additional detailed geology information please see the previous GDR dated February 2000.

SUBSURFACE INVESTIGATION

Our office visited the project area and conducted a site investigation in order to explore the sub-surface soil conditions and to obtain soil samples for laboratory testing. The subsurface exploration utilized a B-47 trailer mounted drill rig, a horizontal drill rig, a cone penetrometer testing (CPT) rig, and a backhoe. The CPT rig was utilized to advance 6 sounding through the asphalt-paved shoulder along the freeway to investigate the drivability of sheet piling shoring. The backhoe was utilized to excavate 6 trenches in order to visually log the existing slope material. Three horizontal augured boreholes we advanced into the slope to evaluate the potential of bore holes caving during construction.

Sampling was accomplished with the B-47 drill rig performing Standard Penetration Testing (SPT) every 5 feet or where needed. Blow counts from the SPT were recorded in the LOTBs. The deepest boring extended to an elevation of 875 feet, which is approximately 50 feet below the existing roadway surface. Soil samples collected from the 2 inch-diameter SPT spoon sampler were packaged in zip-lock bags and bulk bag samples were collected from auger cuttings. Samples for testing were delivered to the District 7 Laboratory and to the Sacramento Laboratory. Log of Test Borings will be provided when they are completed.

Laboratory Testing

Laboratory tests performed on the collected samples included: Mechanical Analysis (California Test Method 202), Moisture Content (CTM 226), Plasticity Indexing (CTM 204) and Corrosion (CTM 643). Gradation plots and corrosion test results are presented in the GDR dated 2000.

In-Situ testing
In-situ testing for this report included Standard Penetration Tests (SPT) which were performed at all vertical boring locations. Percolation testing was conducted with in the area of the proposed detention basins.

Project Site Seismicity
The controlling fault for the site is the Heledale Fault which is a 56 mile long right-lateral fault. The Heledale Fault is capable of a Maximum Credible Earthquake (MCE) of 7.25 and is located about 11 miles northeast of the site according to seismic design recommendation. The peak horizontal bedrock acceleration at the site, based on Caltrans California Hazard Map, is estimated to be 0.4g

RETAINING WALLS

This section describes the methodology used for design of the proposed Retaining Wall, including the selection of soil strength parameters, the proposed slope and wall geometry, and analyzing the estimated soil parameters and wall dimensions for failure resulting from sliding, overturning and soil bearing capacity. The section closes with a presentation of calculated Factors of Safety (FOS) obtained from the slope stability, SNAILZ and bearing capacity analysis.

Retaining Wall #124
Based on information from the District, the design length of Retaining Wall #124, Alternative 2, is approximately 1858 feet long from station 123+22 to 141+80. Proposed wall heights range from approximately 6 feet to 25 feet. The proposed finished slope above Retaining Wall #42 will typically continue from the top of wall at a slope of approximately 27 degrees from horizontal, to the hinge point at the top of slope. The proposed finished slopes above the wall will range in length between 3 and 40 feet. Between stations 121+80 and 134+80, Soundwall #40, which is 10 feet in height, has been constructed on piles on the slope bench along the Caltrans Right of Way. Between station 137+00 and 144+45, the existing Caltrans Right of Way runs along the slope hinge, graded lots and residential houses occupy the area adjacent to Right of Way.

As requested by District, this office analyzed both a Standard Type 1 Retaining Wall and a Soil Nail Wall along the proposed LOL of Retaining Wall #124. After consulting with Caltrans Retaining Wall Specialists, a Standard Type 1 Retaining Wall was rejected due to potential access problems during wall construction related to the cost and difficulty of constructing the temporary shoring required for a Standard Type 1 Retaining Wall. Additionally it is our understanding that District is currently in the process of obtaining permanent subsurface easement for soil nails that are anticipated to extent beyond the current Caltrans Right of Way.

Selection of Soil Strength and Design Parameters
The SPT data from the subsurface investigation for Wall #124 averaged 41 blows per foot near the proposed soil nail area. In general, soil samples from the site were classified as medium dense silty SAND (SM) although one sample from boring B2-15 indicated loose sands on the top 5 feet below ground surface. From these in-situ and Laboratory test results, we estimated the general soil

parameters to be: an angle of internal friction of 33 degrees, Cohesion of 100 psf and a moist unit weight of 130 lb/ft^3.

Wall Design and Analysis

The above soil strength parameters, slope and wall geometry were inputted into the limit equilibrium computer program SNAILZ, created by Caltrans, to determine possible combinations of nail lengths, spacing and the associated Fact of Safety (FOS) for material estimating. A nail inclination angle of 15 degrees and soil nail diameter of 1 inch were design inputs used. In general, between stations 123+22 and 140+50, the soil nails can be spaced on 5 foot centers both vertically and horizontally. Between stations 140 +50 and 141+80 the soil nails could be spaced on 4 foot centers both vertically and horizontally.

Table 1: Wall #42 General Soil Nail Data

Start Station	End Station	Height Range (feet)	Soil Nail Length (feet)
123+22	129+39	10 to 20	16
129+39	140+58	23 to 26	26
140+58	141+80	20 to 30	35

Recommendations

The soil nail design pullout resistance is recommended to be 3,300 lb/ft. Contractor will select drilled hole diameter and soil nail size to meet the design capacity. Loose and/or caving sands may be encountered in the top 5 feet of slope during wall construction, the first row of nails may require a short section of casing. The top row of nails should be placed a maximum of 2 feet below the top of the wall. All construction operations should comply with the special specifications provisions, Section 10.1, based on the following recommended Wall Zones.

Wall Zones

Soil nail Wall #124 will be separated into four zones for soil nail testing and temporary open cut duration purposes. Zone 1 will cover the top 5 feet, of the full face of the wall. Zone 2 through Zone 4 will cover the wall profile betweens stations as listed in the following Table 2.

Table 2: Wall #124 Soil Zones

Wall Zones	Start Station	End Station	Elevation Range
1	123+22	141+80	Top 5 feet of wall
2	123+22	129+39	5 feet below Zone 1
3	129+39	140+58	5 feet below Zone 2
4	140+58	141+80	Bottom of Zone 3 to bottom of wall

Test Nails

The Contractor will perform verification testing and proof testing as specified in the Construction Specifications. A minimum of eight percent (8%)of the total number of nails shall be proof tested.

Construction Considerations

No groundwater was noted on the existing LOTB, and groundwater should not be encountered during soil nail installation. Compressed air should not be introduced into the borehole as the air will dry out the sands and cause them to slough and cave. There is a potential that layers of loose sands will be encountered during construction, holes drilled in loose sands may require casing near the surface. All holes drilled for soil nails should be grouted the same day they are drilled; no holes shall be left open overnight.

Corrosion

The Materials Engineering and Testing Services, testing and technology Branch has performed corrosion tests on soil samples from the field investigation. Test results indicate soils at the site are not considered corrosive. Normal design techniques and construction can be used.

If you require further information, please contact Brian Gutierrez at (916) 227-1222 or Shawn Wei at (916) 227-5252.

Prepared by: Date:

5-17-2010

BRIAN GUTIERREZ, P.E.
Branch C
Office of Geotechnical Design- South 2

REGISTERED PROFESSIONAL ENGINEER
BRIAN A. GUTIERREZ
No. 66258
Exp. 06/10
CIVIL
STATE OF CALIFORNIA

cc: AAbghari - GDS2
SWei – GDS2
Project File – South
R.E. Pending file

Memorandum

To: MR. DAN ADAMS, CHIEF
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES MS#9-48I
OFFICE OF BRIDGE DESIGN CENTRAL
STRUCTURES DESIGN BRANCH - 10

Date: November 04, 2013

File: 08-SBD-15-PM 44.4
EA 08-355561
E-FIS 0800000621

Attention: Mr. Ryan Stiltz

Stoddard Wells Road OC
(Widen)
Br. No. 54-0535

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: Revised Foundation Report

Introduction

This report supersedes the Foundation Report dated August 15, 2013 and presents foundation and seismic design recommendations for the proposed widening of the existing Stoddard Wells Road Overcrossing (OC), Bridge No. 54-0535 on Interstate 15 in the City of Victorville, within San Bernardino County.

The foundation and seismic recommendations contained in this report are based on our review of available General plan, detail sheets (July 12, 2013), Structures Loads (May 23, 2013), subsurface explorations (1956, and 2013), and your request letter dated February 11, 2013. Elevations referenced in this report are based on the NGVD29 vertical datum, unless otherwise indicated.

Project/Site Description

The existing bridge is located on Interstate 15, at Post Mile 44.4 in the City of Victorville, within San Bernardino County. The existing Stoddard Wells Road OC Bridge was built in 1958 as a four span continuous Reinforced Concrete "T" girder (4), supported on Reinforced Concrete two column bents, and diaphragm abutments founded on 45-ton concrete driven piles. The total length and width of the existing bridge are approximately 196 feet and 32.3 feet, respectively.

Proposed Improvements

The existing bridge is planned to be widened approximately 6 feet on each side. The widening will consist of a precast I-girder on each side of the existing bridge supported by a 6 feet pier wall extension doweled into the existing columns and footings. The existing end diaphragm abutments are on pile foundations planned to be widened in kind. In addition, the proposed widening will accommodate pedestrian and wide shoulders. It is recommended by Structures Design (SD) to use Caltrans Class 90 and 140 Alternative "W" driven piles for abutment and bent locations, respectively for the planned widening.

In addition to the planned widening of the existing bridge, it is proposed to carry out seismic retrofit with pier infill walls at the bent locations.

Geologic Setting

The proposed bridge site is located within the Mojave Desert Geomorphic Province of California. The present Mojave desert is the elevated western most extension of the Sonoran Desert, situated between the Transverse Ranges across the San Andres fault on the southwest, the Sierra Nevada Mountains and Basin and Range province on the north across the Garlock fault, and the Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region. The local geology consists of embankment fill, modern alluvium in the Mojave River flood plain, with bedrock and outcrops and mountains of "granitic" rock capped by a metamorphic carbonate skarn.

Geotechnical Investigation

The 1956 As-built Log of Test Borings (LOTB) sheet shows that two 3-inch diameter rotary auger borings and two 2-1/4 inches diameter cone penetrometer soundings were performed prior to the construction of the existing bridge. The borings were drilled to depths approximately ranging from 32 to 43 feet (elevation 2676 to 2667 feet) and the cone penetrometer borings were advanced to depths approximately ranging from 35 to 36 feet (elevation 2675 to 2672 feet) below the existing natural grades. We are assuming refusal of the cone penetrameter to advance deeper at their termination depths.

In addition, the Office of Geotechnical Design South-2 had performed subsurface geotechnical investigations from March 12 through March 21 in 2013.

This subsurface geotechnical exploration included five 4-inch diameter rotary wash borings. The maximum depth of the investigation was approximately 90.0 feet (elevation 2605 feet) below the existing ground surface. The rotary wash information in this report including stations, top of borehole elevations, depths, and groundwater level measurements are summarized in Table 1.

Table 1. Mud Rotary Wash Borings Data

Boring Number	Station Stoddard Wells Road (feet)	Top of Borehole Elevation (feet)	Exploration Depth (feet)	Groundwater Elevation (feet)
R13-001	2+90	2,726.0	80.0	Did not measure
R13-002	5+05	2,730.3	90.0	2,683.3
R13-003	3+96	2,710.4	80.0	Did not measure
R13-004	4+40	2,704.8	84.0	2,682.8
R13-005	3+39	2,709.2	80.0	2,684.2

Refer to Log of Test Borings (LOTB) for boring locations, top of borehole elevations, depths, groundwater level measurements and other details.

Subsurface Conditions

The subsurface characterization of the site is based on borings drilled in 1956 and 2013. The soil materials at this site consist of embankment fills (20-23 feet thick), recent alluvial deposits (Qal), and igneous (monzogranitic) rock. The depth of flood plain alluvium varies from 35 to 67 feet (elevation 2675 to 2663 feet), and consists of loose to very dense combination of well to poorly graded silty sand, clayey sand and sands with gravel and cobbles, overlying weathered to fresh, decomposed to hard granitic rock, that increases in freshness and hardness with increasing depth along the bridge alignment.

Bedrock was encountered from elevation 2,663 through 2,672 feet during 2013 subsurface geotechnical investigation. Refer to Log of Test Borings for more details, and boring locations. The 2013 LOTB will be sent under separate cover.

Based on the Standard Penetration Test (SPT) N-values obtained from the 2013 geotechnical subsurface investigation, the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30} = 330 m/s (1082 ft/s).

Groundwater

In 1956 and 2013 subsurface geotechnical investigation, groundwater was encountered and measured at several borings. The groundwater elevation fluctuated from 2683 to 2684 feet. Groundwater elevations on specified dates are shown on the LOTB sheets. The groundwater elevations may fluctuate due to seasonal rainfall conditions, water levels in the nearly Mojave River , as well as the local irrigation.

Liquefaction Potential Evaluation

The soil profile at each boring location was analyzed for liquefaction potential in accordance with the procedure suggested by Seed et al (1985) and modified by Youd et al (2001). The results of our analysis indicate that this site has a low potential for liquefaction.

Scour Evaluation

The proposed site is located within an area that is generally flat and there is no river, creek, or other types of hydraulic channel that crosses through the project site. Therefore, scour was not considered a design issue in foundation analysis.

Seismic Data Evaluation

Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v2.0.5, USGS 2008 Interactive Deaggregations (Beta) and 1956 and 2013 geotechnical subsurface investigations for the proposed widen bridge.

Seismicity

Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 9.3 miles (15.0 km) from the Helendale-So Lockhart fault. This fault (Fault ID 241, MMax = 7.4, strike-slip, dip = 90 degrees, vertical, Bottom and Top of Rupture Plane approximately 8.0 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure. A map showing the location of the bridge and the nearby faults is attached in Figure 1.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a minimum

deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km).

The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectrum calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to 975 year return period).

For this site, the design response spectrum is controlled by probabilistic response spectrum. The corresponding peak horizontal ground acceleration at proposed site is 0.48g. The recommended acceleration response spectrum is attached in Figure 2.

Laboratory Testing

It should be noted that there are no records of laboratory testing during the 1956 geotechnical exploration were found.

After completion of 2013 geotechnical investigations, selected soil samples at different depths of the recent Wash deposits (late Holocene, Qw) of the flood plain alluvium were evaluated by mechanical analysis, moisture content and Atterberg limits (plasticity). All tests were performed in accordance with the American Society for Testing and Material (ASTM) standards, and results of the tests are included in Appendix A.

Corrosion Evaluation

Representative soil samples collected from the field investigation in 2013 were tested to determine the corrosion potential of the in-situ soils. The results of these tests are presented in Table 3. Caltrans considers a site to be corrosive for structural elements, if one or more of the following conditions exist for the representative soil and /or water samples taken at the site:
Chloride concentration is 500 ppm or greater, sulfate concentration is 2000 ppm or greater, or the pH is 5.5 or less.

TABLE 3. SUMMARY OF CORROSION TESTS

Boring No.	Top of Borehole Elevation (feet)	Sample at Elevation (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B13-01	2,726.8	2,721.0	Sands	7,300	8.75	N/A	N/A
B13-02	2,730.3	2,725.3	Sands	4,710	8.81	N/A	N/A
B13-03	2,710.4	2,700.4	Sands	1,274	7.60	N/A	N/A
B13-04	2,704.8	2,699.8	Sands	4,503	9.10	N/A	N/A
B13-05	2,709.2	2,704.2	Sands	5,019	9.52	N/A	N/A

The laboratory test results indicate that the streambed alluvium underlying the site will be non-corrosive to the proposed pile foundations.

Settlement

Subsurface soils are composed of predominantly granular material. Therefore, long-term consolidation settlement is not expected. A fill delay period of 15 days is recommended to overcome effects of any immediate settlement.

As-Built Foundation Data

The foundation data shown in Table-4 are based on as-built plans dated 1958.

TABLE 4. AS-BUILT FOUNDATION DATA

Support Locations	Foundation Type	Design Loading	Average Length (feet)
Abut. 01	Driven Concrete Pile	45 tons	27.5
Bent 02			13.1
Bent 03			12.9
Bent 04			13.1
Abut. 05			32.7

Foundation Recommendations

The following recommendations are for the proposed Stoddard Wells Road OC (Bridge No. 54-0535) as shown on the General Plan dated July 12, 2013. The proposed widening of the Stoddard Wells Road OC (Bridge No. 54-0535) will be supported on Caltrans Standard Class 90 and 140 Alternative "W" driven piles for abutment and bent locations, respectively. These piles should be installed in

accordance with Section 49-1 and 49-2 of the Caltrans' Standard Specifications (Caltrans' 2010).

The specified pile tip elevations are listed below in Tables 5 and 6. The calculated geotechnical capacities of all Caltrans Standard Class 90 Alternative "W" piles are based on skin friction and end-bearing.

The three controlling LRFD limit states loads (Service-I Limit State, Strength Limit State, and Extreme Event Limit State) are shown in the tables 7 and 8.

As per section 49-2.01C (4) of standard specifications, driven piles at abutments 1 and 5 should be installed through predrilled holes drilled to elevation 2700 ft.

TABLE 5. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS 1 AND 5

Stoddard Wells Road OC (Widen), Bridge No. 54-0535 Abutment Foundations Design Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 90 Alt. "W"	2,720	90	25	90	180	2,680 (a)	2,680	180
Abut. 5	Class 90 Alt. "W"	2,720	90	25	90	180	2,670 (a)	2,670	180

Note:
Design tip elevations are controlled by: (a) Compression

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TABLE 6. FOUNDATION RECOMMENDATIONS FOR BENTS 2 THROUGH 4

Stoddard Wells Road OC (Widen), Bridge No. 54-0535 Bents Foundations Design Recommendations											
Support Location	Pile Type	Cut-off -Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance Per Pile (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2	Class 140 Alt. "W"	2,703.8	455	1	180	0	75	0	2,668 (a-I) 2,673 (a-II) 2,683 (d)	2,668	260
Bent 3	Class 140 Alt. "W"	2,703.8	455	1	180	0	75	0	2,668 (a-I) 2,673 (a-II) 2,683 (d)	2,668	260
Bent 4	Class 140 Alt. "W"	2,703.8	455	1	180	0	75	0	2,670 (a-I 2,675 (a-II) 2,683 (d)	2,670	260

Notes:

1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (d) Lateral Load
2) The specified tip elevation shall not be raised above the design tip elevations for lateral.

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TABLE 7. PILE DATA TABLE

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1	Class 90 Alt "W"	180	0	2,680 (a)	2,680	180
Bent 2	Class 140 Alt "W"	260	0	2,668 (a) 2,683 (d)	2,668	260
Bent 3	Class 140 Alt "W"	260	0	2,668 (a) 2,683 (d)	2,668	260
Bent 4	Class 140 Alt "W"	260	0	2,670 (a) 2,683 (d)	2,670	260
Abut 5	Class 90 Alt "W"	180	0	2,670 (a)	2,670	180

Notes:
1) Design tip elevations for **Abutments** are controlled by: (a) Compression
2) Design tip elevations for **Bents** are controlled by: (a) Compression, (d) Lateral Load

TABLE 8. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Stoddard Wells Road OC (Widen), Bridge No. 54-0535 Foundation Design Data Sheet								
Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 90 Alt. "W"	2,721	2,720.0	2.5	5.0	1	2
Bent 2	LRFD	Class 140 Alt. "W"	2,708	2,703.8	7.0	10.0	1	10
Bent 3	LRFD	Class 140 Alt. "W"	2,708	2,703.8	7.0	10.0	1	10
Bent 4	LRFD	Class 140 Alt. "W"	2,708	2,703.8	7.0	12.5	1	10
Abut 5	WSD	Class 90 Alt. "W"	2,721	2,720.0	2.5	7.2	1	2

TABLE 9. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Stoddard Wells Road OC Widen, Bridge No. 54-0535 Foundation Design Loads											
Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	90	90	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	455	N/A	295	720	180	0	0	295	75	0	0
Bent 3	455	N/A	295	720	180	0	0	295	75	0	0
Bent 4	455	N/A	295	720	180	0	0	295	75	0	0
Abut 5	90	90	25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

General Notes:

1. The structural engineer shall show the pile data table with the specified pile tip elevations on the foundation plan.

2. Support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

Construction Considerations

1. If necessary to attain the specified tip elevation, drilling through the center of the recommended pile (center relief drilling) may be used. Center relief drilling shall not extend lower than 10 feet above the pile tip during installation of the piles. To avoid quick conditions, water elevation inside the pile shall be maintained at or above groundwater or water elevation flowing in an adjacent portion of the Mojave River, as determined by the contractor.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South, Branch 10. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to attention of Asef Wardak (916) 227-1219 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 11-4-2013

Awardak

REGISTERED PROFESSIONAL ENGINEER
ASEF WARDAK
No. C 61960
Exp. 9/30/2015
CIVIL
STATE OF CALIFORNIA

Asef Wardak
Transportation Engineer

cc: District 08 Structure Construction R.E. – Pending File
District 08 Project Manager – Melecio Chalco (Electronic File)
Specs & Estimates – Ofelia Alcantara (Electronic File)
District 08 Materials Engineer – Farzad Tasbihgoo (Electronic File)
HQ GS Corporate – Project Coordination Engineer – Colyn L. Peterson (Electronic File)
HQ Geotechnical Design South-2 – Abbas Abghari – OGDS-2 (Electronic File)
HQ Geotechnical Design South-2 – Angel Perez-Cobo (Electronic File) APC
HQ Geotechnical Archive

FIGURES

Figure 1. Nearby Major Faults with Reference to the Project Site
Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

SOIL SAMPLE LABORATORY TEST RESULT

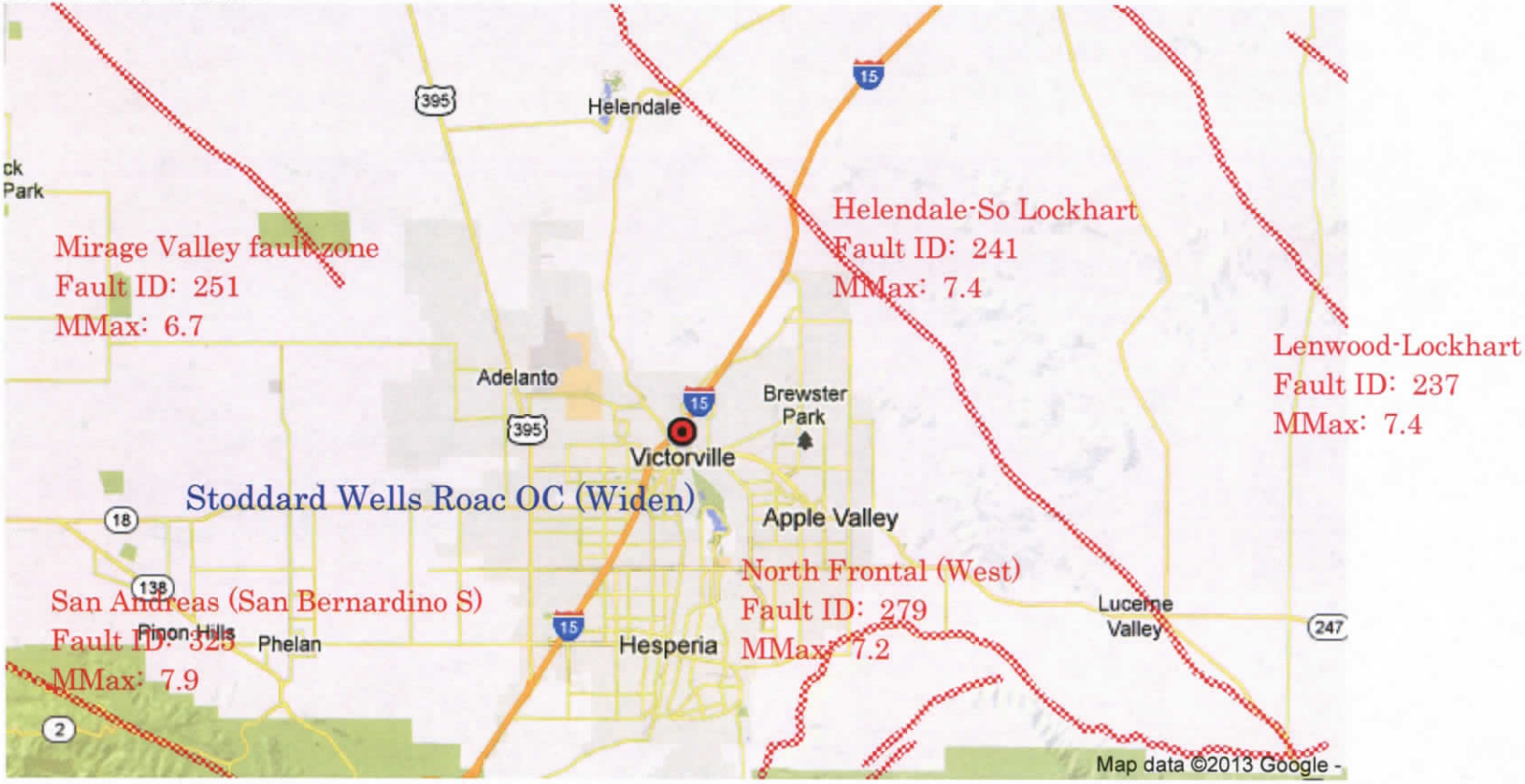
FIGURES

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.2.06)

This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

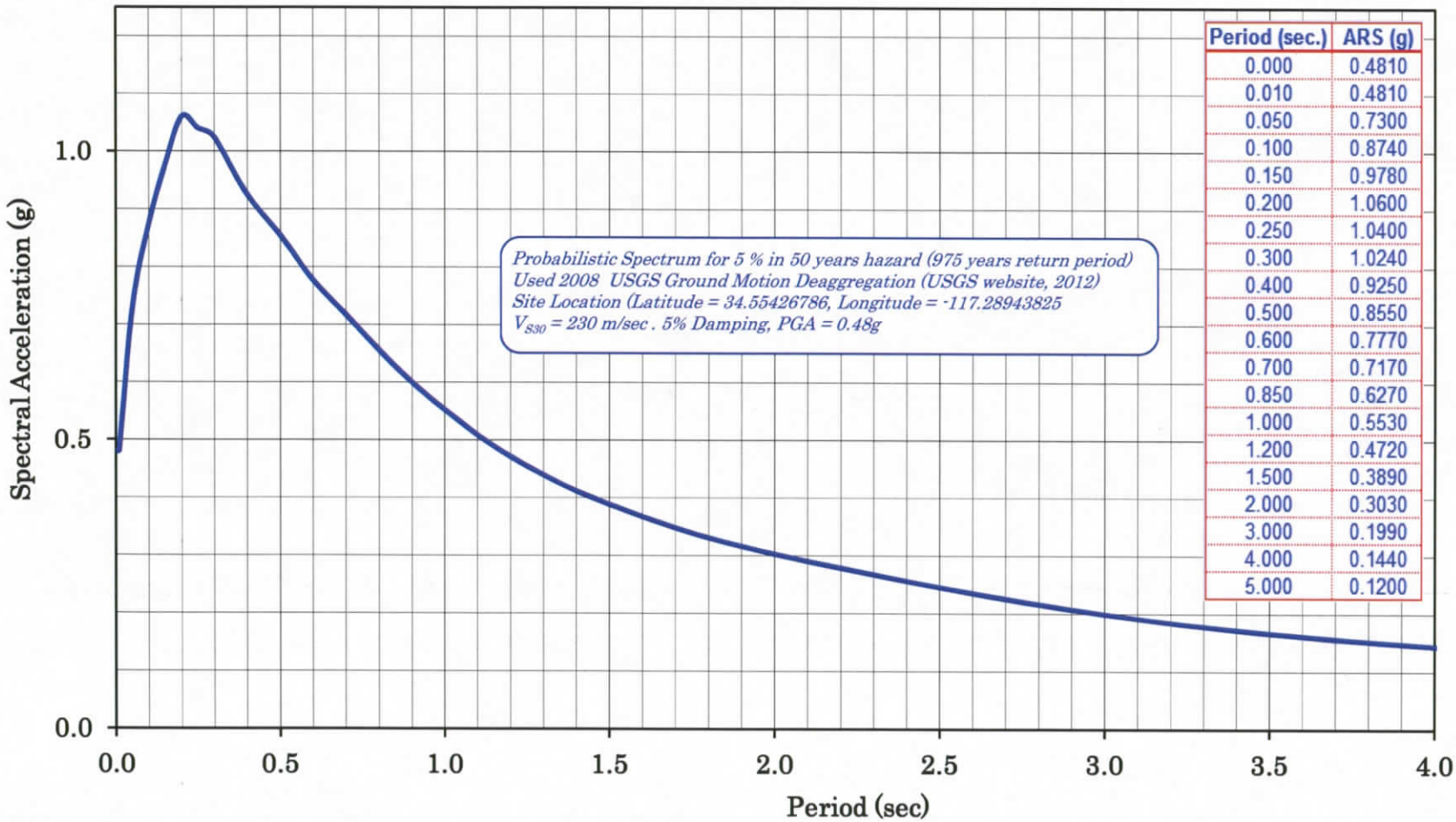
SELECT SITE LOCATION



Latitude: 34.55426786 **Longitude:** -117.28943825 ***Vs30:*** 330 m/s Calculate

Figure 1. Project site and the nearby faults is attached .

Recommended Acceleration Response Spectrum for the Stoddard Wells Road OC (Widen) (Bridge # 54-0535)



Period (sec.)	ARS (g)
0.000	0.4810
0.010	0.4810
0.050	0.7300
0.100	0.8740
0.150	0.9780
0.200	1.0600
0.250	1.0400
0.300	1.0240
0.400	0.9250
0.500	0.8550
0.600	0.7770
0.700	0.7170
0.850	0.6270
1.000	0.5530
1.200	0.4720
1.500	0.3890
2.000	0.3030
3.000	0.1990
4.000	0.1440
5.000	0.1200

Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 6/28/2013

To: Doug Cook / GDS-2

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 08-355561
Project: 0800000621
GL 13-025

Final test results.

Note: All remaining test specimens will be disposed of in 30 calendar days from the release date of the final test results.

AASHTO R18

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 13-025
Dist - EA: 08-355561
Report Date: June 28, 2013
Page: 1/1

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R-13-001_01																						
R-13-002_01																						
R-13-002_10						100	98	97	89	89	88	87	81	70	47	10	5				27.6	
R-13-003_02																						
R-13-004_01																						
R-13-004_05								100	99	99	97	95	91	84	73	16	10				30.6	
R-13-005_01																						
R-13-005_05									100	99	94	88	83	67	35	8	2				29.1	

Memorandum

To: MR. DAN ADAMS, CHIEF
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES MS#9-48I
OFFICE OF BRIDGE DESIGN CENTRAL
STRUCTURES DESIGN BRANCH - 10

Date: November 04, 2013

File: 08-SBd-15-CPM 70.7
EA 08-355561
E-FIS 0800000621

Attention: Mr. Ryan Stiltz

Mojave River West
Frontage Road Bridge
(New)
Br. No. 54C-0661

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: Revised Foundation Report

Introduction

This report supersedes the Foundation Report dated August 15, 2013 and presents the foundation and seismic design recommendations for the proposed Mojave River West Frontage Road Bridge (New), Bridge Number 54C-0661. The proposed county bridge is located parallel to and about 42 feet northwest of the existing Mojave River Bridge (Bridge No. 54-0483) on Interstate 15 in the City of Victorville, within San Bernardino County.

The foundation and seismic recommendations contained in this report are based on our review of General and Foundation Plans (dated April 22 and 24, 2013), Structures Loads (dated May 2, 2013), subsurface explorations (2001 and 2010), 2012 seismic p-s wave testing, Hydraulic Report (dated July 31, 2008), Addendum to the Hydraulic Report (Dated March 29, 2013), and your request letter dated April 21, 2008. Elevations referenced in this report are based on the NGVD29 vertical datum, unless otherwise indicated.

Project/Site Description

The proposed Mojave River West Frontage Road Bridge will consist of five span, precast/post tension concrete slab, on bulb T-girder over bent cap on a single 72-inch column, and short seat type abutments, founded on Caltrans Standard Class 200 Alternative "W" pipe piles at all support locations. The planned bridge will be a two-lane county bridge, connecting the West Frontage Road over Mojave River between stations "WFR"- Line 17+29.34 and 23+03.24, in the City of Victorville.

The total length and width of the proposed bridge are about 574 feet and 42.5 feet, respectively.

Geology of the Proposed Site

The proposed site is located within the Mojave Desert Geomorphic Province of California. The Mojave desert is situated between the Transverse Ranges across the San Andreas fault on the southwest, the Sierra Nevada Mountains and Basin and Range province on the north across the Garlock fault, and the Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region.

The local geology consists of recent Mojave River wash alluvial soils that is incised into the older alluvial valley fill and fan deposits, with granitic bedrock at depth.

Geotechnical Investigation

Two previous (2001 and 2010) geotechnical explorations were conducted to evaluate the subsurface soil conditions for the proposed bridge. The Office of Geotechnical Design South-2 performed the first geotechnical investigation from October 23 through December 13 in 2001. This subsurface geotechnical exploration included twelve 3.75-inch and one 4.25-inch diameter rotary wash borings (total of 13 borings) and seven 2.25 inch diameter cone penetration soundings. The maximum depth of the investigation was approximately 93.0 feet (elevation 2598 feet) below the existing ground surface.

In addition to the 2001 geotechnical subsurface investigation, the Office of Geotechnical Design South-2 performed two additional rotary wash borings at abutment locations of the existing Mojave River Bridge 54-0483 to obtain deeper subsurface information of the area, in April 2010. Both of these borings were converted into Groundwater monitoring wells to measure the Groundwater elevation.

These two borings were advanced to a maximum depth of 181.5 feet (approximate elevation 2536 feet) below the existing road grade. Refer to Log of Test Borings (LOTB) for boring locations, top of borehole elevations, depths, groundwater level measurements and other details.

In October 2012, the piezometric pipes installed in 2010 for groundwater monitoring wells were removed, and downhole geophysical logging was conducted. Primary Wave/Shear Wave (P-S) Suspension Log measurements were collected. For geophysical measurements, refer to the P-S Borehole Logging Report, Dated March 1, 2013, by the Office of Geotechnical Support (Appendix A).

Subsurface Conditions

The subsurface characterization of the site is based on borings drilled in 2001 and 2010. The soil materials at the site consist of recent alluvial deposits (late Holocene, Qw) of the Mojave River and older alluvial valley fill. These wash deposits are streambed alluvium of variable thickness, consisting of loose to very dense interbedded soil layers of silts, sands and combinations of silty sands and clayey sands, with trace gravel and cobbles to full depth of the borings.

The thickness of loose to medium dense soil is approximately 30 to 36 feet deep (elevations 2662 to 2656 feet). Below elevation 2656 feet, the soils generally consist of dense to very dense fine to coarse sand, with fine to coarse gravels, and cobbles.

Bedrock was not encountered to the maximum explored depth of 181.5 feet.

Based on the 2012 p-s wave testing (Appendix A), the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30} = 314 m/s (1030 ft/s).

Groundwater

During both 2001 and 2010 subsurface geotechnical investigations, groundwater was encountered in several borings. Groundwater elevation fluctuated from 2681 feet to 2691 feet. It should be noted that at the time of the 2001 and 2010 subsurface explorations, water was flowing in an adjacent portion of the Mojave River.

Groundwater elevations on specified dates are shown on the LOTB sheets. The groundwater elevations may fluctuate due to seasonal conditions, water levels in the Mojave River, as well as quick condition caused by the excavation process below the groundwater surface during construction.

Liquefaction Potential Evaluation

The soil profile at each boring location was analyzed for liquefaction potential in accordance with the procedure suggested by Seed et al (1985) and modified by Youd et al (2001). The results of our analysis indicate that the loose to medium dense sandy soil layers below the groundwater level in all of the borings are prone to liquefaction.

The thicknesses of potentially liquefiable soils are summarized in Table 1. The total estimated seismically induced ground surface settlement at the support locations is also summarized in Table 1.

The seismically induced ground surface settlements were calculated based on the procedure suggested by Tokimatsu and Seed (1987).

The shear strength of the liquefiable soils was ignored in our analysis of the pile axial capacity under earthquake loading conditions.

The estimated seismically induced ground settlement ranges from 2 to 3 inches. The piles are expected to settle about 1 to 2 inches or less. It is not necessary to use downdrag loads under the extreme limit state because the kinematic load from 1 to 2 inches of pile settlement, cannot compromise the structure integrity under the "no collapse criteria". Also, the structural capacity of the steel piles will not be compromised by this transient load. However, the structural designer should consider this additional settlement of the piles (1 to 2 inches) when they perform the lateral (push over) analysis of the structure.

TABLE 1. RESULTS OF LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES

Support Locations	Approx. Elevation of Liquefiable Soils (feet)	Approx. Thickness of Liquefying Soils (feet)	Total Estimated Seismically-Induced Ground Surface Settlement (inch)
Abut. 01	2690 to 2680	10	1.5
Pier 02	2690 to 2675	15	2.0
Pier 03	2690 to 2665	25	2.5
Pier 04	2690 to 2670	20	2.0
Pier 05	2690 to 2670	20	2.0
Abut. 06	2690 to 2675	15	1.5

Note: Although, our liquefaction studies indicate that there may be some deep and local liquefaction potential in some of the borings, the adverse liquefaction effect(s) to the structure is negligible. Those deep, potentially liquefiable soils layers are located at different depths (not as a continuous uniform layer) along the bridge alignment.

Lateral Spread

It is anticipated that the lateral spread may occur at abutment 1 and 6 locations due to local earthquakes. The additional lateral force generated by the lateral spread should be considered in design.

Kinematic approach is used to estimate the lateral spreading forces in this report. Kinematic approach is a displacement-controlled method. It accounts directly for the interaction between the moving soil and the pile displacement and includes the available mobilized soil resistance since it accounts for the residual strength of liquefied soils. Computer programs LPILE v5 and GSTABLE were used during analyses.

The results of these analyses show that a lateral spreading force is about 35 kip and should be applied on the top of each Class 200 driven piles at the abutments.

Scour Evaluation

The Office of Structure Hydrology and Hydraulics provided a "Final Hydraulic Report" for the above proposed bridge on July 31, 2008 by Ginger Lu, PE., and a "Report Addendum" dated March 29, 2013.

According to the addendum dated March 29, 2013, the potential scour depth is 9.6 feet (elevation 2678.5 feet) below the thalweg elevation of 2688.1 feet at all pier locations. The scour is not applicable for abutments locations. It must be noted that all elevations given in the Hydrology/Hydraulic study are based on NGVD 1929 datum. A copy of the Final Hydraulic Report is attached as Appendix B.

Seismic Data Evaluation

Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v2.2.06, USGS 2008 Interactive Deaggregations (Beta), 2001 and 2010 geotechnical subsurface investigations and 2012 p-s measurements for the proposed bridge.

Seismicity

Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 9.8 miles (15.7 km) from the Helendale-So Lockhart fault. This fault (Fault ID 241, MMax = 7.4, strike-slip, dip = 90 degrees, vertical, Bottom and Top of Rupture Plane approximately 8.1 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure. A map showing the location of the bridge and the nearby faults is attached in Figure 1.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response spectra, but is not less than a minimum deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km).

The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectrum calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to 975 year return period). For this site, the design response spectrum is controlled by probabilistic method. The corresponding peak horizontal ground acceleration is 0.49g. The recommended acceleration response spectrum is attached in Figure 2.

Laboratory Testing

During the 2010 geotechnical investigation, selected soil samples from different depths of the borings of the recent deposits (late Holocene, Qw) of the streambed

alluvium samples have been tested for mechanical analysis, moisture content and Atterberg limits (plasticity).

All tests were performed in accordance with American Society for Testing and Material (ASTM) standards, and results of the tests are included in Appendix C.

Corrosion Evaluation

Representative soil samples collected from the 2001 field investigation were tested to determine the corrosion potential of the in-situ soils. The results of these tests are presented in Table 2. Caltrans considers a site to be corrosive for structural elements, if one or more of the following conditions exist for the representative soil and /or water samples taken at the site: Chloride concentration is 500 ppm or greater, or sulfate concentration is 2000 ppm, or minimum resistivity of less than 1000 ohm-centimeters, or the pH is 5.5 or less.

TABLE 2. SUMMARY OF CORROSION TESTS

Boring No.	Top of Borehole Elevation (feet)	Sample at Elevation (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B5-01	2,691.2	2,689	Sands	5,350	7.4	N/A	N/A
		2,662	Sands	1,700	6.9	N/A	N/A
		2,647	Sands	4,900	6.9	N/A	N/A
		2,622	Sands	4,300	7.5	N/A	N/A
		2,607	Sands	6,100	7.7	N/A	N/A
B8-01	2,691.1	2,688	Sands	3,400	7.4	N/A	N/A
		2,675	Sands	1,800	5.5	N/A	N/A
		2,660	Sands	1,600	7.4	N/A	N/A
		2,640	Sands	5,400	7.1	N/A	N/A
		2,622	Sands	5,350	5.3	N/A	N/A
		2,612	Sands	6,350	7.7	N/A	N/A
B10-01	2,693.1	2,690	Sands	7,400	8.9	N/A	N/A
		2,672	Sands	3,600	7.7	N/A	N/A
		2,654	Sands	6,450	6.9	N/A	N/A
		2,627	Sands	3,900	7.9	N/A	N/A
		2,609	Sands	6,700	7.5	N/A	N/A

Although, corrosion studies indicate that there is one isolated pocket of corrosion potential (below the specified pile tip elevation), overall, streambed alluvium underlying the site will be non-corrosive.

Settlement

Subsurface soils are composed of predominantly granular material. Therefore, long-term consolidation settlement is not expected. A fill delay period of 15 days is recommended to overcome effects of any immediate settlement.

Foundation Recommendations

The following recommendations are for the proposed Mojave River Bridge (Bridge No. 54C-0661) as shown on the General Plan dated June 5, 2013. At all support locations, the proposed bridge will be supported on Caltrans Standard Class 200 Alternative "W" piles. Piles should be constructed in accordance with Section 49-1 and 49-2 of the Caltrans' Standard Specifications (Caltrans' 2010).

The specified pile tip elevations are listed below in Tables 3 and 4. The calculated geotechnical capacities of all Caltrans Standard Class 200 Alternative "W" piles are based on both skin friction and end-bearing. The API method was used to estimate

both, the skin friction and the end bearing. Pile friction resistance within the liquefiable layers (table 1) was ignored in our analyses for the extreme event limit state loading.

The three controlling LRFD limit states loads provided by Structure Design (Service-I Limit State, Strength Limit State, and Extreme Event Limit State) are shown in the Table 7.

As per section 49-2.01C (4) of standard specifications, driven piles at abutment 1 and 6 should be installed through predrilled holes drilled to an elevation of 2690 ft.

Driveability Study:

The Office of Geotechnical Support provided driveability study for the above recommended piles dated July 8, 2013. The result of drivability is included in Appendix D.

TABLE 3. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Mojave River (New), Br # 54C-0661 Abutment Foundations Design Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200	2,702	600	500	150	300	2,663 (a) 2,660 (d)	2,660	500
Abut. 6	Class 200	2,701	600	500	150	300	2,666 (a) 2,660 (d)	2,660	500

Notes:

1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load.

2) The specified tip elevation shall not be raised above the design tip elevations for tension, or lateral.

"Caltrans improves mobility across California"

TABLE 4. FOUNDATION RECOMMENDATIONS FOR BENTS

Mojave River (New), Br # 54C-0661 Piers Foundations Design Recommendations											
Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Pier 2	Class 200	2,674	2,400	1	300	0	400	190	2,631 (a-I) 2,636 (a-II) 2,628 (b-II) 2,639 (d)	2,628	460
Pier 3	Class 200	2,674	3,300	1	240	0	370	190	2,631 (a-I) 2,631 (a-II) 2,625 (b-II) 2,634 (d)	2,625	400
Pier 4	Class 200	2,674	3,300	1	240	0	370	190	2,631 (a-I) 2,621 (a-II) 2,633 (b-II) 2,636 (d)	2,621	400
Pier 5	Class 200	2,674	2,400	1	300	0	400	190	2,633 (a-I) 2,633 (a-II) 2,624 (b-II) 2,635 (d)	2,624	480

Notes:

1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (b-I) Tension (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral Load
2) The specified tip elevation shall not be raised above the design tip elevations for tension, or lateral.

TABLE 5. PILE DATA TABLE

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "W"	300	0	2,663 (a) 2,660 (d)	2,660	500
Bent 2	Class 200 Alt "W"	430	190	2,631 (a) 2,628 (b) 2,639 (d)	2,628	460
Bent 3	Class 200 Alt "W"	370	190	2,631 (a) 2,625 (b) 2,634 (d)	2,625	400
Bent 4	Class 200 Alt "W"	370	190	2,621 (a) 2,633 (b) 2,636 (d)	2,621	400
Bent 5	Class 200 Alt "W"	430	190	2,633 (a) 2,624 (b) 2,635 (d)	2,624	480
Abut 6	Class 200 Alt "W"	300	0	2,666 (a) 2,660 (d)	2,660	500

Notes:

1) Design tip elevations for **Abutments** are controlled by: (a) Compression , (d) Lateral
2) Design tip elevations for **Bents** are controlled by: (a) Compression , (b) Tension, (d) Lateral

TABLE 6. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Mojave River (New), Bridge No. 54C-0661 Foundation Design Data Sheet								
Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)*	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 200	2,710	2,702	6	46	1	8
Pier 2	LRFD	Class 200	2,695	2,674	23	23	1	25
Pier 3	LRFD	Class 200	2,695	2,674	28	28	1	36
Pier 4	LRFD	Class 200	2,695	2,674	28	28	1	36
Pier 5	LRFD	Class 200	2,695	2,674	23	23	1	25
Abut 6	WSD	Class 200	2,706	2,701	6	46	1	8

TABLE 7. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Mojave River (New), Br # 54C-0661 Foundation Design Loads											
	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
Support No.	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 01	600	150	500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 02	2,400	N/A	2,100	5,000	300	0	0	3,000	400	0	190
Bent 03	3,300	N/A	2,600	5,900	240	0	0	3,600	370	0	190
Bent 04	3,300	N/A	2,600	5,900	240	0	0	3,600	370	0	190
Bent 05	2,400	N/A	2,100	5,000	300	0	0	3,000	400	0	190
Abut 06	600	150	500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:
1. Support loads shown are per column.
2. Service I loads are reported as net loads
3. Strength and Extreme loads are reported as gross loads.

General Notes:

1. The structural engineer shall show the pile data table with the specified pile tip elevations on the foundation plan.

2. Support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

Construction Considerations

1. If necessary to attain the specified tip elevation, drilling through the center of the recommended pile (center relief drilling) may be used. Center relief drilling shall not extend lower than 10 feet above the pile tip during installation of the piles. To avoid quick conditions, water elevation inside the pile shall be maintained at or above groundwater or water elevation flowing in an adjacent portion of the Mojave River, as determined by the contractor.
2. The excavation for the pile construction (Type D, as per plans) at pier locations should conform to sections 19-3.03C, 19-3.03D and 19-3.03E of the 2010 standard specification.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South, Branch 10. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to attention of Asef Wardak (916) 227-1219 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 11-4-2013

REGISTERED PROFESSIONAL ENGINEER
ASEF WARDAK
No. C 61960
Exp. 9/30/2015
CIVIL
STATE OF CALIFORNIA

Asef Wardak
Transportation Engineer

cc: District 08 Structure Construction R.E. – Pending File
District 08 Project Manager – Melecio Chalco (Electronic File)
Specs & Estimates – Ofelia Alcantara (Electronic File)
District 08 Materials Engineer – Farzad Tasbihgoo (Electronic File)
HQ GS Corporate – Project Coordination Engineer – Colyn L. Peterson (Electronic File)
HQ Geotechnical Design South-2 – Abbas Abghari – OGDS-2 (Electronic File)
HQ Geotechnical Design South-2 – Angel Perez-Cobo (Electronic File) APC
HQ Geotechnical Archive

FIGURES

Figure 1. Nearby Major Faults with Reference to the Project Site
Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

BOREHOLE GEOPHYSICAL LOGGING

APPENDIX B

FINAL HYDRAULIC REPORT

APPENDIX C

SOIL SAMPLE LABORATORY RESULT

APPENDIX D

DRIVEABILITY STUDY

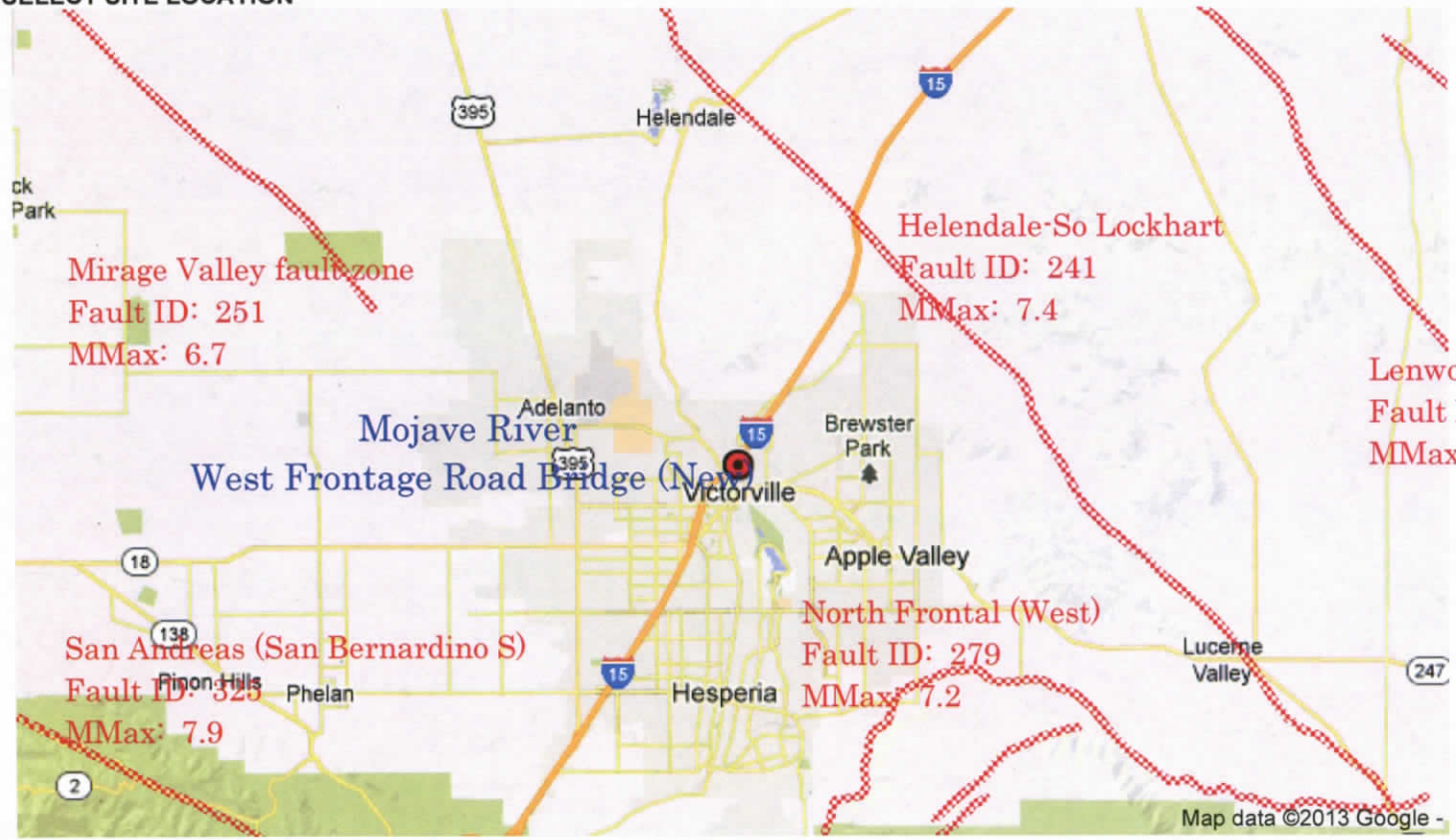
FIGURES

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.2.06)

This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

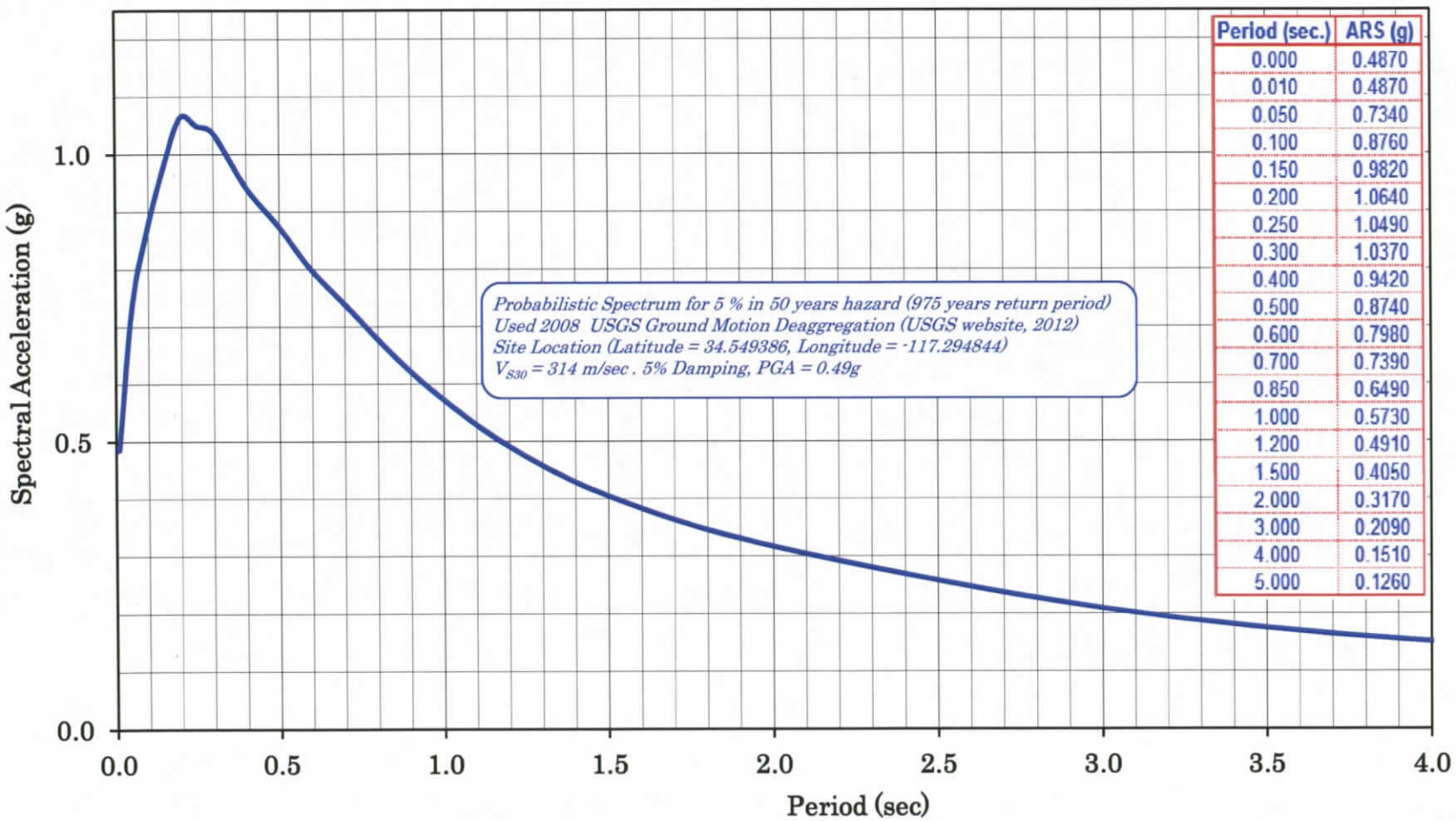
SELECT SITE LOCATION



Latitude: 34.549386 **Longitude:** -117.294844 ***Vs30:*** 314 m/s Calculate

Figure 1. Project site and the nearby faults is attached .

Recommended Acceleration Response Spectrum for the Mojave River New / West Frontage Road Bridge (Bridge # 54C-0661)



Period (sec.)	ARS (g)
0.000	0.4870
0.010	0.4870
0.050	0.7340
0.100	0.8760
0.150	0.9820
0.200	1.0640
0.250	1.0490
0.300	1.0370
0.400	0.9420
0.500	0.8740
0.600	0.7980
0.700	0.7390
0.850	0.6490
1.000	0.5730
1.200	0.4910
1.500	0.4050
2.000	0.3170
3.000	0.2090
4.000	0.1510
5.000	0.1260

Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: **Angel Perez-Cobo**
Geotechnical Design, South-2
Division of Engineering Services

Date: March 1, 2013

File: 08_SBD_15_43.9_2012
Project 0800000621

Attention: Asef Wardak, Doug Cook

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES-MS#5

Subject: Borehole logging, SBD-15 Mojave River Bridge PM 43.93

Introduction

Attached are the results obtained from borehole geophysical logging at the Mojave River bridge (bridge #54-0483) in Victorville, San Bernardino County, California. Two borings in the westbound roadbed (R-10-001 and R-10-002) were logged in early October, 2012. Results include Natural Gamma /Induction, and P-S Suspension log measurements with Vs30 seismic velocity determination. Geophysical results are presented in both tabular and graphical format.

Based on geophysical results, stratigraphy at the site appears to consist of:

- Top section of engineered fill placed over the Mojave River floodplain as road embankment and bridge abutment,
- Softer or unconsolidated (disturbed?), lower seismic velocity, younger alluvial section that appears to be predominately coarse-grained scour and fill deposits of the Mojave River, and
- More consolidated (apparently cemented into rock-like material in places), older, lower alluvial section of coarse-grained to fine-grained Mojave River sediments.

Actual material depths are included in each boring discussion. Crystalline bedrock, or consistent rock-like material, was not encountered in either boring. Liquefaction potential, especially in the low-velocity, saturated, predominately coarse-grained scour and fill section, should be assessed. Please call with any questions.

Report by:

PROFESSIONAL GEOLOGIST
DAVID ALAN HUGHES
No. 7645
Exp. 09/14
STATE OF CALIFORNIA

David Hughes, PG 7645
Engineering Geologist
Geophysics and Geology Branch

SBD-15 Mojave River Bridge PM 43.9
Bridge No. 54-0483, boring R-10-001 (south abutment)
GPS location: North 34.55 degrees, West -117.30 degrees

Drilling was conducted by Caltrans Drilling Services. The boring was drilled in early October, 2012, drilling out a previously installed piezometer (R-10-001). Natural Gamma/Induction and PS Log measurements were collected in this boring. The depth of the boring was reported as 64.3 m/211 ft, and the boring was logged in the open hole. Due to apparent loose conditions, this boring was logged in stages, using the drill stem as a temporary casing. The driller noted apparent soft or unconsolidated conditions at approximately 17 m/56 ft depth (Norm Webb, CT Lead Driller, personal communication), and so the drill stem was pulled up to this interval. The bottom of the boring collapsed at 51.8 m/170 ft upon removal of the drill stem, and the section from approximately 50.3 m/165 ft to 18.0 m/59 ft depth (approximate bottom of the steel drill stem) was logged. The boring collapsed a second time at approximately 9 m/29.5 ft depth (approximate base of the engineered abutment fill) upon removal of the balance of the drill stem. Depths were measured relative to road grade surface, as ground surface elevation was not available.

Geophysical Logs

Induction Log: A plot of the Natural Gamma/Induction log is attached.

Engineered fill used to build up the roadbed/bridge abutment is suggested by higher gamma counts (i.e., more fine-grained material) in the interval from the surface to approximately 8 m/26.4 ft depth. The 2010 boring log notes fill to 7.6 m/25 ft depth.

Variations in the Natural Gamma and Conductivity/Resistivity (Induction) logs suggest interlayered stratigraphy of coarse-grained to fine-grained deposits below the engineered fill, interpreted as sedimentary deposits of the Mojave River.

"Spikes" in the Induction log at approximately 17 m/56 ft depth suggest changed subsurface conditions. These spikes are repeated at approximately the same interval in boring R-10-002. The driller noted apparent soft or unconsolidated conditions at approximately 17 m/56 ft depth, and a section above this interval collapsed on removal of the drill stem (blockage noted at 9 m/29.5 ft depth), suggesting softer or unconsolidated conditions. This may be the result of recent or disturbed alluvium over older, more consolidated sedimentary deposits. The Mojave River has flooded in the historic past (e.g., the 1938 peak flood flow at Victorville estimated at approximately 70,000 cubic feet/second [cfs], the January 1969 flood estimated at approximately 37,500 cfs, with over 10 ft of scour noted at the stream gage). Water pouring through the immediately-upstream Victorville water gap could result in deep scour and fill in the riverbed at this location. This interval is more coarse-grained than the interval above, and in general, more coarse-grained than the interval below.

Material below 17 m/56 ft depth appears to consist of interlayered sedimentary material.

P-S Suspension Log: Seismic velocities determined by the P-S Suspension Log are tabulated on Table 1 and plotted on Plate 2.

The upper, engineered fill section (surface-8 m/26.4 ft) was logged with a shear wave velocity (Vs) of approximately 285 m/s, and shows little variation within the interval logged. The P-

wave velocity (Vp) suggests unsaturated conditions, but the Vp results are questionable and are indicated as such on the Table of results. Rapid borehole fluid loss was noted during logging this section.

The intermediate (younger) alluvial section (8 m/26.4 ft to 17 m/56 ft) was not logged due to unstable conditions that collapsed and blocked the borehole. This suggests softer or unconsolidated conditions. The equivalent section logged in boring R-10-002 indicates Vs is lower than the sections above and below, with mean Vs of ~195 m/s.

The lower (older) section (17 m/56 ft, to the total depth logged at 48 m/157.5 ft) appears to contain more consolidated fluvial material. Rock-like material (Vs>785 m/s), probably cemented coarse-grained sediments, is noted intermittently below 36.5 m/119.8 ft depth, with coarse-grained material noted in the boring log and Natural Gamma log. Crystalline bedrock was not encountered in this boring.

Saturated conditions (Vp>1500 m/s) were noted at the acquisition of Vp signal at 18.5 m/60.7 ft depth. However, actual saturated conditions are probably located much higher in this boring, as Vp signal is missing above this depth, and surface water was noted in the Mojave River course.

Vs30 determination: Shear wave velocities were obtained from Table 2. Missing velocities from poor or missing signal were estimated from adjacent intervals, or mean velocities were obtained from stratigraphically similar intervals in boring R-10-002. Table 3 presents the seismic velocities used to determine the Vs30 in this boring, which is 299.3 m/s. Liquefaction potential, especially in the apparent coarser-grained, saturated, unconsolidated or disturbed younger alluvial section from 8 m/26.4 ft to 17 m/56 ft, should be assessed.

Plate 1 boring R-10-001

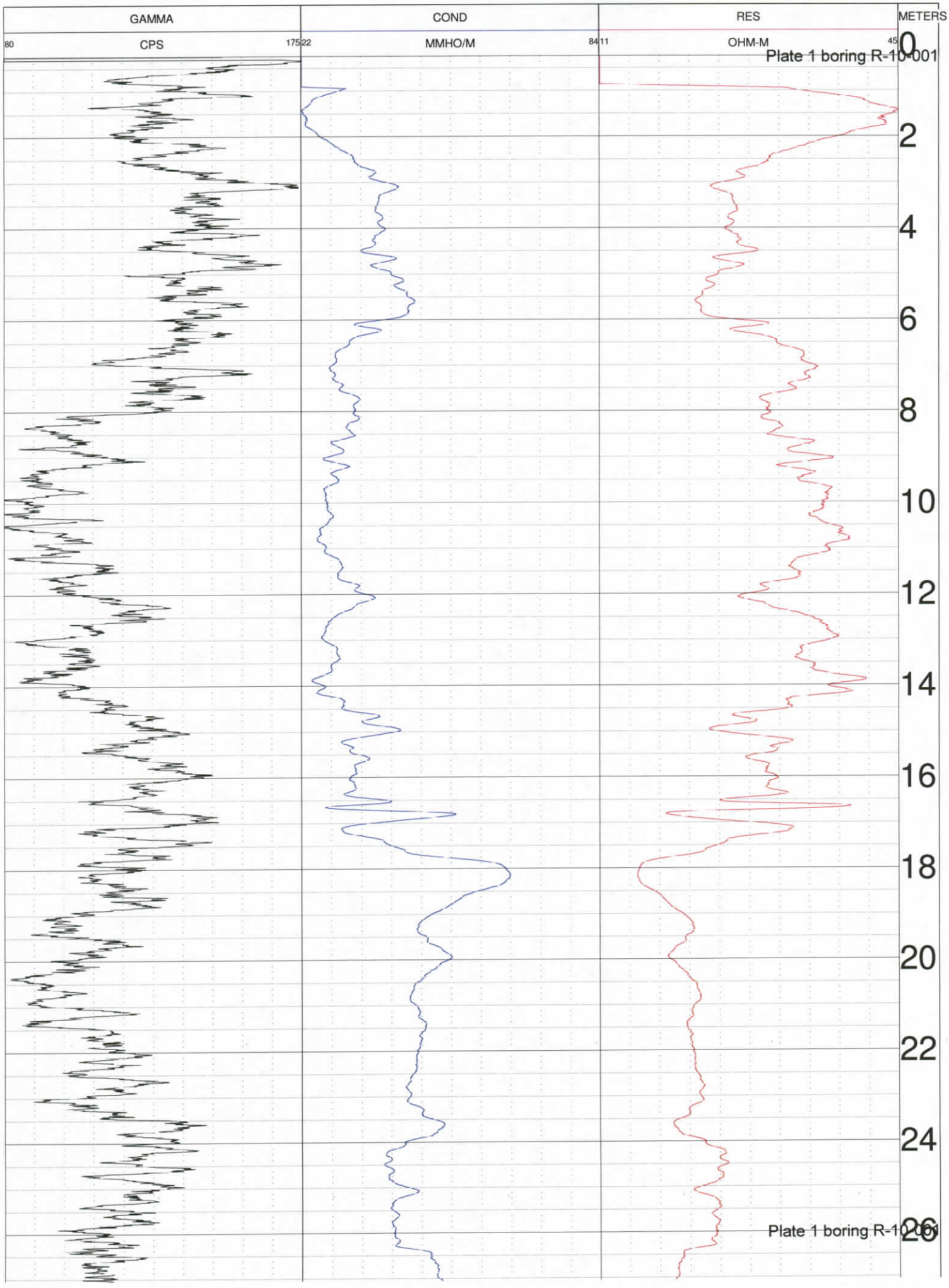
California Department of Transportation
Geophysical Services

SBD-15 54-0483 R-10-001 S ABT

COMPANY	: Caltrans		OTHER SERVICES:
WELL	: SBD-15 54-0483 R-10-001 S ABT		
FIELD	: SBD-15 54-0483 R-10-001 S ABT		
COUNTY	: SBD-15 PM 43.9		
STATE	: CA		
LOCATION	:		
SECTION	:		
TOWNSHIP	:		
RANGE	:		
API NO.	:		
UNIQUE WELL ID.	:		
PERMANENT DATUM	:	ELEVATION KB	:
LOG MEASURED FROM:	GL	ELEVATION DF	:
DRL MEASURED FROM:	GL	ELEVATION GL	:
DATE	: 10/10/12	RIG NUMBER	:
DEPTH DRILLER	:	LOGGER TD	:
BIT SIZE	: 10	ARRIVAL TIME	:
LOG TOP	: 0.25	DEPARTURE TIME:	
LOG BOTTOM	: 51.83	CIRC STOPPED	: AM
CASING OD	:		
CASING BOTTOM	: TD		
CASING TYPE	: PVC		
BOREHOLE FLUID	: 0		
RM TEMPERATURE	: 0		
MUD RES	: 0		
MUD WEIGHT	:		
WITNESSED BY	:		
RECORDED BY	: DH/DG		
REMARKS 1	: Mojave R BR, Victorville		
REMARKS 2	: Open hole, logged in stages		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Plate 1 boring R-10-001


GAMMA
CPS
80
175
COND
MMHO/M
22
84
RES
OHM-M
11
45
METERS
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Plate 1 boring R-10-001
Plate 1 boring R-10-001

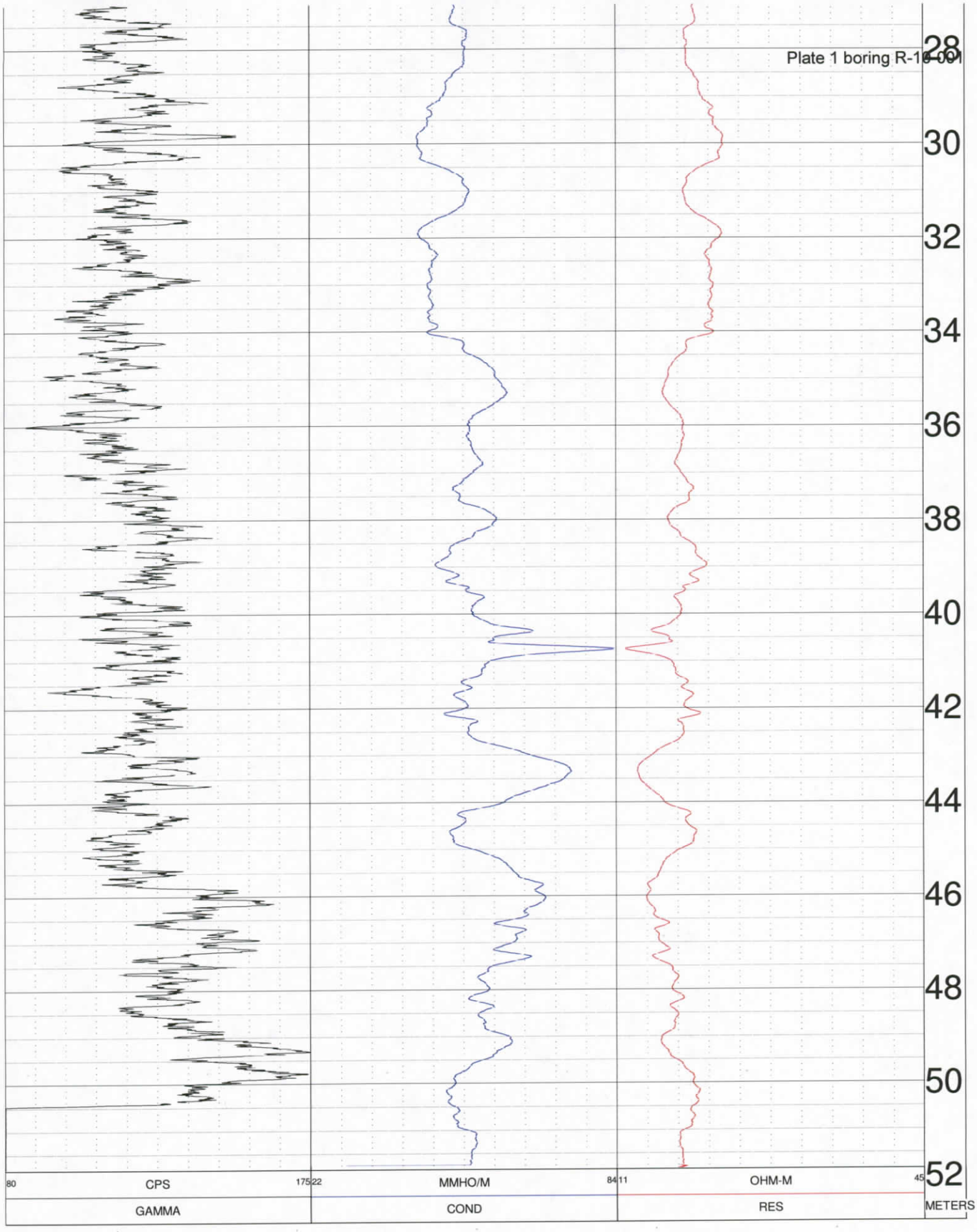
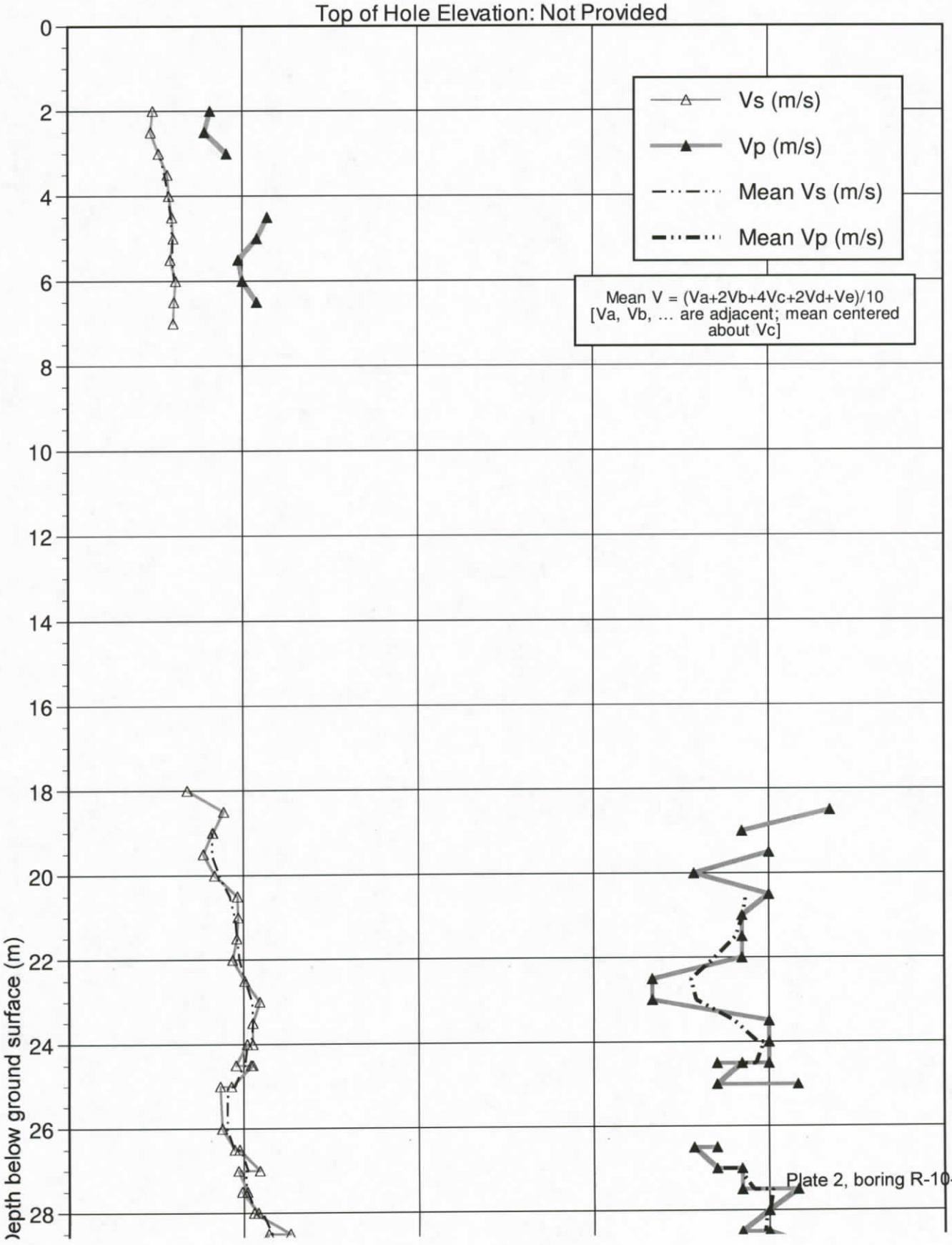


Plate 1 boring R-10-001

Plate 2
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
Downhole Interval Velocities



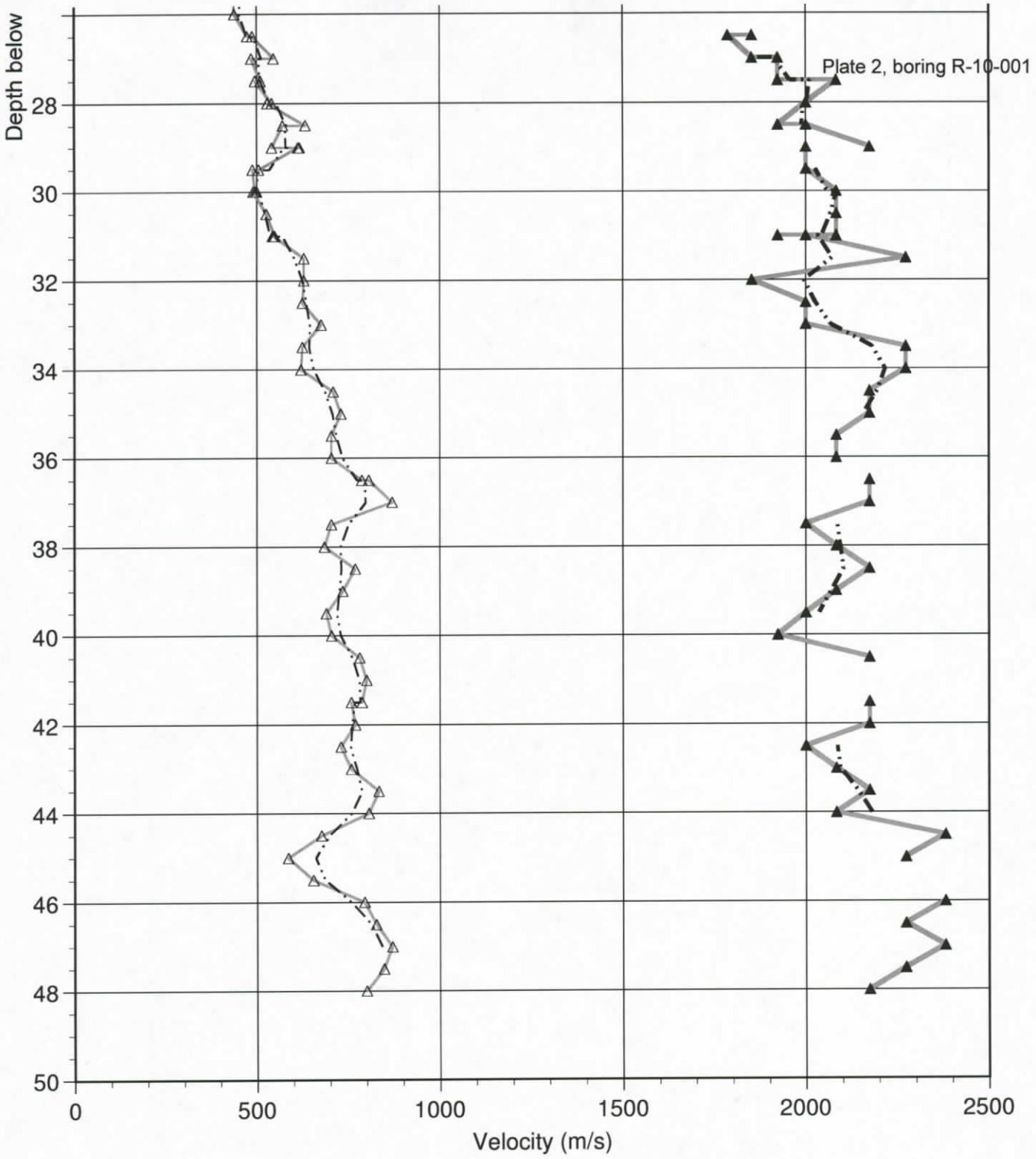


Plate 2, boring R-10-001
Depth below
28
30
32
34
36
38
40
42
44
46
48
50
0
500
1000
1500
2000
2500
Velocity (m/s)

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

	GPS Boring location: North 34.55 degrees, West -117.30 degrees														
Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^3lb/ft^2)	E (10^3lb/ft^2)	K (10^3lb/ft^2)
Not Provided	2	6.6	244	800	408	1339	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2.5	8.2	238	781	392	1287	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	9.8	261	858	455	1491	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3.5	11.5	286	937		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	13.1	290	951		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.5	14.8	299	979	571	1875	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	16.4	303	994	541	1773	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5.5	18.0	294	965	488	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	19.7	310	1017	500	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6.5	21.3	305	1002	541	1773	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7	23.0	303	994		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7.5	24.6		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	18	59.1	340	1116		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	18.5	60.7	444	1458	2174	7132	0.48	2.26	141.40	0.447	1.323	10.108	9344	27625	211098
	19	62.3	413	1356	1923	6309	0.48	2.14	133.69	0.366	1.079	7.432	7637	22542	155228
	19	62.3	412	1350		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	19.5	64.0	386	1267	2000	6562	0.48	2.18	136.25	0.325	0.963	8.296	6795	20122	173269
	20	65.6	418	1373	1786	5859	0.47	2.06	128.62	0.361	1.061	6.089	7533	22161	127164
	20.5	67.3	483	1585	2000	6562	0.47	2.18	136.25	0.509	1.496	8.051	10638	31255	168146
	21	68.9	485	1593	1923	6309	0.47	2.14	133.69	0.505	1.480	7.247	10540	30902	151358
	21.5	70.5	481	1577	1923	6309	0.47	2.14	133.69	0.495	1.452	7.260	10338	30325	151627
	22	72.2	469	1540	1923	6309	0.47	2.14	133.69	0.472	1.386	7.291	9859	28951	152266
	22.5	73.8	503	1649	1667	5468	0.45	1.98	123.58	0.500	1.450	4.832	10440	30277	100927
	23	75.5	546	1793	1667	5468	0.44	1.98	123.58	0.591	1.702	4.711	12346	35551	98387
	23.5	77.1	526	1727	2000	6562	0.46	2.18	136.25	0.605	1.769	7.924	12627	36941	165494
	24	78.7	526	1727	2000	6562	0.46	2.18	136.25	0.605	1.769	7.924	12627	36941	165494
	24	78.7	510	1674	2000	6562	0.47	2.18	136.25	0.568	1.665	7.973	11865	34770	166509
	24.5	80.4	478	1570	2000	6562	0.47	2.18	136.25	0.500	1.469	8.064	10435	30672	168416
	24.5	80.4	521	1709	1852	6076	0.46	2.10	131.15	0.570	1.661	6.445	11902	34684	134596
	24.5	80.4	526	1727	1923	6309	0.46	2.14	133.69	0.593	1.732	7.129	12390	36166	148891
	25	82.0	465	1526	1852	6076	0.47	2.10	131.15	0.454	1.333	6.598	9492	27836	137810
	25	82.0	433	1420	2083	6835	0.48	2.22	138.82	0.417	1.231	9.096	8703	25717	189965
	26	85.3	439	1439		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	26.5	86.9	474	1555	1852	6076	0.46	2.10	131.15	0.472	1.383	6.575	9855	28875	137326
	26.5	86.9	488	1600	1786	5859	0.46	2.06	128.62	0.490	1.431	5.916	10239	29891	123556
	27	88.6	546	1793	1852	6076	0.45	2.10	131.15	0.627	1.822	6.368	13102	38055	132997

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus

Shaded cells denote questionable data.

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
	27	88.6	485	1593	1923	6309	0.47	2.14	133.69	0.505	1.480	7.247	10540	30902	151358
	27.5	90.2	510	1674	1923	6309	0.46	2.14	133.69	0.557	1.630	7.177	11643	34047	149887
	27.5	90.2	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	28	91.9	541	1773	2000	6562	0.46	2.18	136.25	0.638	1.863	7.880	13318	38906	164572
	28	91.9	529	1736	2000	6562	0.46	2.18	136.25	0.611	1.787	7.915	12761	37322	165315
	28.5	93.5	633	2076	1923	6309	0.44	2.14	133.69	0.858	2.469	6.776	17917	51574	141522
	28.5	93.5	571	1875	2000	6562	0.46	2.18	136.25	0.713	2.075	7.780	14884	43329	162484
	29	95.1	541	1773	2174	7132	0.47	2.26	141.40	0.662	1.942	9.822	13822	40554	205128
	29	95.1	617	2025		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	29	95.1	613	2013	2000	6562	0.45	2.18	136.25	0.821	2.379	7.635	17156	49687	159455
	29.5	96.8	505	1657	2000	6562	0.47	2.18	136.25	0.557	1.632	7.988	11627	34089	166827
	29.5	96.8	488	1600	2000	6562	0.47	2.18	136.25	0.519	1.525	8.038	10846	31853	167868
	30	98.4	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	30	98.4	500	1640	2083	6835	0.47	2.22	138.82	0.556	1.634	8.910	11610	34122	186089
	30	98.4	490	1608	2083	6835	0.47	2.22	138.82	0.534	1.572	8.939	11160	32825	186690
	30.5	100.1	526	1727	2083	6835	0.47	2.22	138.82	0.616	1.806	8.830	12865	37717	184417
	31	101.7	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14021	41013	182875
	31	101.7	543	1783	1923	6309	0.46	2.14	133.69	0.633	1.843	7.077	13211	38486	147796
	31	101.7	546	1793	2000	6562	0.46	2.18	136.25	0.652	1.903	7.861	13611	39735	164181
	31.5	103.3	629	2063	2273	7456	0.46	2.31	143.99	0.912	2.661	10.697	19055	55584	223416
	32	105.0	629	2063	1852	6076	0.43	2.10	131.15	0.831	2.385	6.096	17355	49803	127325
	32.5	106.6	625	2051	2000	6562	0.45	2.18	136.25	0.853	2.465	7.593	17806	51490	158589
	33	108.3	676	2217	2000	6562	0.44	2.18	136.25	0.996	2.861	7.402	20810	59749	154583
	33.5	109.9	625	2051	2273	7456	0.46	2.31	143.99	0.901	2.629	10.712	18817	54912	223732
	34	111.5	621	2038	2273	7456	0.46	2.31	143.99	0.890	2.598	10.727	18584	54252	224043
	34.5	113.2	709	2327	2174	7132	0.44	2.26	141.40	1.139	3.282	9.185	23794	68548	191832
	35	114.8	730	2395	2174	7132	0.44	2.26	141.40	1.207	3.467	9.095	25204	72408	189952
	35.5	116.5	704	2310	2083	6835	0.44	2.22	138.82	1.103	3.166	8.181	23032	66124	170860
	36	118.1	704	2310	2083	6835	0.44	2.22	138.82	1.103	3.166	8.181	23032	66124	170860
	36.5	119.8	787	2583		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	36.5	119.8	806	2646	2174	7132	0.42	2.26	141.40	1.473	4.184	8.740	30765	87386	182537
	37	121.4	870	2853	2174	7132	0.40	2.26	141.40	1.713	4.812	8.421	35769	100494	175865
	37.5	123.0	704	2310	2000	6562	0.43	2.18	136.25	1.082	3.094	7.287	22606	64618	152188
	38	124.7	685	2247	2083	6835	0.44	2.22	138.82	1.043	3.003	8.260	21787	62721	172520
	38.5	126.3	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	39	128.0	735	2412	2083	6835	0.43	2.22	138.82	1.202	3.436	8.048	25109	71754	168091
	39.5	129.6	690	2263	2000	6562	0.43	2.18	136.25	1.038	2.974	7.346	21680	62114	153423

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus

Shaded cells denote questionable data.

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G ($10^3 lb/ft^2$)	E ($10^3 lb/ft^2$)	K ($10^3 lb/ft^2$)
	40	131.2	704	2310	1923	6309	0.42	2.14	133.69	1.062	3.022	6.504	22182	63110	135835
	40.5	132.9	781	2563	2174	7132	0.43	2.26	141.40	1.382	3.942	8.861	28873	82336	185061
	41	134.5	800	2625		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	41.5	136.2	787	2583		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	41.5	136.2	758	2485	2174	7132	0.43	2.26	141.40	1.300	3.720	8.971	27149	77695	187358
	42	137.8	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	42.5	139.4	730	2395	2000	6562	0.42	2.18	136.25	1.163	3.310	7.180	24286	69126	149948
	43	141.1	758	2485	2083	6835	0.42	2.22	138.82	1.276	3.634	7.950	26654	75900	166031
	43.5	142.7	833	2734	2174	7132	0.41	2.26	141.40	1.573	4.448	8.607	32850	92893	179757
	44	144.4	806	2646	2083	6835	0.41	2.22	138.82	1.446	4.084	7.723	30204	85288	161297
	44.5	146.0	676	2217	2381	7812	0.46	2.35	146.59	1.072	3.122	11.882	22390	65209	248168
	45	147.6	585	1919	2273	7456	0.46	2.31	143.99	0.789	2.310	10.862	16474	48254	226856
	45.5	149.3	654	2144		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	46	150.9	794	2604	2381	7812	0.44	2.35	146.59	1.479	4.252	11.340	30891	88812	236834
	46.5	152.6	826	2711	2273	7456	0.42	2.31	143.99	1.575	4.486	9.813	32902	93692	204952
	47	154.2	870	2853	2381	7812	0.42	2.35	146.59	1.776	5.053	10.944	37084	105543	228577
	47.5	155.8	847	2780	2273	7456	0.42	2.31	143.99	1.656	4.702	9.705	34596	98202	202693
	48	157.5	800	2625	2174	7132	0.42	2.26	141.40	1.450	4.122	8.771	30275	86083	183191

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 3
Vs30 Worksheet
SBD-15 Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring RC-10-001

Depth (m)	Vs (m/s)	S-wave Travel Time, per 1m interval (sec)	Comments	Calculations	
0.5	250	0.004	Velocity estimated from adjacent measurement		
1.5	250	0.004	Velocity estimated from adjacent measurement	Total travel time (sec):	0.100244
2.5	238	0.004200004			
3.5	286	0.003500004		Total distance (m):	30
4.5	299	0.003349994			
5.5	294	0.003399996		Vs30 (m/s)=	30/ 0.100244
6.5	305	0.003274995		=	299.3 m/s
7.5	300	0.003333333	Velocity estimated from adjacent measurement		
8.5	195	0.005128205	Mean of similar interval in boring R-10-002		
9.5	195	0.005128205	Mean of similar interval in boring R-10-002		
10.5	195	0.005128205	Mean of similar interval in boring R-10-002		
11.5	195	0.005128205	Mean of similar interval in boring R-10-002		
12.5	195	0.005128205	Mean of similar interval in boring R-10-002		
13.5	195	0.005128205	Mean of similar interval in boring R-10-002		
14.5	195	0.005128205	Mean of similar interval in boring R-10-002		
15.5	195	0.005128205	Mean of similar interval in boring R-10-002		
16.5	400	0.0025	Velocity estimated from adjacent measurement		
17.5	400	0.0025	Velocity estimated from adjacent measurement		
18.5	444	0.002250002			
19.5	386	0.002590003			
20.5	483	0.002069999			
21.5	481	0.002080001			
22.5	503	0.001989998			
23.5	526	0.001899999			
24.5	521	0.001920001			
25.5	400	0.0025	Velocity estimated from adjacent measurement		
26.5	474	0.002109998			
27.5	495	0.002020002			
28.5	571	0.001749999			
29.5	505	0.001979998	Velocity estimated from adjacent measurement		

Shaded velocities are estimated from adjacent velocities and/or other data

Calculation of Vs30 follows methodology described in the Caltrans Geotechnical Services Design Manual, v.1.0, August 2009, p.14 .

SBD-15 Mojave River Bridge PM 43.9
Bridge No. 54-0483, boring R-10-002 (north abutment)
GPS location: North 34.55 degrees, West -117.30 degrees

Drilling was conducted by Caltrans Drilling Services. The boring was drilled in early October, 2012, drilling out a previously installed piezometer (R-10-002). This boring was cased with 3-inch diameter PVC casing and grouted from the bottom upon completion of the boring. There was a missing interval of grout from the surface to approximately 7.6 m/25 ft depth (probably from grout settling or grout migration after installation), and this interval is noted as questionable on the P-S Suspension Log data (Table 2). Natural Gamma/Induction and PS Log measurements were collected in this boring. The depth of the boring was reported as 170 ft/51.8 m. Depths were measured relative to road grade surface, as ground surface elevation was not available.

Geophysical Logs

Induction Log: A plot of the Natural Gamma/Induction log is attached.

Engineered fill used to build up the roadbed and bridge abutment is suggested by higher gamma counts (i.e., more fine-grained material) in the interval from the surface to approximately 7.5 m/24.6 ft depth. The 2010 boring log notes fill to 7.3 m/24 ft depth.

Variations in the Natural Gamma and Conductivity/Resistivity (Induction) logs suggest interlayered stratigraphy of coarse-grained to fine-grained deposits below the engineered fill, interpreted as sedimentary deposits of the Mojave River.

"Spikes" in the Induction log at approximately 13.5 m/44 ft depth suggest changed subsurface conditions. Similar spikes appear at approximately the same interval in boring R-10-001. Lower Natural Gamma readings suggest the interval between the base of the engineered fill and the Induction "spikes" is more coarse-grained than intervals above and below.

P-S Suspension Log: Seismic velocities determined by the P-S Suspension Log are tabulated on Table 1 and plotted on Plate 2.

Grout settled to approximately 7.6 m/25 ft depth after casing installation and grouting. This interval was regrouted on the morning of logging. The upper, engineered fill section (surface-7.5 m/24.6 ft) was logged through fresh grout, and the data is recorded as questionable on Table 2. Erratic Vs and poor to missing P-wave signal suggest poor grout bond. This interval is noted as questionable on Table 1.

The intermediate, possible disturbed younger alluvial sediments section (7.5m/24.6 ft to 13.5 m/44 ft), was logged at lower Vs than sections above or below, suggesting softer or more unconsolidated conditions, with mean Vs of ~195 m/s.

The lower, more consolidated older fluvial material section, was logged from 17 m/56 ft to the total depth logged at 48.5 m/159 ft. Rock-like material (Vs>785 m/s) was noted once at 48 m/157.5 ft depth. Crystalline bedrock was not encountered in this boring.

Saturated conditions (Vp>1500 m/s) were noted at the acquisition of Vp signal at 13 m/42.7 ft depth. However, actual saturated conditions are probably much higher in this boring, as Vp signal is poor/unusable/missing above this depth, and surface water was noted in the Mojave River course.

Vs30 determination: Shear wave velocities were obtained from Table 2. Missing velocities from poor or missing signal were estimated from adjacent intervals. Table 3 presents the seismic velocities used to determine the Vs30 in this boring, which is 314.4 m/s. Liquefaction potential, especially in the apparent coarser-grained, saturated, unconsolidated or disturbed younger alluvial section from 7.5 m/26.4 ft to 13.5 m/44 ft, should be assessed.

Plate 1, boring R-10-002

California Department of Transportation
Geophysical Services

SBD-15 54-0483 R-10-002 N ABT

COMPANY	: Caltrans	OTHER SERVICES:	
WELL	: SBD-15 54-0483 R-10-002 N ABT		
FIELD	: SBD-15 54-0483 R-10-002 N ABT		
COUNTY	: SBD-15 PM 43.9		
STATE	: CA		
LOCATION	:		
SECTION	:		
TOWNSHIP	:		
RANGE	:		
API NO.	:		
UNIQUE WELL ID.	:		
PERMANENT DATUM	:	ELEVATION KB	:
LOG MEASURED FROM	: GL	ELEVATION DF	:
DRL MEASURED FROM	: GL	ELEVATION GL	:
DATE	: 10/09/12	RIG NUMBER	:
DEPTH DRILLER	: 51.8m.	LOGGER TD	:
BIT SIZE	: 10	ARRIVAL TIME	:
LOG TOP	: -0.26	DEPARTURE TIME:	
LOG BOTTOM	: 51.52	CIRC STOPPED	: PM
CASING OD	:		
CASING BOTTOM	: TD		
CASING TYPE	: PVC		
BOREHOLE FLUID	: 0		
RM TEMPERATURE	: 0		
MUD RES	: 0		
MUD WEIGHT	:		
WITNESSED BY	:		
RECORDED BY	: DH/DG		
REMARKS 1	: I-15 Mojave R BR, North Abutment, Victorville		
REMARKS 2	: PVC cased and grouted, grout settled 7.8m, fresh grout (top off)		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Plate 1, boring R-10-002

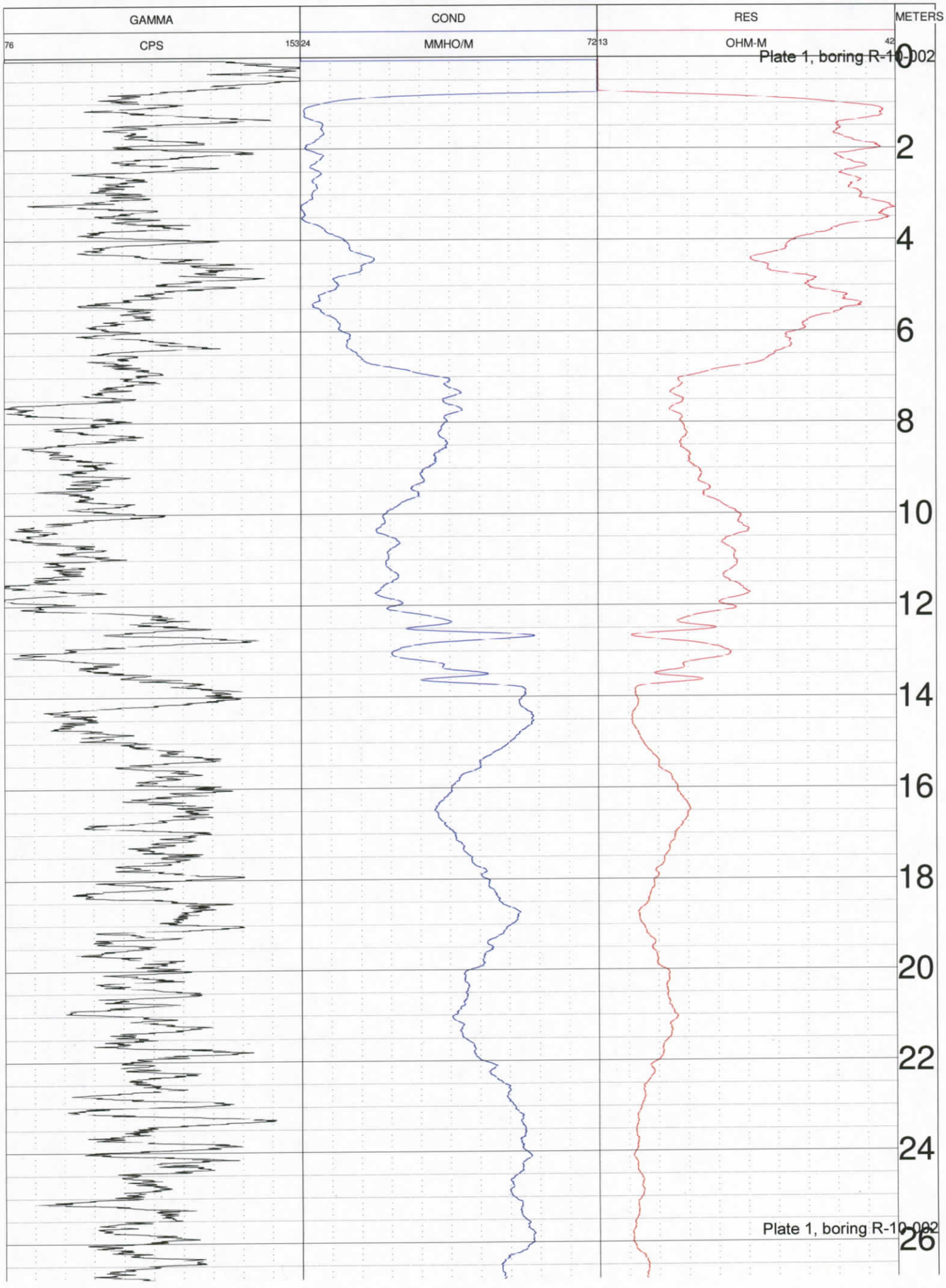


Plate 1, boring R-10-002

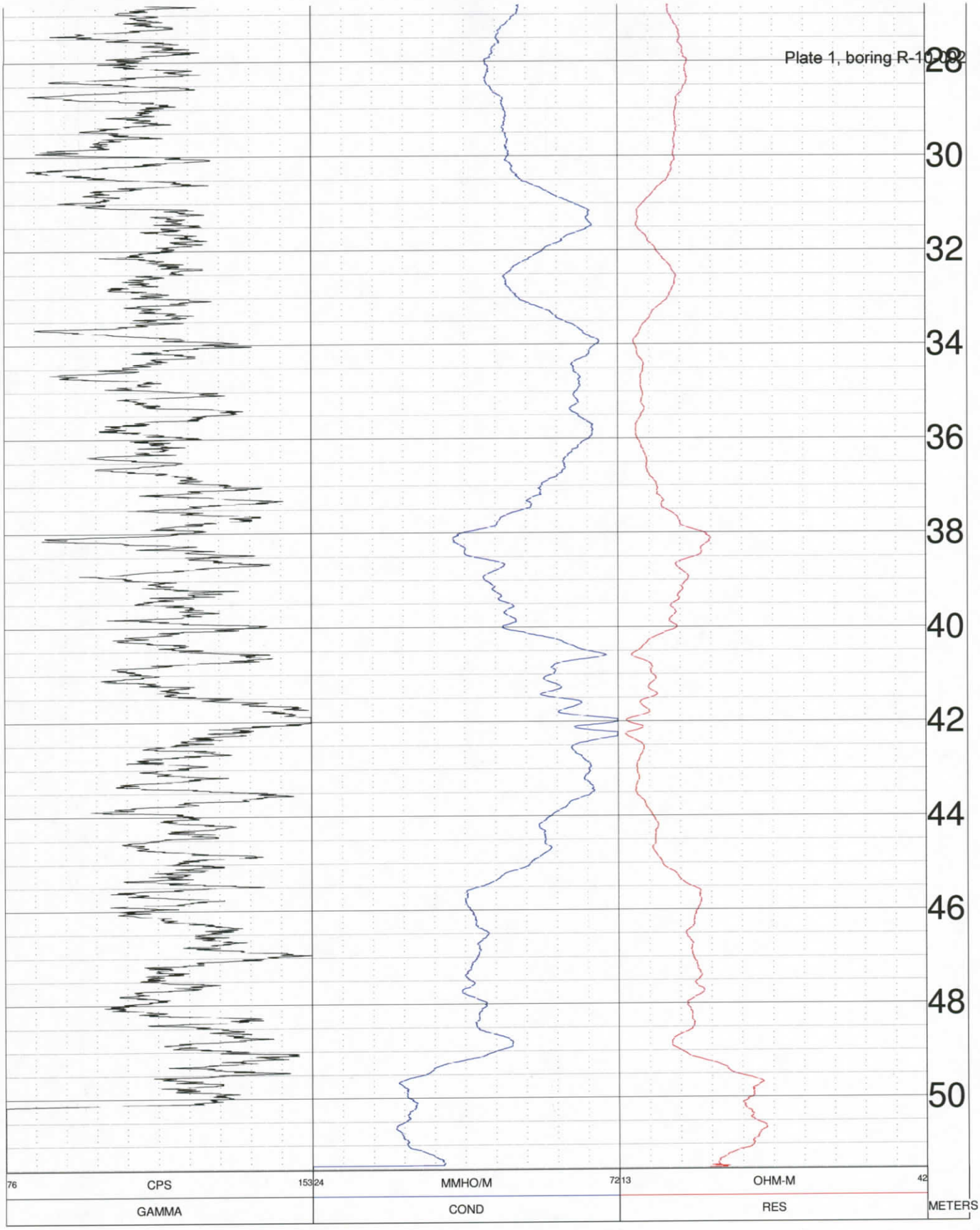
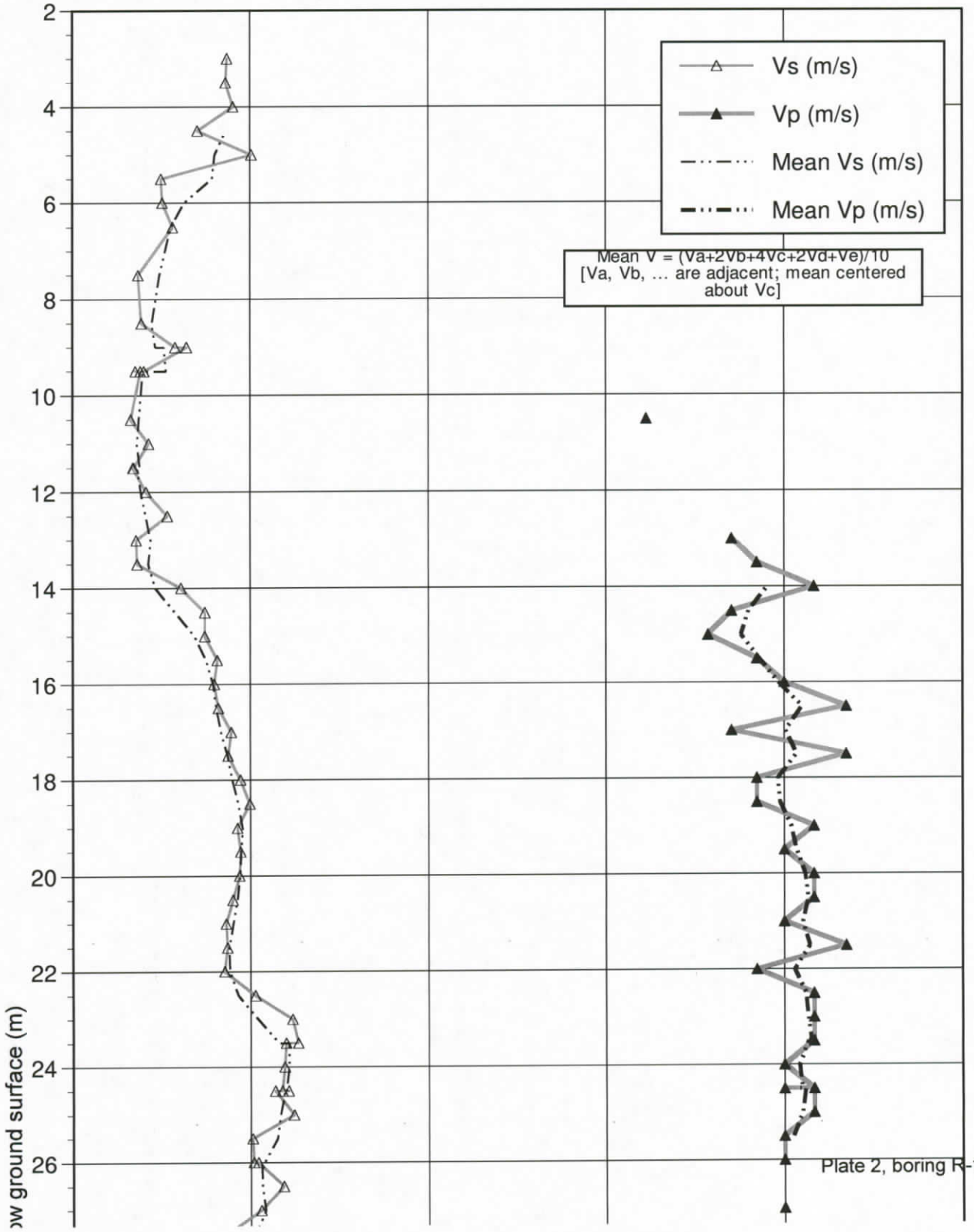


Plate 1, boring R-10-002

Plate 2
SBD-15 Victorville Mojave River Bridge, North Abutment
Bridge No. 54-0483, boring R-10-002
Downhole Interval Velocities

Top of Hole Elevation: Not Provided



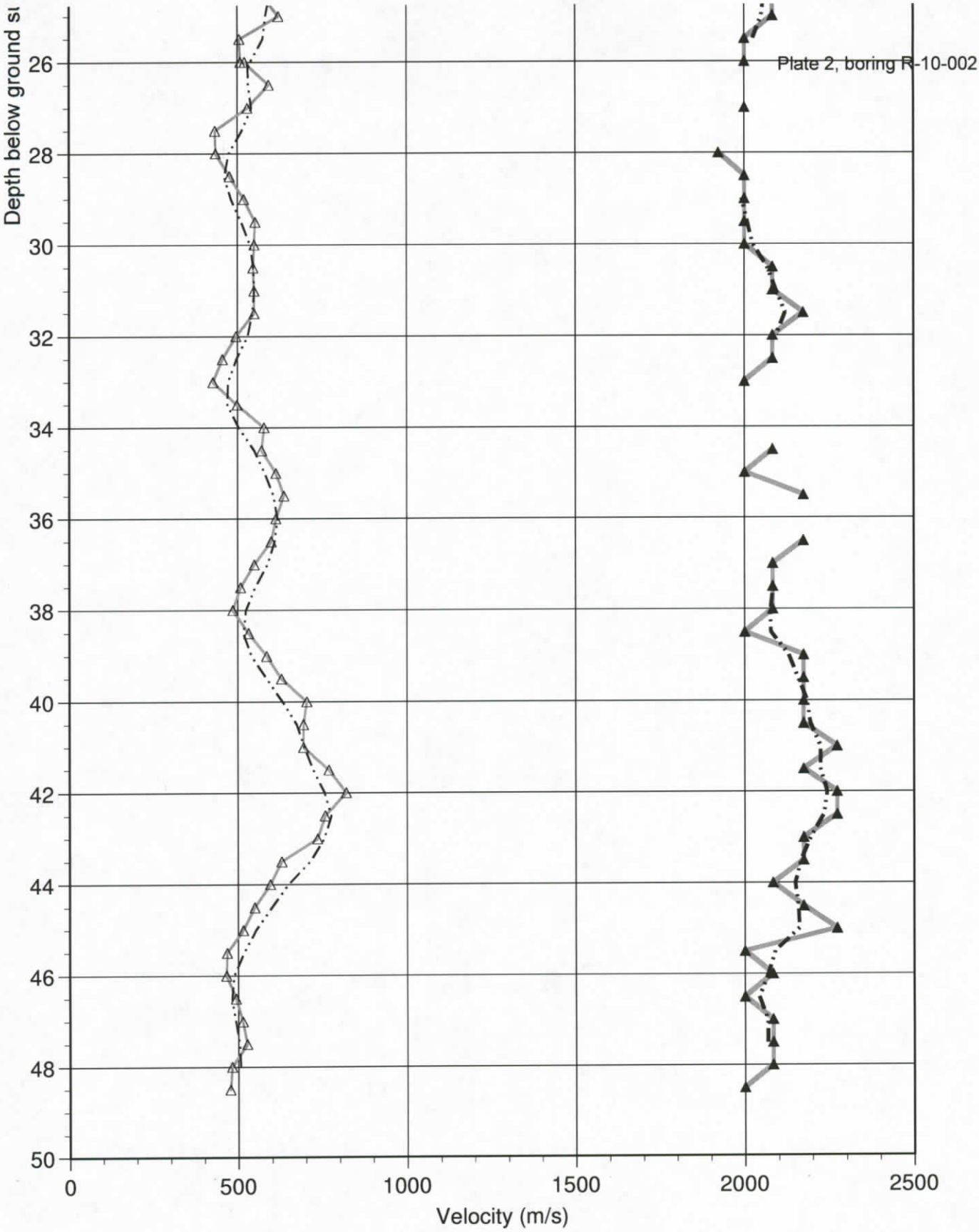


Plate 2, boring R-10-002
Depth below ground su
26
28
30
32
34
36
38
40
42
44
46
48
50
0
500
1000
1500
2000
2500
Velocity (m/s)

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

	Boring location: North 34.55 degrees, West -117.30 degrees														
Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
Not Provided	3	9.8	435	1426		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3.5	11.5	431	1414		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	13.1	452	1485		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.5	14.8	352	1155		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	16.4	503	1649		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5.5	18.0	249	818		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	19.7	253	828		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6.5	21.3	282	927		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7.5	24.6	185	608		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8.5	27.9	194	636		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9	29.5	289	948		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9	29.5	321	1052		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	201	659		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	177	580		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	191	626		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10.5	34.4	164	538	1613	5292	0.49	1.94	121.09	0.052	0.156	4.976	1089	3255	103932
	11	36.1	214	701		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11.5	37.7	172	563		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11.5	37.7	170	558		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12	39.4	207	681		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12.5	41.0	267	877		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	13	42.7	179	587	1852	6076	0.50	2.10	131.15	0.067	0.201	7.115	1404	4199	148594
	13.5	44.3	182	597	1923	6309	0.50	2.14	133.69	0.071	0.212	7.826	1479	4422	163440
	14	45.9	305	1000	2083	6835	0.49	2.22	138.82	0.207	0.616	9.376	4317	12856	195813
	14.5	47.6	372	1220	1852	6076	0.48	2.10	131.15	0.290	0.859	6.817	6063	17936	142381
	15	49.2	372	1220	1786	5859	0.48	2.06	128.62	0.285	0.841	6.190	5946	17570	129279
	15.5	50.9	407	1334	1923	6309	0.48	2.14	133.69	0.354	1.045	7.448	7391	21827	155556
	16	52.5	398	1307	2000	6562	0.48	2.18	136.25	0.346	1.025	8.268	7235	21407	172683
	16.5	54.1	410	1345	2174	7132	0.48	2.26	141.40	0.380	1.127	10.197	7946	23544	212963
	17	55.8	446	1465	1852	6076	0.47	2.10	131.15	0.419	1.230	6.646	8744	25694	138807
	17.5	57.4	437	1433	2174	7132	0.48	2.26	141.40	0.432	1.278	10.128	9021	26682	211530
	18	59.1	472	1548	1923	6309	0.47	2.14	133.69	0.476	1.399	7.285	9952	29218	152142
	18.5	60.7	498	1632	1923	6309	0.46	2.14	133.69	0.530	1.552	7.213	11071	32418	150650
	19	62.3	463	1519	2083	6835	0.47	2.22	138.82	0.477	1.405	9.016	9954	29345	188297
	19.5	64.0	472	1548	2000	6562	0.47	2.18	136.25	0.486	1.428	8.083	10142	29829	168807
	20	65.6	469	1540	2083	6835	0.47	2.22	138.82	0.490	1.444	8.998	10236	30161	187921

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
	20.5	67.3	450	1478	2083	6835	0.48	2.22	138.82	0.451	1.331	9.050	9423	27808	189005
	21	68.9	431	1414	2000	6562	0.48	2.18	136.25	0.405	1.197	8.189	8469	24994	171038
	21.5	70.5	435	1426	2174	7132	0.48	2.26	141.40	0.428	1.267	10.133	8942	26454	211634
	22	72.2	427	1402	1923	6309	0.47	2.14	133.69	0.391	1.153	7.398	8168	24081	154520
	22.5	73.8	513	1682	2083	6835	0.47	2.22	138.82	0.585	1.717	8.872	12213	35853	185285
	23	75.5	617	2025	2083	6835	0.45	2.22	138.82	0.847	2.460	8.522	17696	51385	177974
	23.5	77.1	633	2076	2083	6835	0.45	2.22	138.82	0.891	2.582	8.464	18603	53919	176765
	23.5	77.1	599	1965	2083	6835	0.45	2.22	138.82	0.797	2.320	8.588	16652	48457	179366
	24	78.7	595	1953	2000	6562	0.45	2.18	136.25	0.773	2.245	7.699	16150	46881	160796
	24.5	80.4	588	1930	2083	6835	0.46	2.22	138.82	0.769	2.242	8.625	16070	46817	180143
	24.5	80.4	606	1988	2000	6562	0.45	2.18	136.25	0.802	2.324	7.661	16743	48536	160006
	24.5	80.4	568	1864	2083	6835	0.46	2.22	138.82	0.718	2.096	8.694	14993	43774	181579
	25	82.0	621	2038	2083	6835	0.45	2.22	138.82	0.858	2.490	8.507	17917	52002	177680
	25.5	83.7	505	1657	2000	6562	0.47	2.18	136.25	0.557	1.632	7.988	11627	34089	166827
	26	85.3	508	1665	2000	6562	0.47	2.18	136.25	0.562	1.648	7.980	11745	34427	166669
	26	85.3	521	1709	2000	6562	0.46	2.18	136.25	0.592	1.733	7.941	12365	36195	165843
	26.5	86.9	592	1941		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	27	88.6	529	1736	2000	6562	0.46	2.18	136.25	0.611	1.787	7.915	12761	37322	165315
	27.5	90.2	433	1420		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	28	91.9	435	1426	1923	6309	0.47	2.14	133.69	0.405	1.193	7.380	8455	24910	154138
	28.5	93.5	476	1562	2000	6562	0.47	2.18	136.25	0.495	1.455	8.070	10336	30387	168548
	29	95.1	518	1700	2000	6562	0.46	2.18	136.25	0.586	1.716	7.949	12237	35831	166013
	29.5	96.8	552	1813	2000	6562	0.46	2.18	136.25	0.666	1.944	7.842	13914	40591	163778
	30	98.4	549	1803	2000	6562	0.46	2.18	136.25	0.659	1.923	7.852	13761	40160	163981
	30.5	100.1	546	1793	2083	6835	0.46	2.22	138.82	0.664	1.943	8.766	13868	40579	183079
	31	101.7	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14021	41013	182875
	31.5	103.3	549	1803	2174	7132	0.47	2.26	141.40	0.684	2.005	9.792	14281	41869	204516
	32	105.0	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	32.5	106.6	455	1491	2083	6835	0.48	2.22	138.82	0.459	1.355	9.039	9595	28307	188775
	33	108.3	427	1402	2000	6562	0.48	2.18	136.25	0.399	1.177	8.199	8325	24576	171230
	33.5	109.9	498	1632		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	34	111.5	578	1896		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	34.5	113.2	571	1875	2083	6835	0.46	2.22	138.82	0.726	2.119	8.683	15165	44260	181350
	35	114.8	613	2013	2000	6562	0.45	2.18	136.25	0.821	2.379	7.635	17156	49687	159455
	35.5	116.5	637	2090	2174	7132	0.45	2.26	141.40	0.919	2.670	9.479	19191	55772	197969
	36	118.1	613	2013		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	36.5	119.8	599	1965	2174	7132	0.46	2.26	141.40	0.812	2.370	9.621	16962	49493	200941

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
	37	121.4	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14020	41013	182875
	37.5	123.0	508	1665	2083	6835	0.47	2.22	138.82	0.573	1.683	8.887	11967	35145	185614
	38	124.7	485	1593	2083	6835	0.47	2.22	138.82	0.524	1.542	8.953	10944	32203	186977
	38.5	126.3	532	1745	2000	6562	0.46	2.18	136.25	0.618	1.806	7.907	12897	37709	165134
	39	128.0	585	1919	2174	7132	0.46	2.26	141.40	0.775	2.263	9.671	16178	47271	201987
	39.5	129.6	629	2063	2174	7132	0.45	2.26	141.40	0.896	2.606	9.509	18712	54426	198608
	40	131.2	704	2310	2174	7132	0.44	2.26	141.40	1.123	3.238	9.206	23460	67630	192277
	40.5	132.9	694	2278	2174	7132	0.44	2.26	141.40	1.092	3.153	9.248	22813	65846	193140
	41	134.5	694	2278	2273	7456	0.45	2.31	143.99	1.112	3.222	10.431	23231	67301	217847
	41.5	136.2	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	42	137.8	820	2689	2273	7456	0.43	2.31	143.99	1.550	4.417	9.848	32365	92255	205668
	42.5	139.4	758	2485	2273	7456	0.44	2.31	143.99	1.324	3.806	10.149	27647	79484	211959
	43	141.1	735	2412	2174	7132	0.44	2.26	141.40	1.225	3.516	9.071	25576	73423	189456
	43.5	142.7	629	2063	2174	7132	0.45	2.26	141.40	0.896	2.606	9.509	18712	54426	198608
	44	144.4	595	1953	2083	6835	0.46	2.22	138.82	0.788	2.294	8.601	16455	47901	179630
	44.5	146.0	549	1803	2174	7132	0.47	2.26	141.40	0.684	2.005	9.792	14281	41869	204516
	45	147.6	515	1691	2273	7456	0.47	2.31	143.99	0.613	1.805	11.097	12799	37704	231756
	45.5	149.3	467	1533	2000	6562	0.47	2.18	136.25	0.477	1.402	8.095	9953	29285	169058
	46	150.9	465	1526	2083	6835	0.47	2.22	138.82	0.481	1.418	9.010	10047	29613	188173
	46.5	152.6	493	1616	2000	6562	0.47	2.18	136.25	0.530	1.555	8.024	11061	32469	167581
	47	154.2	513	1682	2083	6835	0.47	2.22	138.82	0.585	1.717	8.872	12213	35852	185285
	47.5	155.8	526	1727	2083	6835	0.47	2.22	138.82	0.616	1.806	8.830	12865	37717	184416
	48	157.5	481	1577	2083	6835	0.47	2.22	138.82	0.514	1.513	8.966	10734	31600	187257
	48.5	159.1	476	1562	2000	6562	0.47	2.18	136.25	0.495	1.455	8.070	10336	30387	168548

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 2
Vs30 Worksheet
SBD-15 Victorville Mojave River Bridge, North Abutment
Bridge No. 54-0483, boring R-10-002

Depth (m)	Vs (m/s)	S-wave Travel Time, per 1m interval (sec)	Comments	Calculations	
0.5	250	0.004	Velocity estimated		
1.5	250	0.004	Velocity estimated	Total travel time (sec):	0.09542
2.5	250	0.004	Velocity estimated		
3.5	431	0.002320003		Total distance (m):	30
4.5	352	0.002839997			
5.5	249	0.004009993		Vs30 (m/s)=	30/ 0.09542
6.5	282	0.003539998		=	314.4 m/s
7.5	185	0.005400005			
8.5	194	0.005160012			
9.5	191	0.005239992			
10.5	164	0.006100016			
11.5	172	0.00583002			
12.5	267	0.003739996			
13.5	182	0.005500006			
14.5	372	0.002690002			
15.4	407	0.00246			
16.5	410	0.00244			
17.5	437	0.002290001			
18.5	498	0.002009998			
19.5	472	0.002119996			
20.5	450	0.002220002			
21.5	435	0.002299998			
22.5	513	0.001949998			
23.5	599	0.001669998			
24.5	588	0.001699995			
25.5	505	0.001979998			
26.5	592	0.00169			
27.5	433	0.002309997			
28.5	476	0.002099998			
29.5	552	0.001810001			

Shaded velocities are estimated from adjacent velocities and/or other data

Calculation of Vs30 follows methodology described in the Caltrans Geotechnical Services Design Manual, v.1.0, August 2009, p.14 .

APPENDIX 1: GEOPHYSICS AND GEOLOGY BRANCH BOREHOLE GEOPHYSICAL LOGGING PROGRAM

This appendix summarizes the instruments and procedures used in the Borehole Geophysical Logging Program. Two logging units are currently deployed: a Century Geophysical system and an OYO Geosciences P-S Logging system. Both systems consist of downhole probes connected by a winch to a data acquisition system on the surface. Specific attributes of these systems are described below.

I. INSTRUMENTATION

A. Century system

The Century system is used to obtain caliper, natural gamma, and conductivity or resistivity measurements. These measurements constitute the basic logging suite. Three probes are used for these measurements: a caliper probe, a conductivity/gamma combination (induction probe), or a resistivity/gamma combination probe.

The caliper probe mechanically measures borehole diameter for assessment of hole quality (e.g., the presence of washouts or squeeze-ins). Caliper measurements are not collected in cased borings.

The gamma tools measure natural background radioactivity from decay of naturally occurring radioisotopes. These isotopes are commonly concentrated in clays and arkosic sands. The natural gamma log provides the best information concerning interpretation of material types, contacts, and thickness. Although a gamma reading is not generally repeatable in the sense of absolute precision, general trends can be seen from the log. This log provides sharp contrasts between units of sand (low gamma counts) and clay (high gamma spikes). The gamma log is thus useful for distinguishing between clayey and sandy beds.

The conductivity and resistivity tools measure formation conductivity or resistivity of the adjacent formation. Conductivity and resistivity are inversely related and are influenced by porosity and the amount of clay minerals present in the formation, as well as the salinity of pore fluids; thus, the conductivity and resistivity logs are useful for delineating sandy versus clayey zones and freshwater versus brackish/saltwater zones. Materials of high conductivity usually show up well in the conductivity log, and suggest clay-rich beds. Increases in resistivity, along with changes in the natural gamma, suggest subsurface lithologic changes.

Additional Century tools include the full wave sonic. The full wave sonic tool is designed to measure the time it takes for a compressional sound wave to travel a unit distance. The interval transit time for a formation depends on the elastic properties of the formation, which are related to lithology and porosity. In general, waves travel faster through denser formations. Therefore, an increasing travel time for a given type of material indicates increased porosity. Sonic-derived porosity is reported, and rock quality can be assessed using a tube-wave amplitude analysis. Cement bond logs (CBL) of steel or PVC cased borings can be obtained using this tool.

B. OYO P-S Logger

The OYO Model 170 Suspension P-S Logging system was used to obtain in-situ Vs and Vp measurements. The logging system consists of a downhole probe connected to a surface winch and seismograph. The probe contains a seismic source and two sets of oriented geophones separated by a fixed (1-meter) distance. Because the source is at a constant distance from the receivers, interval velocities can be recorded with greater detail and at greater depths than conventional (surface-source) downhole shear wave surveys.

The source is a self-contained, electronically activated hammer. The hammer transmits pulses through the borehole fluid into the adjacent medium. The pulse generates refracted P waves and converted shear waves. (The principle of wave conversion is discussed in detail in Telford et al., 1976, p. 249-255.) In addition to P waves and converted S waves, the pulse generates a surface wave on the borehole wall with a velocity equivalent to the formation shear wave (Kitsunezaki, 1980); this wave is often referred to as a **flexural wave** (other waves are also generated, but only those pertinent to our investigation are presented here.) The refracted P wave, P-converted S wave and flexural wave are transmitted back into the borehole fluid, where they are detected by the geophones. The arrival times of the different waves at each geophone are then used to calculate P- and S- wave velocities for the interval between them. To aid in identification of S waves, the hammer fires two oppositely-polarized pulses. The resulting change in S-wave polarity (recorded on separate geophone channels) can then be used to determine the onset of the S-wave and flexural wave. In low-velocity materials ($V_p \leq 1500$ m/s), body waves (P and S waves) cannot be directly measured due to refraction of those waves into the formation and away from the borehole. The ability to generate and detect the flexural wave enables measurement of shear-wave velocity for those materials.

To accommodate site-specific conditions, the distance between the source and the geophones can be varied via detachable spacers (filter tubes) of fixed lengths. The distance between source and geophones can be varied up to 3 meters, to maximize signal amplitude, minimize record length and provide a sufficient measurement interval to allow recognition of the source pulse at the geophones.

The seismograph consists of a central processing unit connected to a signal monitor and printer. Six channels (three for each geophone) are recorded with each measurement and displayed on the monitor. Recording gains are individually adjustable for each channel. Additionally, multiple shots may be recorded and stacked with each measurement for additional signal enhancement.

II. DATA ACQUISITION AND PROCESSING

A. Century system

Logging operations with the Century system requires two trips into the borehole. The caliper log is used first, to assess potential borehole instability that must be corrected prior to additional measurements. The caliper is calibrated before logging and checked immediately

afterward to assess instrument drift. If excessive drift is discovered, the caliper log is repeated. Conductivity or resistivity logs are recorded after the caliper log. A repeat section of conductivity or resistivity measurements is recorded after the run to check for drift. All logs are measured from the bottom to the top of the borehole, with measurements recorded continuously as the probe is raised.

Parameters for the full wave sonic (borehole diameter, gain, sampling interval) are downloaded into the tool from the surface. A repeat section can be recorded after changing the tool parameters, based on real-time observations, inspection of the lithologic log, and consultation with the drillers and geologist.

B. OYO P-S Logger

The general operation of the P-S logger is as follows: 1) the probe is lowered to a selected depth in the hole, 2) gains, number of stacks and display parameters are optimized, 3) the probe is then lowered to the bottom of the hole, and 4) measurement proceeds. Measurement usually proceeds from the bottom up. The probe is incrementally raised and measurements are collected and stored on floppy disk and hard copy printout. Signal quality is monitored throughout the process and recording parameters are re-adjusted as necessary.

Once collected and stored, data are processed using PSLog, a proprietary software package developed by OYO Corporation. PSLog is used to examine the trace data, pick arrival times and calculate P and S interval velocities. (Basic concepts of interval velocity are presented in Telford et al., 1976, p. 347-350.) Arrival times are picked manually. To refine arrival picks, signal filtering can be used to attenuate undesirable frequencies and enhance the S-wave signal. Pick quality can be grouped into four general categories (based on shear wave observation):

Excellent: first breaks easily identifiable from a single shot without filtering; little or no background noise;

Good: decreasing signal-to-noise ratio; amplitude peaks (immediately following first break) identifiable without filtering, but filtering required for accurate picking of arrivals; stacking of multiple shots may be needed;

Fair: low signal-to-noise ratio; filtering required for recognition of amplitude peaks; stacking required;

Poor: very noisy; filtering and stacking required for recognition of amplitude peaks; picking of identical peaks (or troughs) at upper and lower geophones possible by comparison to adjacent records;

Not Detected: no recognizable shear waves, or recognition of identical amplitude peaks at upper and lower geophones not possible; extremely noisy.

Once velocities have been obtained, the data are exported to a spreadsheet for additional calculations. These calculations may include mean velocities, cumulative travel times and elastic moduli. These data are subsequently tabulated and exported to a graphing program for final printing and reporting.

III. ADVANTAGES AND LIMITATIONS

A. Century system

The caliper log provides accurate, fast measurement of borehole diameter; however, because the caliper arms do not move independently, ellipticity or dipping irregularities cannot be detected. Instead, average borehole diameter is measured. The gamma log likewise provides rapid measurement and can be run through steel or plastic casing with little attenuation. However, since gamma decay is not a constant process, log repeatability is never exact. Additionally, arkosic sands or leukocratic lava beds may exhibit high gamma counts unrelated to clay or shale content. Conductivity (induction) logs can be easily run through plastic casing, but are less sensitive than some resistivity logs. Sensitivity is also reduced by saline drilling fluids. Resistivity logs require continuity with the formation, so they must be run in open, fluid-filled holes.

Borehole diameter, lithologic changes (i.e., hard material/soft material), condition of the drilling fluids, and tool decentralization affect the quality of the full wave sonic measurements.

B. OYO P-S Logger

Because the source is a constant distance from the geophones, an advantage of the P-S Logger over shear wave loggers using a surface source is the ability to collect data from greater depths in shorter times. Additionally, since the interval velocity is obtained over a shorter total distance, more detailed interval velocity data can be obtained. Data can be obtained from cased holes, provided plastic (e.g., PVC) casing is used. Because the <u>difference</u> in arrival times between the two geophones is used to calculate interval velocity, timing errors caused by shot delay and P-wave travel within the borehole fluid are eliminated, and pick accuracy up to ± 0.01 ms can be obtained. Finally, stacking and filtering capabilities allow optimal data collection in marginal environments.

The primary limitation of the P-S Logger is velocity error due to misalignment of the geophones in the borehole or lithologic heterogeneity between geophones, borehole eccentricity and washouts. This error can be partially compensated by averaging normal and reversed shear wave velocities and by increasing measurement density, but cannot be completely eliminated. Additional limitations are related to measurement environment and are not unique to the P-S Logger. These include noisy environments (low signal to noise ratio), hard rock (difficult P and S differentiation due to high S velocities) and borehole instability. Despite these limitations, the P-S Logger remains an efficient tool for in-situ determination of P and S velocities.

NOTES ON P-S LOG CALCULATIONS

Initial elastic moduli are derived from the velocity measurements. Calculations of elastic moduli use an empirical relationship between P-wave velocity and density (Owen and Vickery, 1997). The seismic source used for these measurements creates very low strain (10^{-6} to 10^{-7}); therefore, the derived elastic moduli represent maximum values. At higher strain, the moduli will decrease. If these data are used for purposes other than estimation of earthquake ground response (i.e., determination of qu [FHWA, 1988]), caution should be observed. Additionally, because these moduli assume elastic deformation in an isotropic medium, they may not be accurate for fractured rock, dipping sediments or other highly anisotropic rock or soil. These moduli should be considered tentative pending comparison to laboratory test results.

REFERENCES

FHWA, July 1988, Drilled Shafts, Publication No. FHWA-HI-88-042, p. 266.

Kitsunezaki, C., 1980, A new method for shear-wave logging, Geophysics, **45**, no. 10, p. 1489-1506.

Owen, W.P., and Vickery, D.K., *in* Bell, R.S., 1997, Borehole velocity logging for the Caltrans bridge retrofit program, Proceedings of the symposium on the application of geophysics to engineering and environmental problems, Environmental and Engineering Geophysical Society, p. 947-51.

Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys, D.A., 1976, Applied Geophysics, New York, Cambridge University Press.

APPENDIX B

State of California Department of Transportation
Division of Engineering Services
Office of Design & Technical Services

Structure Hydraulics

REPORT ADDENDUM FOR 7/31/2008 FINAL HYDRAULIC REPORT

West Frontage Road Bridge over Mojave River

Located within the city of Victorville and paralleled to the
Interstate 15 in San Bernardino County.

JOB:
Bridge No.54C-0661, EPIS 0800000621

LOCATION:
08-SBd-15-PM 43.86

PREPARED BY (Signature)

REGISTERED PROFESSIONAL ENGINEER
J GINGER LU
C 71324
EXP 12/31/2013
CIVIL
STATE OF CALIFORNIA

Ginger Lu, PE
Structure Hydraulics & Scour Mitigation
March 29, 2013

This report has been prepared under my direction as the professional engineer in responsible charge of the work, in accordance with the provisions of the Professional Engineers Act of the State of California.

Addendum

General:

This report is an addendum to supplement scour number and water surface elevation for the revised proposed structure, which is not in the 7/31/2008 Final Hydraulic Report for West Frontage Road Bridge over Mojave River. The newly proposed structure for the road is a 574.' long, 43' wide, 7.33 thick precast-prestressed- concrete (PC/PS) bulb T-girder structure with 20° skew. This 5-span bridge will be supported by four one-column bents on case-in-drilled-hole (CIDH) piles.

This report bases geometric information on the General Plans provided on 3/1/2013 by the Office of Bridge Design and the same survey data from 5/21/04 by PI North. The values in this report are in English and based on 1929 NGVD vertical datum.

Stage/Velocity:

The hydraulics software - HEC-RAS was used to model the 480' stretch of the river channel for the project site. There were two conditions (the proposed and the existing) constructed on the 2004 surveyed DTM for the project. The existing condition contains the existing I-15 structures without the Frontage Road bridge and the proposed condition with the Frontage Road bridge. The difference in the water surface elevations (WSEL) of a 100 year event between the two conditions is about two tenths of a foot and the results are listed below.

Condition	***Proposed***
WSEL (Q_{100}), ft	2700.3
Velocity (Q_{100}), ft/s	9.9
Design Soffit Elevation, ft	2707.33
Available Freeboard, ft	7.0

Scour:

The total potential scour at the project site was determined in accordance with the procedures outlined in HEC-18, "Evaluating Scour at Bridges Fifth Edition" (Chapter 7.2, FHWA-HIF-12-003, 2012). The only scour depth being affected with the proposed is local pier scour depth and all other assumptions and scour risks remain the same. Local scour depth for Q_{100} at piers is the total scour depth in this case and the scour numbers are shown as follows.

Condition	***Proposed***
Thalweg Elevation, ft	2688.1
Scour Depth, ft (Q_{100})	9.6
Scour Elevation, ft	2678.5

Summary & Recommendation:

Hydrologic Summary			
Drainage Area: 513 mi^2			
Frequency	***Design Flood 50-year Event***	***Base Flood 100-year Event***	***Overtopping Flood/Flood of Record?***
Discharge	25,500 cfs	30,900 cfs	N/A
WSEL at Bridge	2699.5 ft	2700.3 ft	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

Bridge	***Proposed***
Design Soffit Elevation, Q_{100}	2707.3 ft
Available Freeboard, Q_{100}	7.0 ft
Total Scour Elevation, Q_{100}	2678.5 ft

In conclusion, new foundations should be placed below the total scour elevation. Lastly, it is recommended that new structure should be aligned with the existing structure, and any construction efforts disrupting the existing grouted riprap levees should be avoided. Any disturbances to the grouted riprap should be replaced in kind.

State of California Department of Transportation
Division of Engineering Services
Office of Design & Technical Services

Structure Hydraulics

FINAL HYDRAULIC REPORT

West Frontage Road Bridge over Mojave River

Located within the city of Victorville and paralleled to the
Interstate 15 in San Bernardino County.

JOB:
Bridge No.54C-0661, EA 08-355561

LOCATION:
08-SBd-15-PM 43.86

PREPARED BY (Signature)

Ginger Lu, PE
Structure Hydraulics & Scour Mitigation
July 31, 2008

This report has been prepared under my direction as the professional engineer in responsible charge of the work, in accordance with the provisions of the Professional Engineers Act of the State of California.

Hydrology/Hydraulics Report

General:

It is proposed to construct a new two-lane county bridge parallel to and 15 ft downstream from the existing Mojave River Bridge (Bridge No. 54-0483) for the West Frontage Road in the city of Victorville. Four alternatives are being considered for this bridge, and a bridge length of 574 ft and width of 52 ft with seat-type abutments on piles are selected for them. Alternative A proposes an eight-span, 4.33-ft deep and cast-in-place prestressed (CIP/PS) concrete box girder superstructure supported by 1.5 ft thick pier walls with 1 row of piles per bent. Alternative B proposes a four-span, 6-ft deep and CIP/PS concrete box girder superstructure supported by 4.5-ft diameter columns and 2 columns per bent on cast-in-drilled-hole (CIDH) pile extensions. Alternative C proposes an eight-span, 4.33-ft deep and deep precast I girder superstructure supported by 1.5 ft thick pier walls with1 row of piles per bent. Alternative D proposes an eight-span, 4.33-ft deep and precast I girder superstructure supported by 3-ft diameter cast-in-steel-shell (CISS) pile extensions.

This report bases geometric information on the General Plans provided on 4/15/08 by the Office of Structure Design and surveying data from 5/21/04 (1929 NGVD) by Preliminary Investigations, North Section. This document makes reference to the Mojave River Floodplain Maintenance Plan (FMP) and the Technical Appendices of this FMP published in June 1997 by U.S. Army Corps of Engineers (USACE) Los Angeles District.

Basin:

The Mojave River Basin lies on the northern side of the San Bernardino Mountains, which are the source of the headwaters to the Mojave River. Elevations in the mountainous headwaters range from 3000 feet to 8500 feet and receive approximately 40 inches of mean annual precipitation, compared to 5 inches mean annual precipitation near the bridge site. Nearly all of the surface runoff in the Mojave River is contributed by the mountainous headwaters. According to the Mojave River Flood Plain Maintenance Plan (USACE 1997), the shallow surface soils, impervious bedrock, and steep gradients produce high runoff rates and rapid concentration of floodwaters.

Near the confluence of Deep Creek and West Fork Mojave River, flood control is provided by the Mojave River Dam, which is operated by the Army Corps of Engineers. Under the dam's design flood, maximum outflow from the reservoir is 23,500 cfs. The project site is located approximately 14 miles downstream from the dam and has a drainage basin of 513 square miles at Lower Narrows near Victorville within the Mojave River Basin.

Discharge:

Discharge information for this report was obtained from the study prepared by the USACE in

the Mojave River Floodplain Maintenance Plan. The discharge values differ between the FEMA Flood Insurance Study and the USACE study, and the values used in the USACE hydraulic study were utilized for this report (see Table below).

Frequency	***FEMA Flood Insurance Study (cfs)***	***Army Corps of Engineers Study (cfs)***	***Discharge Used (cfs)***
50-yr	20,000	25,500	25,500
100-yr	26,000	30,900	30,900
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

Flood History:

In reviewing the Caltrans bridge files, there is no known record of bridge overtopping. In 1993 the left bank of the river, upstream of the Mojave River Bridge, was overtopped and required emergency channel clearing and levee repair. The overtopping of the levee is attributed to the dense woody vegetation and large sand bars in the vicinity of the bridge, which obstructed the channel. According to the Mojave River Floodplain Maintenance Plan, many of the bridge bays were almost completely blocked with debris and vegetation.

Channel Maintenance:

As a result of the flooding of 1993, the San Bernardino County Flood Control District, in coordination with the ACOE, has been actively maintaining the river channel clear of vegetation in the vicinity of the Mojave River Bridge. The clearing limits consist of clearing vegetation and sedimentation along a 300-foot centerline extending approximately 4500 ft upstream of the bridge to approximately 1400 ft downstream of the bridge. Based on discussions with the Flood Control District, the clearing operations consist of grading the river channel in order to remove vegetation and sedimentation using heavy equipment. Clearing operations occur about every 2 to 3 years when the river channel has built up debris or sedimentation beyond approximately two feet.

As part of the Flood Control District's agreement with the ACOE, the Flood Control District is required to maintain a minimum downstream channel capacity of 23,500 cfs from the Mojave River Dam plus downstream tributary inflow and storm runoff.

Stage/Velocity:

A Manning's roughness coefficient of 0.033 for the channel bottom and 0.04 for the banks, and a slope of 0.3% were used in the analysis. In order to pass drift, a minimum of 3 feet of

freeboard is recommended. The bridge hydraulics program BrEase was used to determine the water surface elevations (WSEL) and velocities for Q_{50} and Q_{100}.

Bridge	***Alt. A***	***Alt. B***	***Alt. C***	***Alt. D***
WSEL, Q_{50}	2698.7 ft	2698.7 ft	2698.7 ft	2698.5 ft
Velocity Q_{50}	8.4 ft/sec	8.4 ft/sec	8.4 ft/sec	8.4 ft/sec
WSEL, Q_{100}	2699.6 ft	2699.6 ft	2699.6 ft	2699.3 ft
Velocity Q_{100}	9.0 ft/sec	9.0 ft/sec	9.0 ft/sec	9.0 ft/sec
Design Soffit Elevation, Q_{100}	2709.5 ft	2707.8 ft	2709.5 ft	2709.5 ft
Available Freeboard, Q_{100}	10.3 ft	8.9 ft	10.3 ft	10.3 ft

Streambed and Scour:

At the project site location, the streambed is a relatively straight uniform trapezoidal channel consisting of levees on both sides of the channel. In the immediate vicinity of the existing bridge, the levees are armored with grouted riprap. No hydraulic skew was observed at the bridge site. The channel bed material consists mostly of sand. The total potential scour at the project site was determined in accordance with the procedures outlined in HEC-18, "Evaluating Scour at Bridges". Total scour at bridges comprises three components: long term aggradation and degradation, general scour, and local scour at piers or abutments.

A review of recent and historic channel cross-sections taken at the bridge indicates that the channel has been aggrading. Due to the channel grading that the Flood Control District has been performing since the early 1990s, it is difficult to accurately determine an aggradation rate. General scour consists of natural river scour and contraction scour (if any) at the bridge location. There is no apparent evidence indicating a potential for general river scour. Based on given bridge design in relation to the existing levees, minimal to no flow contraction is expected to occur. The existing abutment embankments are flush with the levees and do not protrude into the channel. Moreover, the calculated WSEL is below the estimated soffit elevation. Therefore, no contraction scour, pressure scour, or local abutment scour is anticipated.

Scour Type	***Scour Depth***	***Comments***
Degradation	N/A	No channel degradation observed in the past 50 years.
General Scour	0 ft	The Flood Control District maintains the channel bottom. No flow contraction due to the bridge.
Local Pier Scour	See Table below	Assuming no debris accumulation due to pier nose extensions.
Local Abutment Scour	N/A	Embankments for the abutments are flush with the channel levees and protected by grouted riprap.

Local scour at piers is addressed here as the total scour for the proposed bridge, and the scour depths for Q_{100} are calculated as follows.

Bridge	***Alt. A***	***Alt. B***	***Alt. C***	***Alt. D***
Scour Depth, Q_{100}	5.6	10.3	5.6	8.0
Max. Scour Elevation	2683.7	2679.4	2683.7	2681.3
Thalweg Elevation	2689.3	2689.3	2689.3	2689.3

Drift:

Vegetation within the river channel varies from dense woody stands of cottonwood and willows, to desert shrubs and grasses. River scour can locally alter the riverbed, often removing large stands of vegetation and sand bars (USACE, 1997). The potential for debris accumulation at the piers during a major flood event is determined to be high, and three (3) feet of freeboard at the bridge soffit is recommended in order to pass drift.

The waterway opening of the new structure is recommended to be equal to or greater than that of the existing bridge upstream to minimize downstream drift problems at the proposed site, and the bents of the proposed structure should be aligned with the bents of the existing bridge. All four proposed alternatives exceed 3 ft minimal freeboard requirement. With active clearing operations of the channel, all four alternatives are expected experience minimal drift problems.

Bank Protection:

According to the Mojave River Flood Plain Maintenance Plan, the earthen levees in this area typically consist of sand and loosely compacted dirt overlaid with dumped rock. The existing levees in the vicinity of the Mojave River Bridge are armored with grouted riprap extending approximately 200 feet upstream and 100 feet downstream of the bridge. Impacts to the existing levees should be avoided, if possible. Any disturbances to the grouted riprap should be replaced and any new abutment work that extends beyond the existing riprap should be protected by new riprap.

Summary & Recommendation:

Hydrologic Summary			
Drainage Area: 513 mi^2			
Frequency	*Design Flood 50-year Event*	*Base Flood 100-year Event*	*Overtopping Flood/Flood of Record?*
Discharge	25,500 cfs	30,900 cfs	N/A

WSEL at Bridge	2698.7 ft	2699.6 ft	N/A
Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.			

Bridge	Alt. A	Alt. B	Alt. C	Alt. D
Design Soffit Elevation, Q_{100}	2709.5 ft	2707.8 ft	2709.5 ft	2709.5 ft
Available Freeboard, Q_{100}	10.3 ft	8.9 ft	10.3 ft	10.3 ft
Total Scour Elevation, Q_{100}	2683.7 ft	2679.4 ft	2683.7 ft	2681.3 ft

In conclusion, all alternatives meet the hydraulic requirements. Total scour elevation should be considered as a maximum elevation in which any new foundations should be placed below. Lastly, it is recommended that new structure should be aligned with the existing structure, and any construction efforts disrupting the existing grouted riprap levees should be avoided. Any disturbances to the grouted riprap should be replaced in kind.

APPENDIX C

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 4/23/2013

To: Asef Wardak / GDS-2

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 08-355561
GL 10-043

Revised Final test results as per your request.

AASHTO R18

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 10-043
Dist - EA: 08-355561
Report Date: April 23, 2013

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R10-001_05								100	97	91	75	53	33	19	11	9	6		NP		17.1	
R10-001_06								100	99	93	77	58	32	15	9	7	4		NP		21.0	
R10-001_07								100	96	75	49	28	13	7	4	3	1		NP		19.8	
R10-001_08								100	98	94	80	53	32	17	8	6	3		NP		19.9	
R10-001_09				100	92	83	79	78	73	63	47	31	17	10	7	2	2		NP		14.4	
R10-001_10				100	92	73	60	58	48	40	31	23	16	10	7	2	1		NP		11.9	
R10-001_11				100	96	92	88	86	76	62	41	25	17	11	7	2	2		NP		15.6	
R10-001_12					100	97	97	96	92	86	79	69	55	39	27	11	6	18	2		16.5	
R10-001_13								100	99	97	94	89	80	46	20	9	5		NP		20.2	
R10-001_14									100	96	89	80	70	51	27	11	6		NP		22.4	
R10-001_15								100	99	92	79	57	36	22	14	3	1		NP		19.3	
R10-001_16						100	98	97	91	82	69	53	36	22	15	6	4		NP		15.7	
R10-001_17								100	96	91	80	60	39	24	17	8	4		NP		16.3	
R10-001_18								100	99	96	87	73	57	39	25	7	2	21	6		15.8	
R10-001_19								100	95	91	83	74	63	46	31	9	4				16.8	
R10-001_20								100	97	91	77	59	41	29	21	11	6				17.7	
R10-001_21							100	99	94	86	69	49	33	22	16	9	5	27	9		17.0	
R10-001_22				100	96	96	95	93	86	80	71	58	43	30	22	9	5	20	4		13.1	
R10-001_23									100	98	91	76	58	40	28	10	3	22	7		15.4	
R10-001_24								100	99	96	87	71	54	38	28	8	3	23	6		16.0	
R10-001_25								100	95	89	75	57	44	34	28	17	7	32	16		13.5	
R10-001_26						100	99	98	92	82	66	49	36	27	22	15	10	36	18		15.1	
R10-001_27						100	96	95	91	86	74	56	39	26	19	12	9	24	7		14.5	
R10-001_28					100	98	97	97	95	92	85	74	57	41	31	15	9	22	6		15.4	
R10-001_29					100	98	97	96	88	74	58	44	30	21	16	10	5	23	4		15.3	
R10-001_30						100	98	97	89	75	60	46	35	26	22	15	9	34	17		13.4	
R10-001_31						100	99	98	91	80	62	46	33	25	20	12	8	31	17		16.6	
R10-001_32							100	98	87	76	63	48	34	24	19	9	6	26	10		13.9	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 10-043
Dist - EA: 08-355561
Report Date: April 23, 2013
Page: 2/3

CLASSIFICATION TEST SUMMARY

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	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R10-001_33						100	97	96	88	76	60	44	31	21	17	9	5	25	11		15.8	
R10-001_34							100	99	94	85	72	58	44	33	27	17	13	36	19		13.3	
R10-002_04								100	99	91	69	46	31	18	10	3	1		NP		16.8	
R10-002_05								100	99	95	84	66	42	21	13	3	1		NP		21.0	
R10-002_06					100	98	98	97	94	86	62	39	23	11	6	2	1		NP		17.4	
R10-002_07					100	84	80	78	75	62	37	22	14	9	6	2	1		NP		14.4	
R10-002_08				100	95	89	89	87	85	78	54	33	21	10	6	2	1		NP		16.2	
R10-002_09				100	86	83	81	77	77	73	66	59	52	36	18	7	4	20	2		15.8	
R10-002_10				100	94	94	92	92	90	86	77	63	47	29	18	7	3				15.9	
R10-002_12						100	98	98	95	91	82	66	51	38	28	14	9	26	10		15.4	
R10-002_13									100	97	88	72	51	33	23	4	1		NP		13.3	
R10-002_14								100	99	94	82	65	46	33	25	5	1	19	3		16.8	
R10-002_15							100	99	98	96	87	72	53	39	30	12	8	21	4		27.4	
R10-002_16									100	98	90	71	48	31	22	5	1	22	5		20.3	
R10-002_17								100	99	97	85	66	49	35	25	5	1	26	9		18.2	
R10-002_18									100	97	87	69	47	32	23	4	1	24	7		17.1	
R10-002_19									100	98	89	70	50	33	23	5	1	21	3		16.1	
R10-002_20									100	99	90	73	52	35	27	9	3	29	14		16.4	
R10-002_21						100	99	99	98	95	83	67	49	32	22	8	4		NP		14.2	
R10-002_22									100	98	89	71	50	31	21	17	7	22	7		16.6	
R10-002_23									100	98	91	74	56	40	30	11	4	24	8		16.3	
R10-002_24						100	96	95	90	87	78	68	54	39	29	10	5	21	6		12.4	
R10-002_25					100	98	93	92	88	82	70	53	39	28	22	11	6	25	9		33.5	
R10-002_26						100	99	97	90	80	65	48	33	24	20	13	8	30	13		19.8	
R10-002_27				100	97	95	92	89	76	66	52	40	29	21	17	12	9	33	17		15.9	
R10-002_28									100	97	88	71	49	33	25	12	5				13.5	
R10-002_29									100	96	85	70	54	39	29	12	5	26	9		14.7	
R10-002_30								100	96	90	78	63	45	28	18	5	1		NP		14.5	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
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R10-002_31							100	99	97	92	82	66	45	26	16	6	3		NP		14.7	
R10-002_32						100	99	97	90	81	66	49	35	26	21	11	5	23	8		14.3	
R10-002_33				100	96	92	86	84	70	57	44	32	21	15	11	6	2		NP		18.6	
R10-002_34						100	97	96	88	73	56	38	24	16	12	5	3		NP		14.6	
R10-002_35					100	98	92	89	78	66	51	39	28	20	16	9	6	24	9		14.5	
R10-002_36				100	95	93	88	83	69	56	42	33	27	22	19	14	11	40	24		13.5	

APPENDIX D

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: ANGEL PEREZ-COBO
Senior Transportation Engineer
Office of Geotechnical Design South 2
Division of Engineering Services

Date: July 8, 2013

File: 08-SBD-15-PM43.93
Mojave River Bridge (New)
08-355561 (08 0000 0621)
Bridge No. 54C-0661

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services - MS 5
Office of Geotechnical Support

Subject: Driveability Study: Mojave River Bridge (New)

Introduction

Per the request of Geotechnical Design South 2, this Office performed a pile driveability analyses for the proposed installation of Caltrans' Standard Class 200 Steel Pipe Piles with a wall thickness of 0.5-inch at the above-referenced project. The study was requested by Mr. Asef Wardak of the Office of Geotechnical Design - South 2. Personnel from the Foundation Testing Branch (FTB) of the Office of Geotechnical Support performed the analyses utilizing the GRLWEAP™ computer program, Version 2010. This study analyzes the pile-driving systems based on three (3) subject hammers identified as Delmag D36-23, Delmag D46-32 and Delmag D62-02 diesel hammers.

Description of Piling

The new Mojave River Bridge project includes the installation of approximately 65 feet length Class 200 Alt "W" Pipe Piles. For the driveability study, steel yield strength fy of 45 ksi will be used in the analysis (based on Caltrans Standard Plans dated 2010). The required maximum design loading for the subject piling, bottom of footing (BOF) elevation, specified tip elevation, and penetration length at the subject locations are included Table 1.

Table 1. Piling Information

Location	Pile Type	Nominal Controlling Resistance		Estimated Bottom Of Footing Elevation (ft)	Specified Tip Elevation (ft)	Pile Penetration Length Analyzed (ft)
		Compression (kips)	Tension (kips)			
Abut 1	16" Dia. PP Class 200 Alt "W"	300	250	2702	2637	65
Pier 2	16" Dia. PP Class 200 Alt "W"	400*	250	2674	2609	65
Pier 3	16" Dia. PP Class 200 Alt "W"	370	250	2674	2609	65
Pier 4	16" Dia. PP Class 200 Alt "W"	370	250	2674	2609	65
Pier 5	16" Dia. PP Class 200 Alt "W"	400*	250	2674	2609	65
Abut 6	16" Dia. PP Class 200 Alt "W"	300	250	2701	2636	65

Notes: Information provided by Geotechnical Designer per Pile Data Table from Foundation Report as used in the analyses.
*Controlling Design

Subsurface Conditions and Soil Resistance Parameters

Based on the provided Log of Test Borings, Boring R-10-001 was used to characterize the subsurface conditions at Abutment 1, Boring B-7-01 for Pier 2, Boring B-5-01 for Pier 3 and Pier 4, Boring B-11-01 for Pier 5 and Boring R-10-002 for Abutment 6. According to the borings, the foundation materials encountered at the subject site consists of poorly graded to well-graded sand, silty sand, medium to very dense sand and sandy silt, fine to medium sand and sand with gravel. For a complete description of the subsurface conditions, please refer to the Log of Test Borings included in the Appendix. Table 2 presents the soil resistance parameters that were used in the analyses.

Table 2: Soil Resistance Parameters

PARAMETER TYPE	QUAKE	DAMPING
Skin	0.10 inch	0.10 sec/ft
Toe	0.13 inch	0.15 sec/ft

Pile Driving Resistance

When installing driven piles, the piles must overcome resistance to penetration developed by the soil. The driving resistance determines the size of the required impact hammer and the stress magnitude imparted to the subject pile by the driving system. An estimated driving resistance is necessary to perform a driveability study when investigating the potential for pile damage due to overstressing during driving. Driving resistance can be related to static axial capacity using set-up and relaxation factors. These factors are applied to various soil layers penetrated while driving the subject pile.

The maximum driving resistance generated in the analysis was based on information from the boring logs provided by the Geotechnical Designer. According to the Geotechnical Designer (per Foundation Report), the maximum nominal resistance in compression for the subject piling is calculated to be 400 kips (Pier 2 and Pier 5). The analyses and output values rely upon the following assumptions:

- The piles are assumed to plug during driving and therefore modeled to be driven as displacement piles.
- The gain/loss soil resistance factor of 0.8 for skin and 1.0 for toe were used in modeling the driving installations.
- Site-specific soil profiles from Borings R-10-001, B-7-01, B-5-01, B-11-01 and R-10-002 with design parameters were used.
- All hammers are assumed to be operating at a minimum of 80% efficiency.

Description of Pile Driving Systems

This study involves modeling the performance of three (3) selected hammer/driving systems to reflect the range of rated energies possibly appropriate for the installation of the subject piles to the specified tip elevations at each support.

The analyses was performed using GRLWEAP™ recommended, and default parameters. For each subject hammer, the analysis was performed with the hammer operating at an 80% rated efficiency for determining driving-behavior stresses imparted to the subject pile(s). The analysis for each hammer was utilized to demonstrate the predicted blow counts and corresponding

maximum compressive stresses expected during pile driving. Standard configurations for each driving system and related components were based upon information published in GRLWEAP™ literature and its hammer database. The hammer descriptions are listed in Table 3.

Table 3: Summary of Hammer Systems

Hammer Manufacturer	Delmag	Delmag	Delmag
Hammer Model	D36-23	D46-32	D62-02
Hammer Type*	Open End Diesel	Open End Diesel	Open End Diesel
Rated Energy*	88.5 ft-kips	122.2 ft-kips	152.5 ft-kips
Ram Weight*	7.9 kips	10.1 kips	13.7 kips
Maximum Rated Stroke*	13.0 ft	13.1 ft	12.7 ft
Helmet Weight*	3.6 kips	3.6 kips	3.6 kips

Notes: *Based on information from hammer database (GRLWEAP Version 2010).

Discussion of Results

Printouts and charts of the analyses depicting predicted relationships between ultimate capacities/driving resistances and driving stresses versus blow counts for each of the hammers are included in the Appendix. The results of the analyses for the three hammers used in this study based on the driving conditions modeled are summarized in Table 4, respectively.

Table 4. Summary of Results

Hammer Model No.	Blow Count within allowable limit at all support locations(1) (yes/no)	Driving Stress less than Allowable Compression Limit(2)
D36-23	yes	yes
D46-32	yes	yes
D62-02	yes	no

Notes: 1) Blow count allowable limit = 96 blows/ft;
2) Allowable compression driving stress equivalent to {(0.9 * fy) = 40.5 ksi

The GRLWEAP™ wave equation program is a one-dimensional analysis and does not consider buckling or bending of the pile due to non-uniform blows or localized stresses at the pile tip, or position of the hammer helmet with the pile-reinforcement/pile cushion which may occur during pile driving. Also, it has been observed in the field that significantly harder or softer driving could occur than the GRLWEAP™ predictions.

Summary

Based on the submitted information from Geotechnical Designers (OGDS2), this Office recommends OGDS2 staff review the output results from this driveability study for the new Mojave River Bridge to determine if the results are in accordance to the design requirements.

If you have any questions regarding this report, please contact Toua Vang at (916) 227-7243.

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS E. BRITTSAN
No. GE2459
Exp. 9/30/14
GEOTECHNICAL
STATE OF CALIFORNIA

TOUA VANG
Transportation Engineer, Civil
Foundation Testing Branch
Office of Geotechnical Support

DOUGLAS E. BRITTSAN, G.E.
Senior Transportation Engineer
Foundation Testing Branch
Office of Geotechnical Support

Attachments

C: A. Wardak – OGDS2 (Email)
M. DeSalvatore - OGDS1 (Email)
R. Stiltz - SD (Email)
Geodog

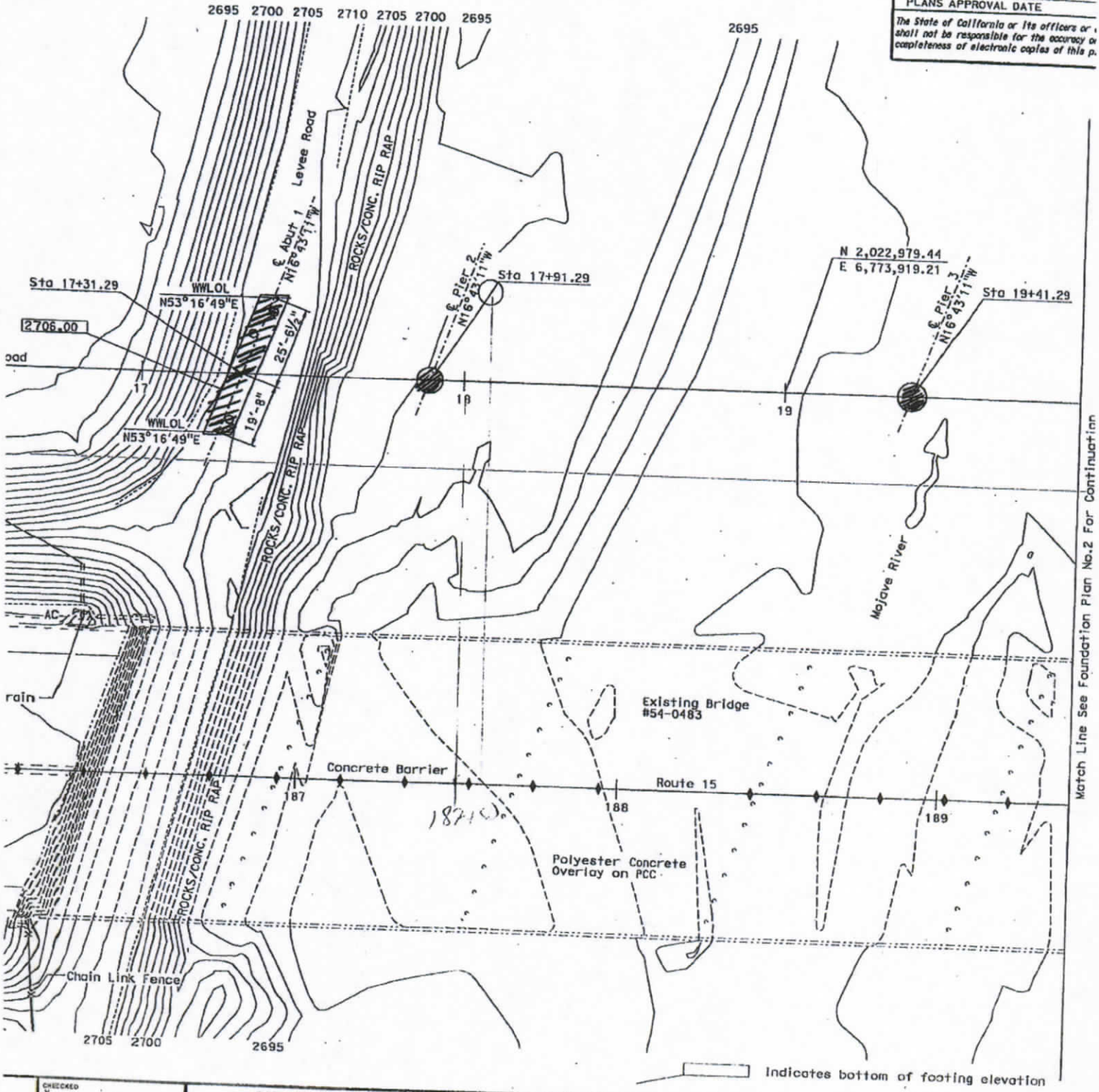
APPENDIX

DIST	COUNTY	ROUTE	P TOT
08	SBd	15	

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

The State of California or its officers or shall not be responsible for the accuracy or completeness of electronic copies of this p

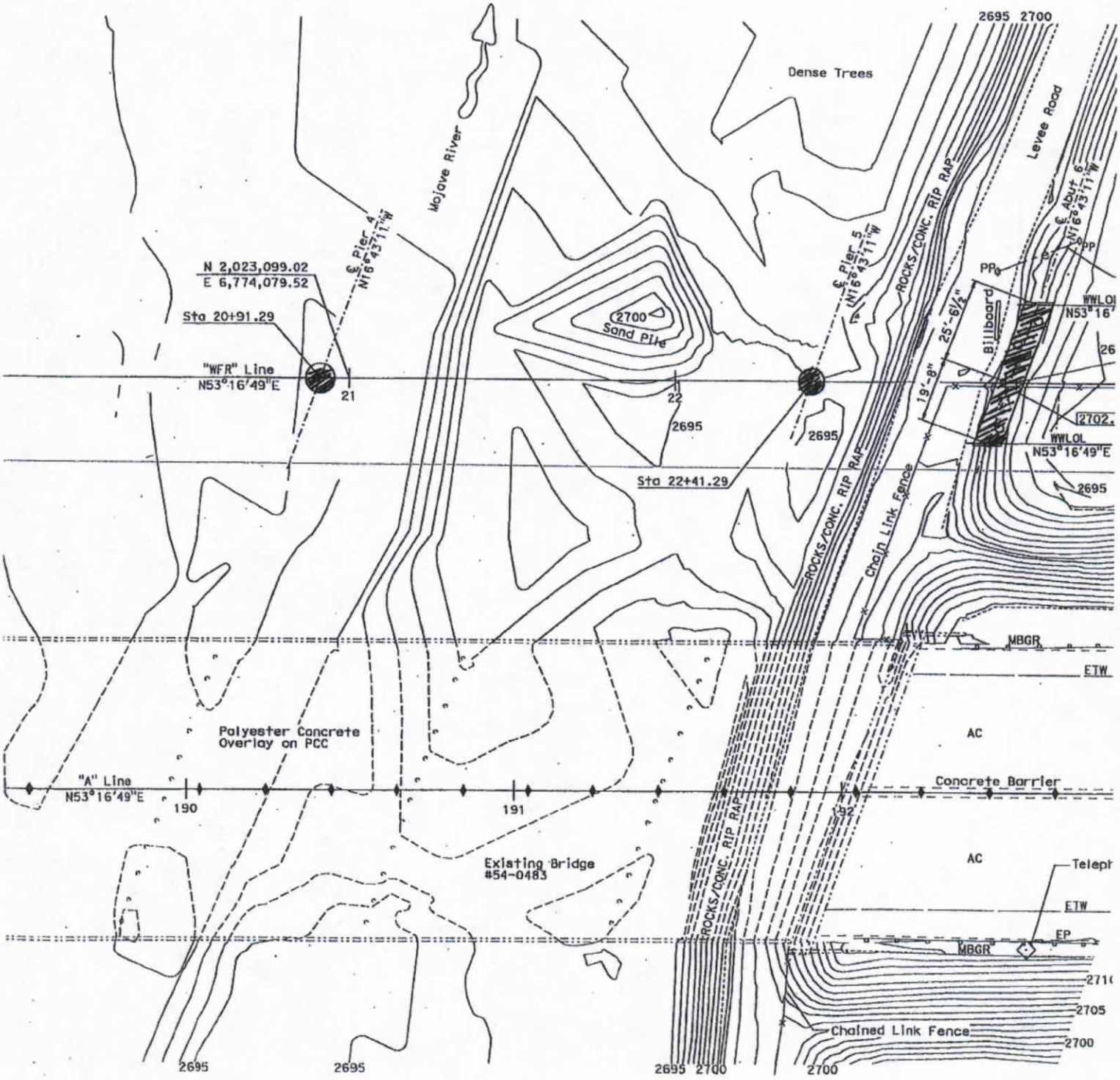


Indicates bottom of footing elevation

CHECKED X	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10	BRIDGE NO. 54C-0661 POST MILE 43.93	MOJAVE RIVER BRIDGE FOUNDATION PLAN N
CHECKED X				
CHECKED X				
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 08 EA 355561	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES

CURVE DATA

Δ	T	L
30°26'44"	779.63	1522.39
30°26'44"	815.99	1593.41



IMINARY INVESTIGATION SECTION							
	PHOTOGRAMMETRY AS OF: X						
	SURVEYED	BY Dist./T.Gillett 2008	CHECKED	BY T.Gillet 10/2008			
Sheet	DRAFTED	BY J.Martinez 10/2008	CHECKED	BY T.Zolnikova 10/2008			

DESIGN	BY R. Stiltz	CHECKED X
DETAILS	BY G. Hollstrom	CHECKED X
QUANTITIES	BY X	CHECKED X

STATE OF
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

GLISH1 (REV. 10/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 10 OF 11

UNIT: 3643	CONTRACT No.	BRIDGE No.
PROJ. No. & PHASE: 08000006211	08-355561	54-0483
VERT DATUM: NGVD 1929	Sheet	of

REGISTERED PROFESSIONAL ENGINEER Asef Wardak No. C61960 Exp. 9-30-13 CIVIL STATE OF CALIFORNIA

Caltrans Metric

DIST	COUNTY
08	SBd

REGISTERED CIV

PLANS APPROVAL

The State of California shall not be responsible completeness of electron

For Boring locations in Imperial units, see table on "LOG OF TEST BORINGS 3 OF 11"

15.5 m Lt. Sta 58+39.0 C/L Rte. 15

B-11-01

820.54

GWS EL. 820.00 m 12-6-01

95 mm

Well graded SAND (SW), loose, gray, dry to moist, fine to coarse SAND with scattered fine to coarse GRAVELS.

4 35

17 35

Poorly graded SAND (SP), medium dense, dark greenish gray, moist to wet, fine to medium grained.

26 35

Becomes dense at elev. 815.72 m.

Well graded SAND (SW), very dense, greenish gray, moist to wet, with fine to coarse SAND and GRAVELS.

60 35

23 35

Poorly graded SAND (SP), dense, dark greenish gray, moist to wet, fine to medium grained, minor SILT.

30 35

44 35

Becomes very dense at elev. 809.63 m.

29 35

Become dense at elev. 808.1 m.

19 35

Becomes medium dense, color changes to olive brown at elev. approx. 806.82 m.

34 35

Becomes very dense, color changes to yellowish brown at elev. approx. 805.30 m.

Scattered coarse SAND grains beginning at elev. approx. 804.69 m.

26 35

Becomes dense at elev. 803.53 m.

16 35

Becomes medium dense at elev. 802.10 m, fine to medium grained SAND.

32 35

Becomes dense at elev. approx. 800.48 m.

24 35

31 35

31 35

42 35

Becomes very dense at elev. approx. 794.39 m.

Trace coarse SAND beginning at elev. approx. 794.02 m.

41 35

12-6-01

48 m Lt. Sta 58+79.0 C/L Rte. 15

B-1-01

821.49

108 mm

23 35

SILTY SAND (SM), medium dense, brown, f grained, dry.

Well graded SAND (SW), medium dense, light gray, medium to coarse grained.

10 35

SILTY SAND (SM), loose, dark brown, trace CLAY,

11 35

Poorly graded SAND (SP), medium dense, bluish gr fine grained.

Trace coarse SAND at elev. 817.07 m. and scatter black organic lenses.

2 35

SILT (ML), very loose, dark bluish gray, wet

20 35

SILT with SAND (ML), very loose, bluish blac

31 35

Well-graded SAND (SW), medium dense, bluish gray with granitic GRAVELS and COBBLES, medium graine

Fine to coarse granitic GRAVELS at elev. 813.47

95 mm

E150 35

Well-graded SAND (SW) very dense, grayish brown, to wet, fine to medium grained.

46 35

Becomes dense at elev. 807.38 m, trace fine GRAV

E191 35

Becomes very dense at elev. 805.85 m.

41 35

Becomes dense at elev. 804.33 m.

Color change to yellowish brown at elev. 803.75

55 35

Becomes very dense at elev. 802.81 m.

39 35

Becomes dense at elev. 801.28 m, trace fine gran GRAVELS.

33 35

26 35

Becomes medium dense at elev. 798.23 m.

34 35

Becomes dense at elev. 796.71 m.

42 35

E104 35

Becomes very dense at elev. 793.66 m.

10-23-01

58+50 58+60 58+70 58+80

ALL DIMENSIONS ARE IN METE

FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483	MOJAVE RIVER E
E. Neupert; F. Gerami			KILOMETER POST 70.5	LOG OF TE

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 08 EA 355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMI 9-15-01 1-18-05

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 8 OF 11

UNIT: 3643 PROJ. No. & PHASE: 08000006211	CONTRACT No. 08-355561	BRIDGE No. 54-0483
VERT DATUM: NGVD 1929		Sheet of

For Boring locations in Imperial units, see table on "LOG OF TEST BORINGS 3 OF 11"

REGISTERED PROFESSIONAL ENGINEER Asef Wardak No. C61960 Exp. 9-30-13 CIVIL STATE OF CALIFORNIA

Caltrans Metric

DIST	COU
08	

REGISTE

PLANS A

The State of shall not be completeness

17.5 m Lt. Sta 57+73.0 C/L Rte. 15

2691.1

B-5-01

820.27 .10 m .6

95 mm Well graded SAND (SW), loose, light brownish gray, wet, fine to coarse SAND with trace fine GRAVELS.

Becomes medium dense at elev. 818.44 m.

13 35 Poorly graded SAND (SP), medium dense, dark gray, wet, fine to medium SAND, trace fine GRAVEL.

18 35

33 35 Becomes dense at elev. 815.39 m.

E83 35 Well graded SAND (SW), dense, dark gray, wet, fine to coarse SAND with minor fine to coarse GRAVELS.

COBBLES and coarse GRAVELS at elev. 812.65 m.

20 35 Poorly graded SAND (SP), medium dense, dark greenish gray, moist, fine grained SAND, minor SILT, trace fine to coarse GRAVEL.

22 35 Becomes dense at elev. 810.82 m.

25 35

42 35 Becomes very dense at elev. 807.77 m.

35 35

27 35 Well graded SAND (SW), dense, dark grayish brown, moist to wet, fine to coarse SAND, trace fine GRAVELS.

27 35

Color changes to yellowish brown at elev. 801.98 m.

38 35 Becomes very dense at elev. 801.53 m.

39 35 Fine to medium grained SAND, no GRAVELS.

19 35 Becomes medium dense at elev. 798.63 m.

45 35 Becomes very dense at elev. 797.11 m.

30 35 Becomes dense at elev. 795.58 m.

32 35 Trace fine to coarse GRAVELS.

29 35

11-1-01

29 m Lt Sta 57+79.5 C/L Rte. 15

2691

B-6-01 2691

820.23

95 mm GWS EL. 820.20 m 11-6-01

Well graded SAND (SW), loose, gray, wet, fine to

6 35 Poorly graded SAND with SILT (SP-SM), loose, dar grained SAND, trace fine to coarse GRAVEL.

5 35 Well graded SAND (SW), loose, gray, wet, fine to fine to coarse GRAVELS.

6 35

21 35 Becomes dense at elev. 813.92 m.

18 35 Poorly graded SAND with SILT (SP-SM), medium den fine grained SAND.

Color changes to dark greenish gray at elev. 811

25 35 Becomes dense at elev. 810.87 m.

28 35

47 35 Becomes very dense at elev. 807.83 m, SILT.

41 35

42 35 Well graded SAND (SW), very dense, dark greenish fine to coarse SAND and trace fine GRAVELS, mino

28 35 Becomes dense at elev. 803.25 m.

73 35 Becomes very dense at elev. 801.73 m, color chan brown, predominantly fine to medium grained SAND

26 35

19 35 Becomes medium dense at elev. 798.68 m.

36 35 Becomes very dense at elev. 797.16 m.

27 35 Becomes dense at elev. 795.63 m.

18 35 Becomes medium dense at elev. 794.11 m.

48 35 Becomes very dense at elev. 792.59 m.

11-7-01

70 57+80 57+90 58+00 58+10

ALL DIMENSIONS ARE

RVICES	FIELD INVESTIGATION BY: E. Neupert; F. Gerami	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483 KILOMETER POST 70.5	MOJAVE RIVI LOG OF

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 08 EA 355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DAT

:ations in Imperial units,
'LOG OF TEST BORINGS 3 OF 11"

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 6 OF 11

UNIT: 3643	CONTRACT No.	BRIDGE No.
PROJ. No. & PHASE: 08000006211	08-355561	54-0483
VERT DATUM: NGVD 1929	Sheet	of

REGISTERED PROFESSIONAL ENGINEER Asef Nardak No. C61960 Exp. 9-30-13 CIVIL STATE OF CALIFORNIA

Caltrans Metric

DIST	COUNTY
08	SBd

REGISTERED

PLANS APPRO

The State of Califo shall not be respon completeness of el

16.5 m Lt Sta 57+22.0 C/L Rte. 15

used B-7 + B-5 => for pier #4 L

O.G.E = 2691.4'
GWE = 2690.7
0.7 used

B-7-01

95 mm GWS EL. 820.20 11-8-01

Well graded SAND (SW), loose, gray, moist to wet, fine to coarse SAND, scattered fine to coarse GRAVELS.

Coarse GRAVEL clast at elev. 818.64 m.
Piece of concrete from elev. 818.41 to 817.97.

Poorly graded SAND (SP), medium dense, dark gray, moist, predominantly fine to medium grained SAND, minor SILT, trace fine GRAVELS.

Becomes very dense at elev. 814.22 m.

Well graded SAND (SW), medium dense, gray, wet, fine to coarse SAND.

Poorly graded SAND (SP), medium dense, dark greenish gray, moist to wet, predominantly fine to medium grained, minor SILT.

Becomes dense at elev. 809.65 m.

Becomes very dense at elev. 806.6 m.

Well graded SAND (SW), medium dense, dark greenish gray, moist to wet, fine to coarse SAND with scattered fine GRAVELS.

Trace coarse GRAVEL at elev. 803.71 m.
Become dense, color change to greenish gray at elev. 803.56 m.

Trace coarse GRAVELS at elev. 800.6 m.
Become dense, color changes to yellowish brown at elev. 800.45 m.

Becomes dense at elev. 797.46 m.

Becomes very dense at elev. 792.89 m.

11-8-01

40.0 m Lt Sta 57+26.5 C/L Rte. 15

B-20-01

820.94

300/0.27

11-7-01

100 200

0 57+30 57+40 57+50

PROFILE
HOR. 1:100
VER. 1:100

ALL DIMENSIONS ARE IN M

CES	FIELD INVESTIGATION BY: E. Neupert; F. Gerami	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483 KILOMETER POST 70.5	MOJAVE RIVER LOG OF T

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 08
EA 355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRE 9-15-03

R-10-002

2713.7'

3 6" Asphalt concrete pavement of road surface over well-graded SAND

Well-graded SAND with SILT (SW-SM); dense; yellowish brown; dry; few fin

Elev.	Depth	Description
2710	37 1.4	
2700	44 1.4	
	33 1.4	-moist.
2690	24 1.4	-medium dense; trace fine GRAVEL.
	19 1.4	GWS Elev 2688.5' 6-26-10 — Poorly-graded SAND with SILT (SP-SM); medium dens mostly fine and medium SAND; few fines; trace fin cementation; (NATIVE).
2680	15 1.4	Well-graded SAND with SILT (SW-SM); medium dense; gray; wet; few fine G
	19 1.4	-with GRAVEL; light gray.
2670	61 1.4	-very dense; dark gray.
	24 1.4	SILTY SAND with GRAVEL (SM); medium dense; gray; medium to fine SAND; coarse GRAVEL; little fines.
2660	52 1.4	SILTY SAND (SM); very dense; gray; well-graded SAND; few well-graded GRA strong cementation.
	40 1.4	-dense.
2650	26 1.4	SILTY SAND (SM); medium dense; gray; medium and fine SAND; little fines weak cementation.
	47 1.4	-very dense; yellowish brown; strong cementation.
2640	31 1.4	-dense; light brown; trace GRAVEL.
	35 1.4	-some fines.
2630	28 1.4	-brown; little fines.
	27 1.4	
2620	29 1.4	
	28 1.4	
2610	30 1.4	
	40 1.4	
2600	16 1.4	-medium dense; dark brown; weak to moderate cementation.
	26 1.4	-some fines.
2590	67 1.4	-very dense; strong cementation.
	48 1.4	-gray and light brown; well-graded SAND; moderate cementation.
2580	50 1.4	-light brown; few fine and coarse GRAVEL.
	72 1.4	-strong cementation.
2570	34 1.4	-dense; fine and medium SAND; little fines; medium cementation.
	23 1.4	-medium dense; some fines.
2560	62 1.4	-very dense; strong cementation.
	62 1.4	
2550	58 1.4	-few fine GRAVEL.
	66 1.4	Well-graded SAND with CLAY and GRAVEL (SW-SC); very dense; light brown; wet; some well-graded GRAVEL; little fines; strong cementation.
2540	51 1.4	-little fine GRAVEL.
	101 1.4	-light gray.
2530	104 1.4	Poorly-graded SAND with CLAY and GRAVEL (SP-SC); very dense; light gray; wet; coarse to medium SAND; some well-graded GRAVEL; little fines.

4-28-10
Terminated at Elev 2533.7'
ERi = 68%

PROFILE
Horiz: 1" = 20'
Vert: 1" = 10'

192+00 194+00

GEOTECHNICAL SERVICES
INVESTIGATION BY: Mardak

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH X

BRIDGE NO. 54-0483
POST MILE 43.93

MOJAVE RIVER BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 11

UNIT: 3643
PROJECT NUMBER & PHASE: 08000006211
CONTRACT NO.: 08-355561

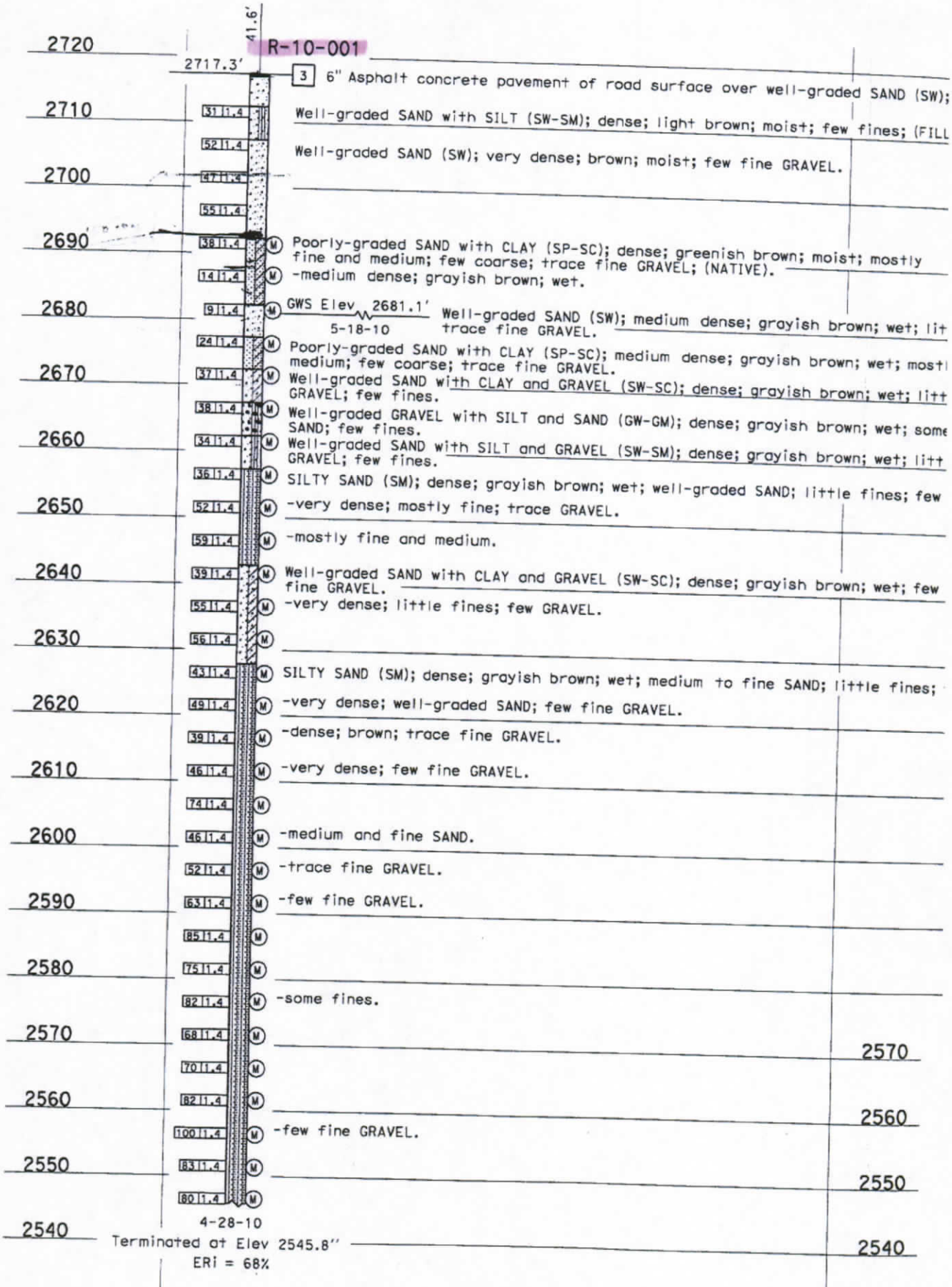
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 01-29-13 02-14-13 03-01-13

SHEET X OF X

USERNAME => s116982 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 08:35



D GEOTECHNICAL SERVICES

D INVESTIGATION BY:

Ibrahim

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN

DESIGN BRANCH X

BRIDGE NO. 54-0483

POST MILE 43.93

UNIT: 3643

PROJECT NUMBER & PHASE: 0800000511

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 1 OF 11

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

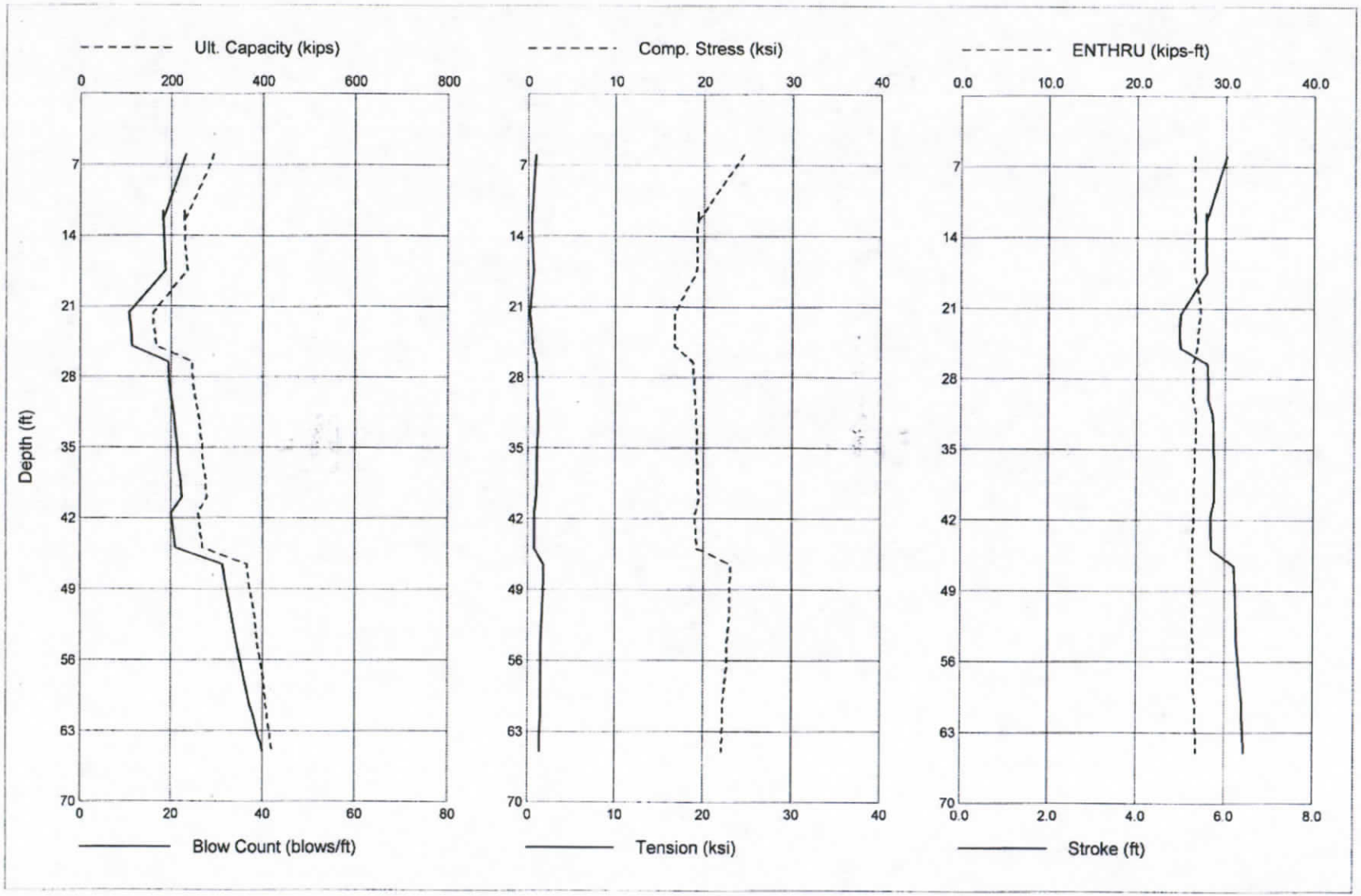
SHEET OF

RNAME => s116982 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 08:35

California D.O.T.
Mojave River Bridge D36-23 (Abut 1)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Abut 1)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

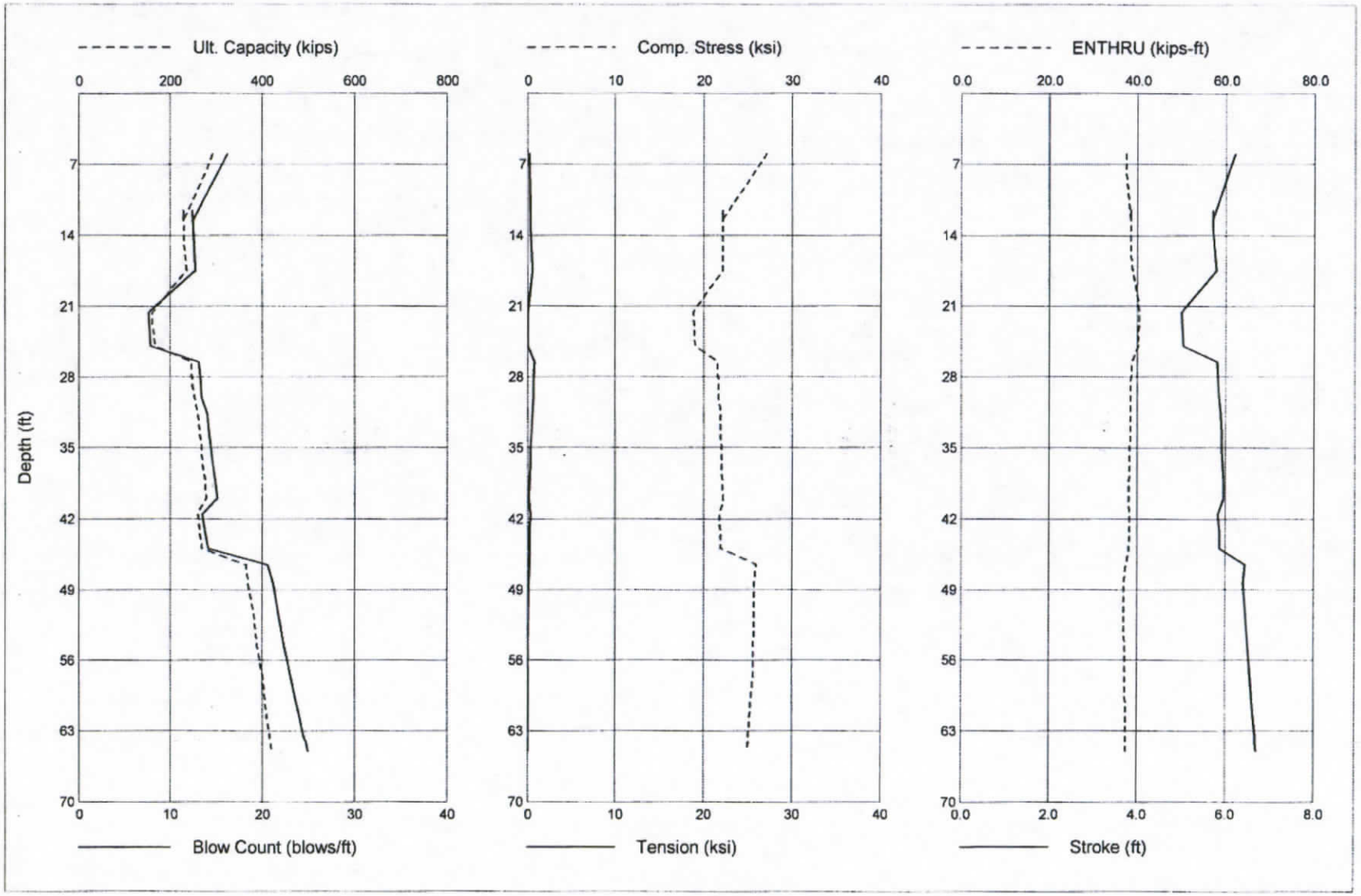
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	23.2	24.527	-0.903	6.02	26.5
12.5	229.3	7.6	221.6	18.2	19.313	-0.462	5.56	26.6
11.6	228.3	6.7	221.6	18.1	19.361	-0.427	5.55	26.6
13.4	230.3	8.7	221.6	18.3	19.298	-0.499	5.56	26.5
17.5	235.7	14.1	221.6	18.7	19.167	-0.689	5.58	26.5
21.6	160.6	20.7	140.0	10.9	16.686	-0.296	4.99	27.2
23.4	163.9	23.9	140.0	11.2	16.641	-0.436	4.96	26.9
25.0	166.7	26.8	140.0	11.4	16.697	-0.546	4.98	26.8
26.6	245.4	29.6	215.8	19.3	18.845	-1.056	5.61	26.4
28.4	248.8	33.0	215.8	19.6	18.909	-1.098	5.62	26.4
30.0	251.8	36.0	215.8	19.9	18.988	-1.133	5.63	26.4
31.6	260.8	39.1	221.6	20.6	19.196	-1.188	5.73	26.7
33.4	264.6	42.9	221.6	20.9	19.270	-1.183	5.74	26.7
35.0	267.9	46.2	221.6	21.3	19.302	-1.150	5.75	26.6
36.6	271.3	49.7	221.6	21.6	19.323	-1.111	5.76	26.6
38.4	275.5	53.9	221.6	22.1	19.387	-1.067	5.77	26.5
40.0	279.2	57.5	221.6	22.4	19.414	-1.025	5.78	26.5
41.6	259.7	61.4	198.3	20.0	19.088	-0.826	5.68	26.5
43.4	264.3	66.0	198.3	20.5	19.142	-0.794	5.69	26.4
45.0	268.4	70.1	198.3	20.9	19.211	-0.771	5.71	26.4
46.6	365.7	74.1	291.6	31.2	23.091	-1.878	6.21	26.4
48.4	370.6	79.0	291.6	31.9	22.972	-1.815	6.23	26.4
54.4	387.4	95.8	291.6	34.4	22.643	-1.589	6.29	26.5
60.4	405.9	114.3	291.6	37.2	22.263	-1.511	6.40	26.7
61.6	409.7	118.1	291.6	37.9	22.226	-1.502	6.41	26.7
63.4	416.0	124.4	291.6	39.0	22.183	-1.481	6.44	26.8
63.8	417.1	125.5	291.6	39.2	22.191	-1.478	6.44	26.8
64.1	418.2	126.6	291.6	39.5	22.176	-1.472	6.45	26.8
65.0	421.4	129.8	291.6	40.1	22.156	-1.458	6.46	26.8

Total Continuous Driving Time 31.00 minutes; Total Number of Blows 1496

California D.O.T.
Mojave River Br D46-32 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br D46-32 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

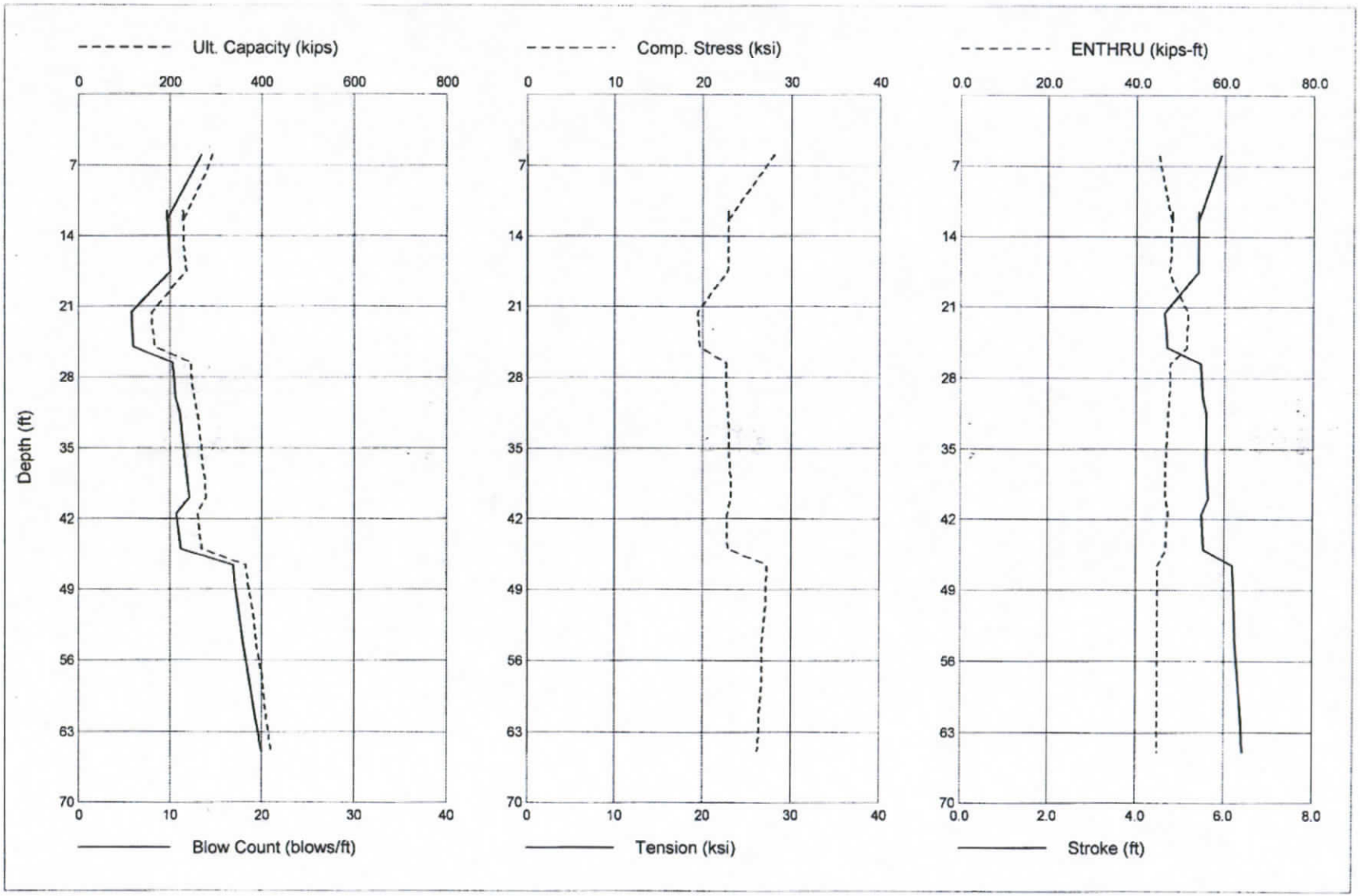
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	16.3	27.109	-0.223	6.22	37.5
12.5	229.3	7.6	221.6	12.5	22.111	-0.377	5.71	38.5
11.6	228.3	6.7	221.6	12.4	22.117	-0.343	5.70	38.5
13.4	230.3	8.7	221.6	12.5	22.118	-0.413	5.71	38.5
17.5	235.7	14.1	221.6	12.7	22.160	-0.588	5.80	38.9
21.6	160.6	20.7	140.0	7.6	18.817	0.000	5.01	40.4
23.4	163.9	23.9	140.0	7.7	18.907	0.000	5.03	40.3
25.0	166.7	26.8	140.0	7.8	18.998	0.000	5.05	40.2
26.6	245.4	29.6	215.8	13.1	21.605	-0.791	5.82	38.7
28.4	248.8	33.0	215.8	13.3	21.716	-0.708	5.84	38.6
30.0	251.8	36.0	215.8	13.4	21.722	-0.651	5.85	38.6
31.6	260.8	39.1	221.6	14.0	21.873	-0.550	5.90	38.5
33.4	264.6	42.9	221.6	14.2	21.952	-0.468	5.92	38.4
35.0	267.9	46.2	221.6	14.4	22.006	-0.394	5.93	38.3
36.6	271.3	49.7	221.6	14.6	22.080	-0.327	5.94	38.2
38.4	275.5	53.9	221.6	14.9	22.130	-0.238	5.96	38.1
40.0	279.2	57.5	221.6	15.1	22.195	-0.166	5.97	38.1
41.6	259.7	61.4	198.3	13.5	21.761	-0.323	5.84	38.3
43.4	264.3	66.0	198.3	13.8	21.907	-0.278	5.87	38.2
45.0	268.4	70.1	198.3	14.1	21.955	-0.223	5.88	38.1
46.6	365.7	74.1	291.6	20.6	26.004	-0.270	6.46	37.4
48.4	370.6	79.0	291.6	21.2	25.761	-0.204	6.42	37.0
54.4	387.4	95.8	291.6	22.3	25.603	0.000	6.52	37.2
60.4	405.9	114.3	291.6	23.7	25.315	0.000	6.63	37.4
61.6	409.7	118.1	291.6	24.0	25.255	0.000	6.65	37.4
63.4	416.0	124.4	291.6	24.5	25.146	0.000	6.68	37.4
63.8	417.1	125.5	291.6	24.6	25.097	0.000	6.68	37.5
64.1	418.2	126.6	291.6	24.8	25.104	0.000	6.69	37.4
65.0	421.4	129.8	291.6	25.0	25.017	0.000	6.70	37.5

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 991

California D.O.T.
Mojave River Br D62-02 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br D62-02 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

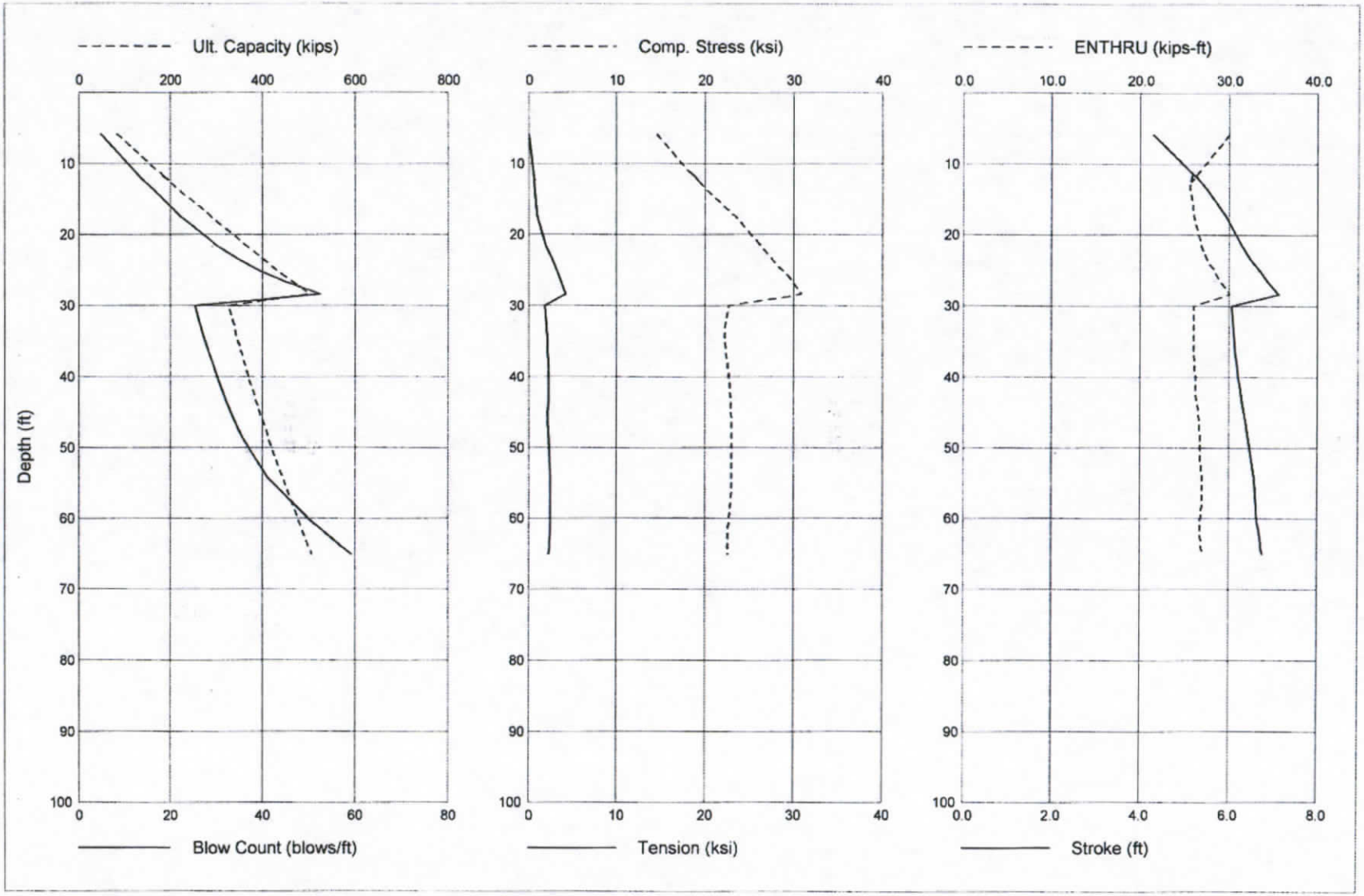
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	13.4	28.143	0.000	5.93	45.2
12.5	229.3	7.6	221.6	9.7	22.884	0.000	5.41	48.0
11.6	228.3	6.7	221.6	9.7	22.916	0.000	5.41	48.1
13.4	230.3	8.7	221.6	9.8	22.838	0.000	5.41	47.9
17.5	235.7	14.1	221.6	10.1	22.761	0.000	5.41	47.5
21.6	160.6	20.7	140.0	5.8	19.497	0.000	4.65	51.7
23.4	163.9	23.9	140.0	5.9	19.614	0.000	4.68	51.6
25.0	166.7	26.8	140.0	6.0	19.695	0.000	4.70	51.5
26.6	245.4	29.6	215.8	10.3	22.628	0.000	5.48	47.7
28.4	248.8	33.0	215.8	10.5	22.686	0.000	5.50	47.6
30.0	251.8	36.0	215.8	10.6	22.725	0.000	5.52	47.5
31.6	260.8	39.1	221.6	11.1	22.933	0.000	5.59	47.3
33.4	264.6	42.9	221.6	11.3	22.991	0.000	5.60	47.1
35.0	267.9	46.2	221.6	11.5	23.035	0.000	5.61	46.9
36.6	271.3	49.7	221.6	11.7	23.064	0.000	5.61	46.7
38.4	275.5	53.9	221.6	11.9	23.150	0.000	5.63	46.6
40.0	279.2	57.5	221.6	12.1	23.235	0.000	5.65	46.6
41.6	259.7	61.4	198.3	10.7	22.730	0.000	5.50	47.2
43.4	264.3	66.0	198.3	11.0	22.809	0.000	5.51	46.9
45.0	268.4	70.1	198.3	11.2	22.877	0.000	5.53	46.8
46.6	365.7	74.1	291.6	16.9	27.229	0.000	6.20	44.9
48.4	370.6	79.0	291.6	17.1	27.141	0.000	6.21	44.8
54.4	387.4	95.8	291.6	18.0	26.772	0.000	6.27	44.8
60.4	405.9	114.3	291.6	19.1	26.511	0.000	6.36	44.9
61.6	409.7	118.1	291.6	19.3	26.444	0.000	6.38	44.9
63.4	416.0	124.4	291.6	19.7	26.356	0.000	6.41	44.9
63.8	417.1	125.5	291.6	19.7	26.322	0.000	6.41	45.0
64.1	418.2	126.6	291.6	19.8	26.319	0.000	6.41	45.0
65.0	421.4	129.8	291.6	20.0	26.239	0.000	6.43	45.0

Total Continuous Driving Time 17.00 minutes; Total Number of Blows 794

California D.O.T.
Mojave River Br (D36-23) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D36-23) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

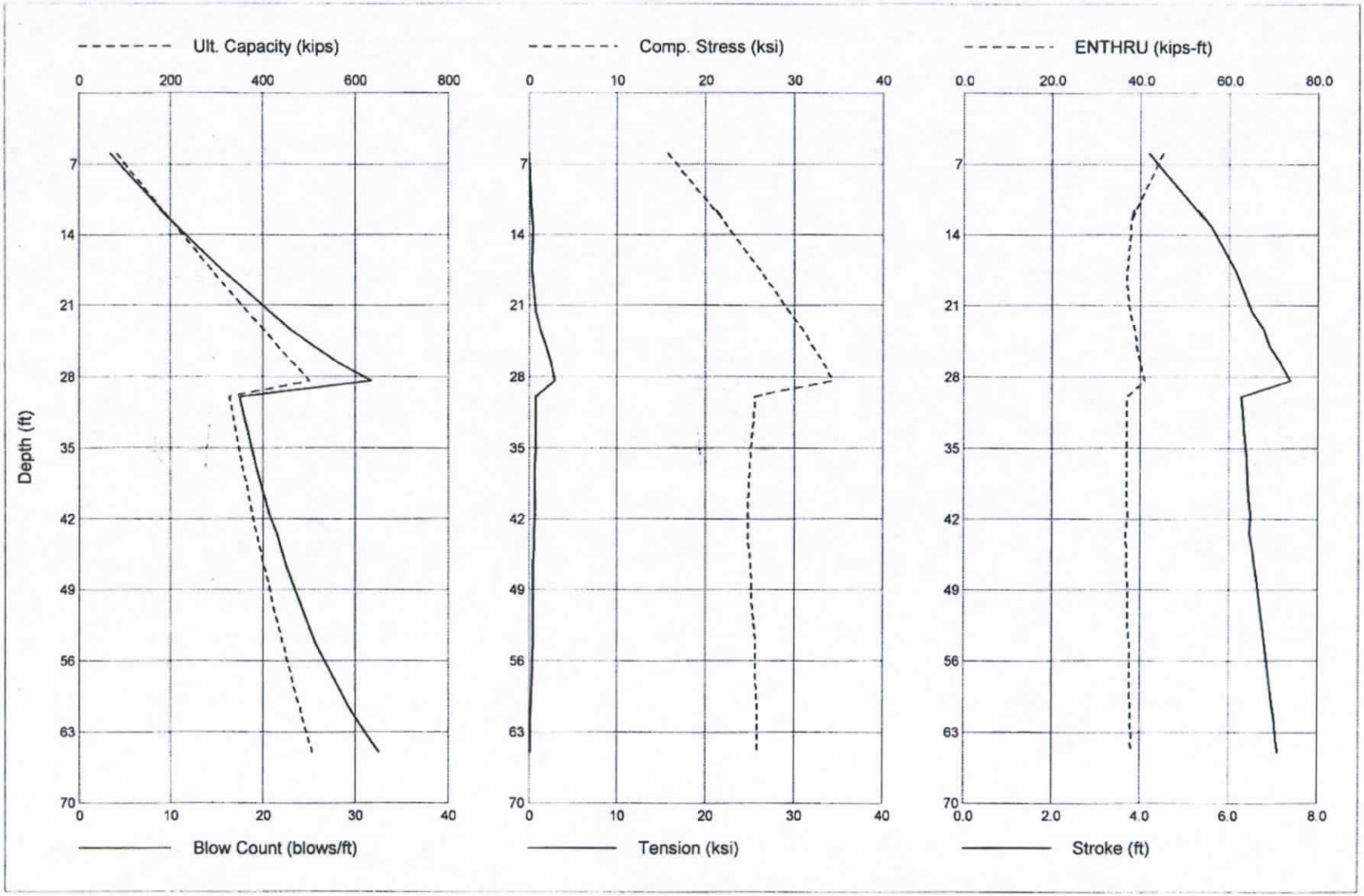
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	4.9	14.544	0.000	4.30	30.0
12.5	197.0	10.7	186.4	14.3	19.228	-0.710	5.37	25.8
11.6	180.5	9.0	171.6	12.8	18.655	-0.550	5.23	25.9
13.4	213.7	12.5	201.2	15.8	19.917	-0.746	5.49	25.7
17.5	288.3	22.2	266.1	22.1	23.406	-1.000	5.94	26.1
21.6	365.6	34.7	330.9	30.3	26.297	-2.002	6.31	26.9
23.4	401.8	41.3	360.5	35.0	27.613	-2.734	6.49	27.6
25.0	432.8	47.2	385.6	39.3	28.808	-3.236	6.71	28.4
26.6	464.2	53.6	410.6	44.7	29.832	-3.690	6.89	29.1
28.4	502.0	61.7	440.2	52.5	30.905	-4.208	7.13	30.1
30.0	327.3	67.5	259.8	25.4	22.661	-1.866	6.06	26.1
31.6	333.6	73.2	260.4	26.1	22.488	-1.985	6.08	26.1
33.4	341.3	80.2	261.2	26.9	22.261	-2.109	6.11	26.1
35.0	348.0	86.2	261.8	27.6	22.281	-2.190	6.14	26.1
36.6	354.9	92.4	262.5	28.4	22.396	-2.219	6.16	26.1
38.4	363.2	100.0	263.2	29.4	22.548	-2.240	6.19	26.2
40.0	370.4	106.6	263.9	30.2	22.665	-2.248	6.22	26.3
41.6	377.8	113.3	264.5	31.1	22.759	-2.263	6.26	26.3
43.4	386.8	121.5	265.3	32.2	22.837	-2.263	6.30	26.4
45.0	394.5	128.6	265.9	33.2	22.908	-2.235	6.35	26.6
46.6	402.4	135.8	266.5	34.2	22.964	-2.208	6.39	26.7
48.4	411.9	144.6	267.3	35.5	22.998	-2.275	6.44	26.8
54.4	444.2	174.5	269.7	41.2	22.952	-2.503	6.58	27.0
60.4	478.9	206.7	272.2	50.6	22.634	-2.522	6.65	26.8
61.6	485.8	213.1	272.6	52.7	22.607	-2.487	6.68	26.8
63.4	497.1	223.7	273.4	56.2	22.584	-2.407	6.73	26.9
63.8	499.1	225.6	273.5	56.9	22.579	-2.387	6.74	26.9
64.1	501.1	227.4	273.7	57.4	22.562	-2.367	6.74	26.9
65.0	506.9	232.9	274.0	59.3	22.544	-2.287	6.77	27.0

Total Continuous Driving Time 41.00 minutes; Total Number of Blows 1919

California D.O.T.
Mojave River Br (D46-32) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D46-32) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

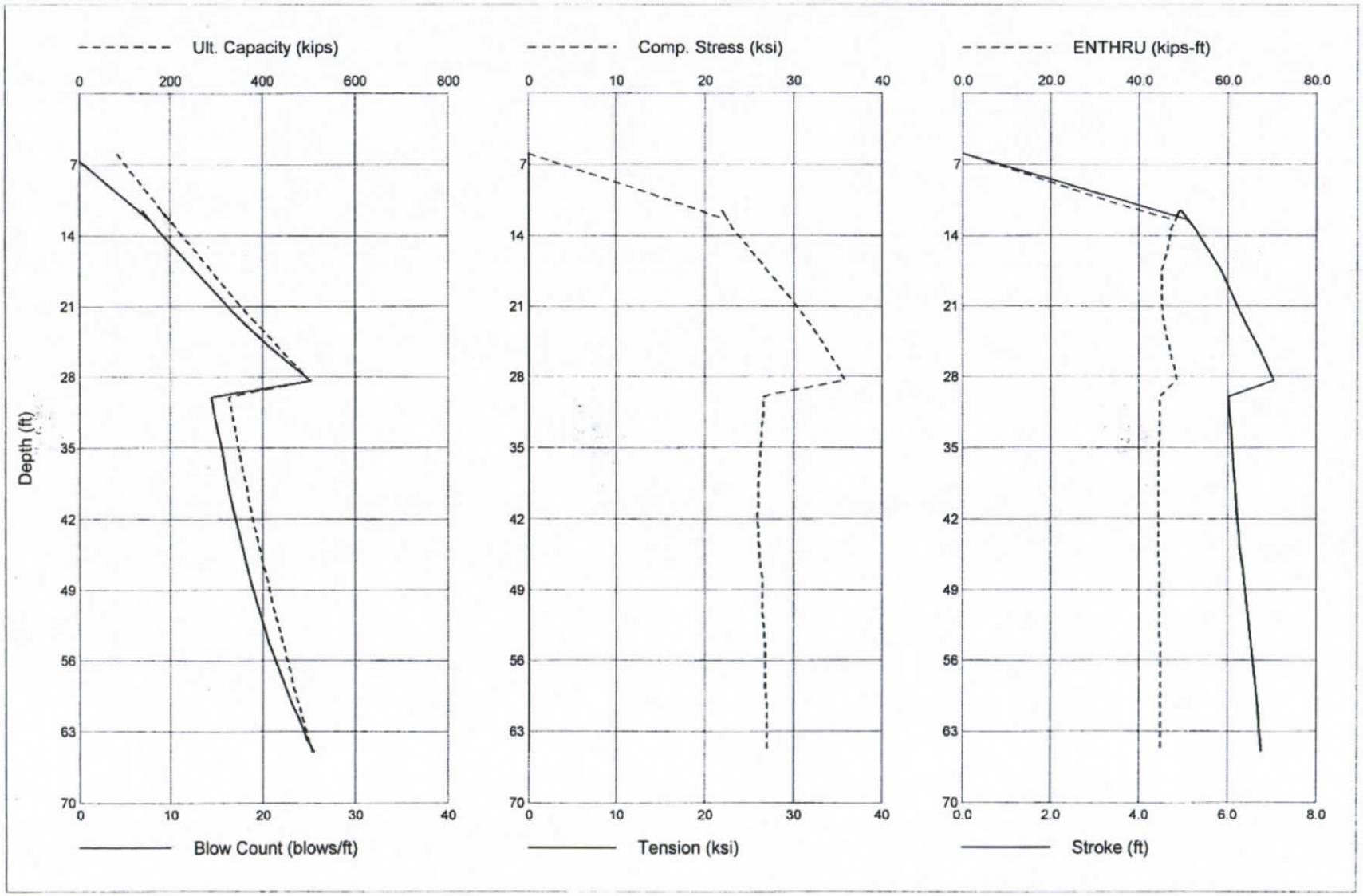
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	3.5	15.782	0.000	4.20	45.2
12.5	197.0	10.7	186.4	9.9	21.768	-0.413	5.46	38.1
11.6	180.5	9.0	171.6	8.9	21.162	-0.372	5.30	38.6
13.4	213.7	12.5	201.2	10.9	22.513	-0.431	5.62	37.8
17.5	288.3	22.2	266.1	15.6	26.176	-0.393	6.15	37.1
21.6	365.6	34.7	330.9	20.7	29.427	-0.823	6.51	37.6
23.4	401.8	41.3	360.5	23.0	31.003	-1.342	6.79	38.7
25.0	432.8	47.2	385.6	25.6	32.075	-1.972	6.93	39.2
26.6	464.2	53.6	410.6	28.1	33.242	-2.506	7.15	40.1
28.4	502.0	61.7	440.2	31.7	34.444	-2.924	7.39	41.1
30.0	327.3	67.5	259.8	17.5	25.581	-0.808	6.29	37.0
31.6	333.6	73.2	260.4	17.9	25.432	-0.821	6.32	37.0
33.4	341.3	80.2	261.2	18.4	25.290	-0.782	6.35	37.0
35.0	348.0	86.2	261.8	18.8	25.141	-0.780	6.38	37.0
36.6	354.9	92.4	262.5	19.2	25.062	-0.745	6.40	37.0
38.4	363.2	100.0	263.2	19.7	24.932	-0.735	6.44	37.1
40.0	370.4	106.6	263.9	20.2	24.837	-0.698	6.46	37.1
41.6	377.8	113.3	264.5	20.7	24.756	-0.666	6.50	37.2
43.4	386.8	121.5	265.3	21.5	24.782	-0.623	6.48	36.8
45.0	394.5	128.6	265.9	22.0	24.945	-0.568	6.54	37.0
46.6	402.4	135.8	266.5	22.5	25.092	-0.513	6.59	37.1
48.4	411.9	144.6	267.3	23.2	25.278	-0.493	6.64	37.2
54.4	444.2	174.5	269.7	25.8	25.684	-0.475	6.82	37.6
60.4	478.9	206.7	272.2	29.2	25.826	-0.280	6.99	37.8
61.6	485.8	213.1	272.6	30.0	25.873	-0.196	7.02	37.9
63.4	497.1	223.7	273.4	31.3	25.826	-0.160	7.08	38.0
63.8	499.1	225.6	273.5	31.6	25.835	-0.161	7.08	38.0
64.1	501.1	227.4	273.7	31.8	25.844	-0.161	7.09	37.9
65.0	506.9	232.9	274.0	32.6	25.815	-0.162	7.11	38.0

Total Continuous Driving Time 27.00 minutes; Total Number of Blows 1232

California D.O.T.
Mojave River Br (D62-02) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D62-02) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

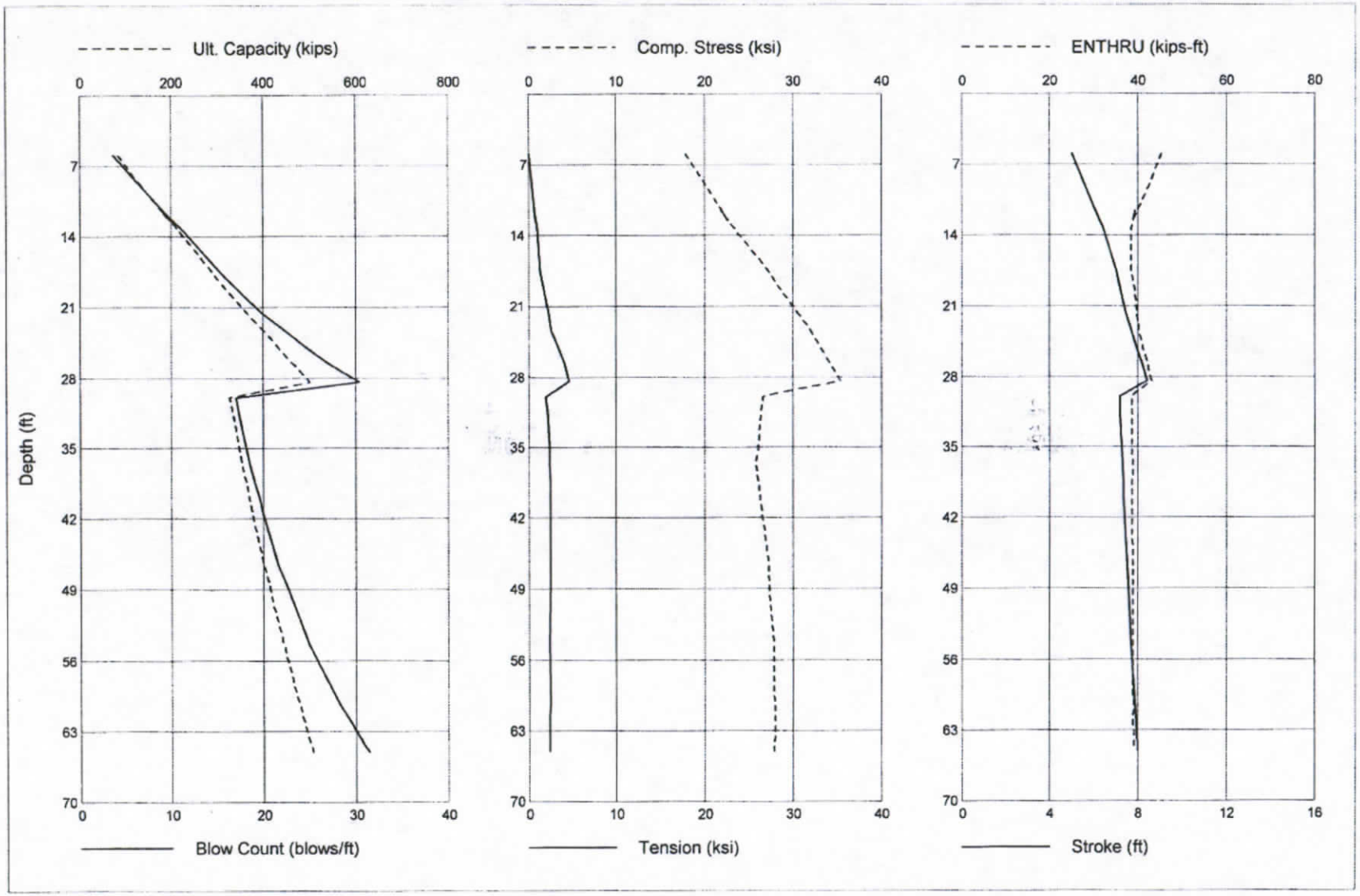
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	-1.0	0.000	0.000	0.00	0.0
12.5	197.0	10.7	186.4	7.7	22.487	0.000	5.11	48.2
11.6	180.5	9.0	171.6	6.9	21.928	0.000	4.94	49.1
13.4	213.7	12.5	201.2	8.6	23.116	0.000	5.25	47.2
17.5	288.3	22.2	266.1	12.7	27.027	0.000	5.85	45.1
21.6	365.6	34.7	330.9	16.9	30.837	0.000	6.29	45.3
23.4	401.8	41.3	360.5	18.9	32.363	0.000	6.49	46.0
25.0	432.8	47.2	385.6	20.7	33.574	0.000	6.68	46.8
26.6	464.2	53.6	410.6	22.7	34.702	0.000	6.85	47.6
28.4	502.0	61.7	440.2	25.3	35.933	0.000	7.06	48.5
30.0	327.3	67.5	259.8	14.4	26.640	0.000	6.02	44.7
31.6	333.6	73.2	260.4	14.7	26.578	0.000	6.05	44.7
33.4	341.3	80.2	261.2	15.1	26.427	0.000	6.08	44.6
35.0	348.0	86.2	261.8	15.5	26.289	0.000	6.11	44.5
36.6	354.9	92.4	262.5	15.8	26.183	0.000	6.14	44.5
38.4	363.2	100.0	263.2	16.2	26.118	0.000	6.17	44.5
40.0	370.4	106.6	263.9	16.6	26.055	0.000	6.20	44.5
41.6	377.8	113.3	264.5	17.0	25.938	0.000	6.22	44.5
43.4	386.8	121.5	265.3	17.5	26.043	0.000	6.26	44.4
45.0	394.5	128.6	265.9	17.9	26.170	0.000	6.29	44.5
46.6	402.4	135.8	266.5	18.3	26.325	0.000	6.34	44.6
48.4	411.9	144.6	267.3	18.8	26.472	0.000	6.39	44.7
54.4	444.2	174.5	269.7	20.7	26.851	0.000	6.54	45.0
60.4	478.9	206.7	272.2	23.2	27.022	0.000	6.68	45.0
61.6	485.8	213.1	272.6	23.8	27.015	0.000	6.70	45.0
63.4	497.1	223.7	273.4	24.7	27.034	0.000	6.74	45.0
63.8	499.1	225.6	273.5	24.8	27.031	0.000	6.75	45.0
64.1	501.1	227.4	273.7	25.0	27.029	0.000	6.75	45.0
65.0	506.9	232.9	274.0	25.6	27.024	0.000	6.78	45.0

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 970

California D.O.T.
Mojave River Bridge D36-23 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

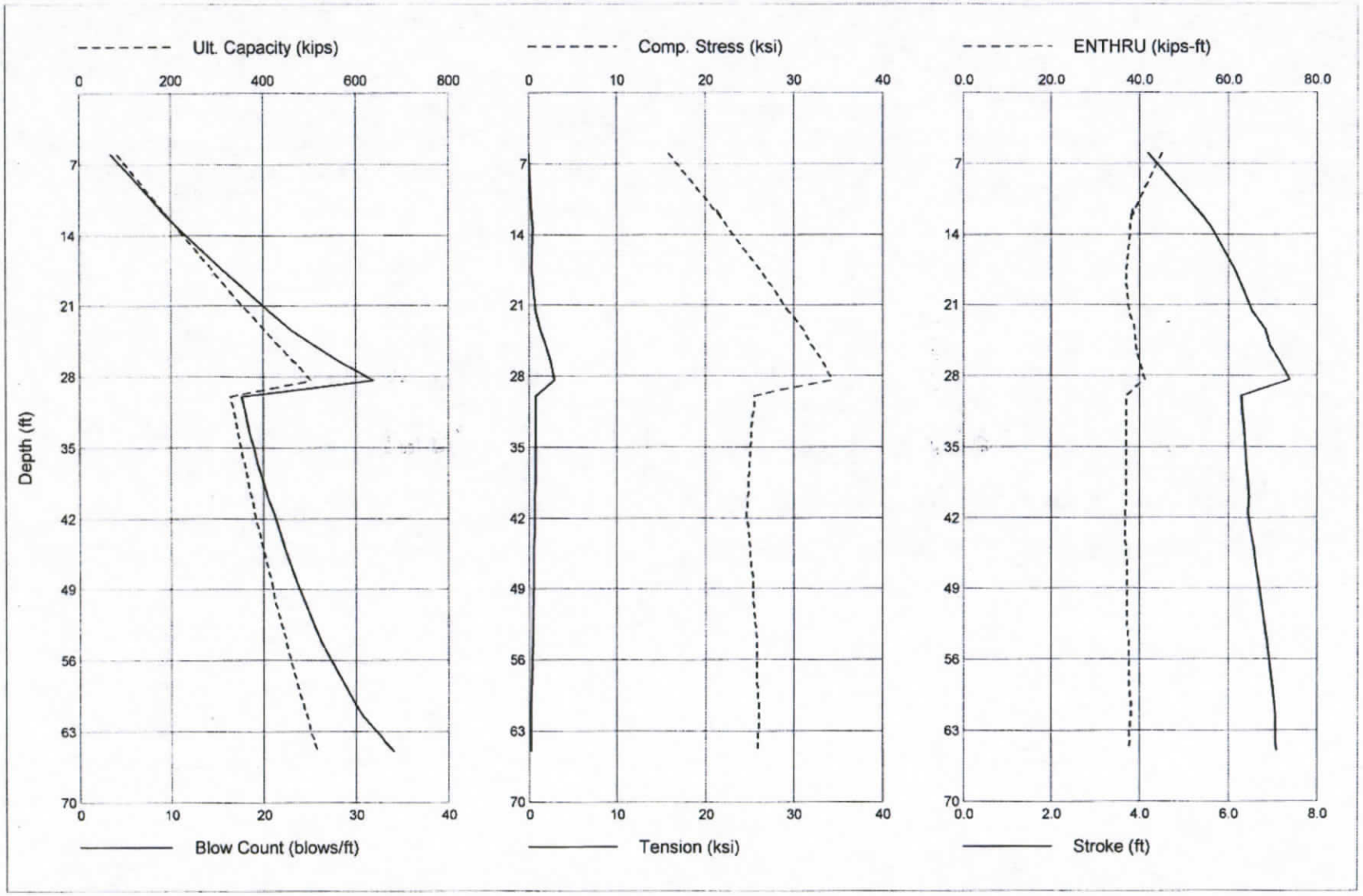
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	3.7	17.917	0.000	5.03	45.4
12.5	197.0	10.7	186.4	10.2	22.594	-0.848	6.24	38.9
11.6	180.5	9.0	171.6	9.2	21.948	-0.674	6.08	39.3
13.4	213.7	12.5	201.2	11.2	23.434	-1.022	6.40	38.6
17.5	288.3	22.2	266.1	15.3	27.240	-1.357	7.00	38.6
21.6	365.6	34.7	330.9	19.9	30.467	-2.288	7.46	39.7
23.4	401.8	41.3	360.5	22.4	31.919	-2.652	7.69	40.3
25.0	432.8	47.2	385.6	24.7	33.090	-3.359	7.91	41.0
26.6	464.2	53.6	410.6	27.1	34.134	-4.096	8.15	42.1
28.4	502.0	61.7	440.2	30.4	35.504	-4.649	8.42	43.1
30.0	327.3	67.5	259.8	17.1	26.592	-2.025	7.17	38.7
31.6	333.6	73.2	260.4	17.4	26.446	-2.154	7.20	38.7
33.4	341.3	80.2	261.2	17.8	26.232	-2.296	7.24	38.7
35.0	348.0	86.2	261.8	18.2	26.054	-2.399	7.27	38.8
36.6	354.9	92.4	262.5	18.6	25.916	-2.453	7.30	38.9
38.4	363.2	100.0	263.2	19.1	26.080	-2.486	7.34	38.8
40.0	370.4	106.6	263.9	19.6	26.277	-2.498	7.38	38.8
41.6	377.8	113.3	264.5	20.0	26.523	-2.524	7.41	38.8
43.4	386.8	121.5	265.3	20.6	26.776	-2.529	7.46	38.8
45.0	394.5	128.6	265.9	21.1	27.029	-2.519	7.49	38.9
46.6	402.4	135.8	266.5	21.6	27.245	-2.530	7.53	39.0
48.4	411.9	144.6	267.3	22.4	27.401	-2.501	7.57	38.9
54.4	444.2	174.5	269.7	25.0	27.870	-2.448	7.71	38.9
60.4	478.9	206.7	272.2	28.3	28.021	-2.475	7.88	39.1
61.6	485.8	213.1	272.6	29.1	28.006	-2.440	7.90	39.0
63.4	497.1	223.7	273.4	30.3	27.970	-2.408	7.96	39.1
63.8	499.1	225.6	273.5	30.6	27.965	-2.390	7.97	39.1
64.1	501.1	227.4	273.7	30.7	27.946	-2.397	7.98	39.2
65.0	506.9	232.9	274.0	31.4	27.890	-2.356	8.00	39.2

Total Continuous Driving Time 28.00 minutes; Total Number of Blows 1197

California D.O.T.
Mojave River Bridge D46-32 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000



California D.O.T.
Mojave River Bridge D46-32 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000

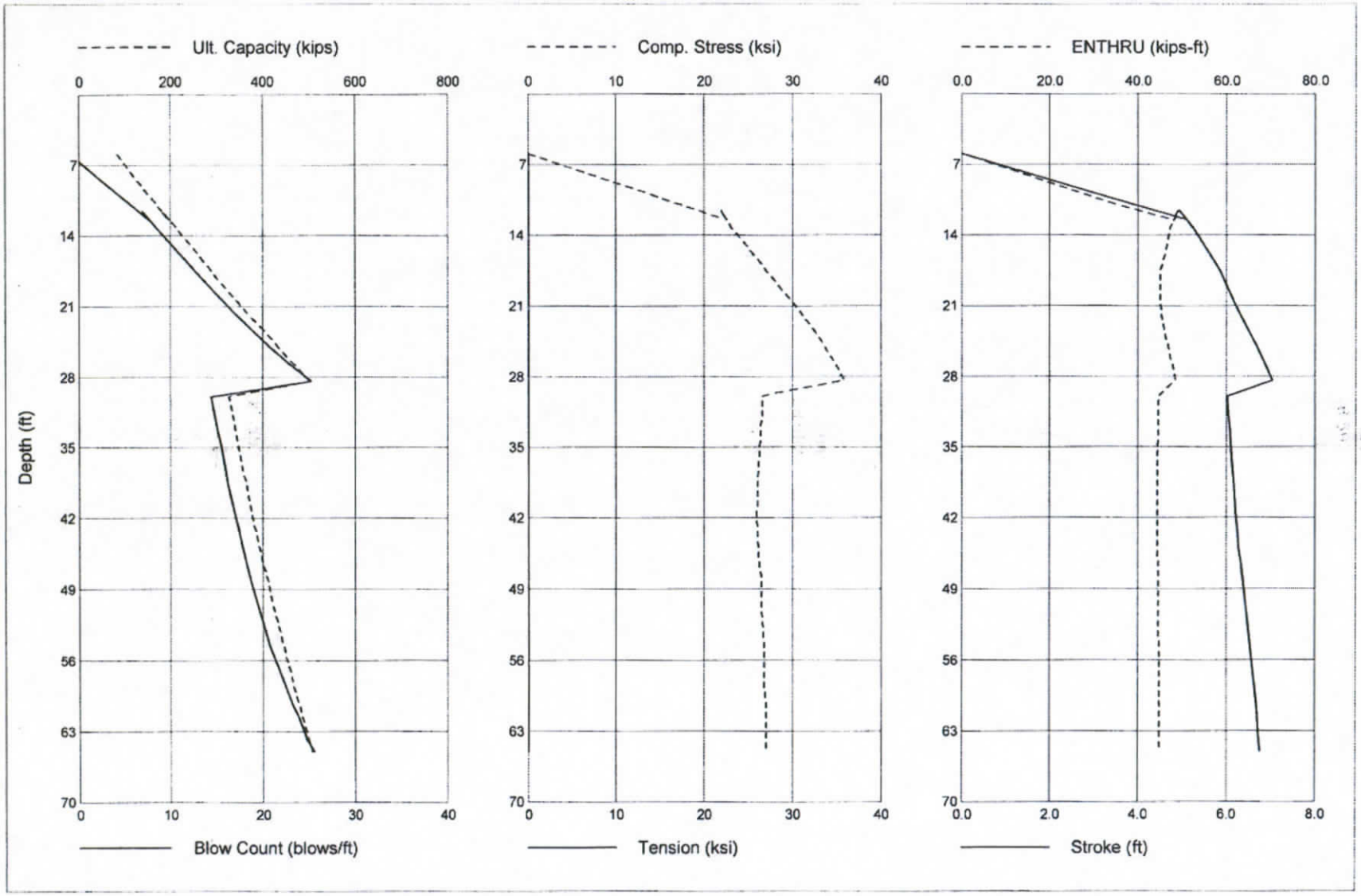
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.6	1.8	82.8	3.5	15.793	0.000	4.20	45.2
12.5	197.5	11.1	186.4	9.9	21.760	-0.416	5.47	38.1
11.6	180.9	9.3	171.6	8.9	21.231	-0.375	5.31	38.5
13.4	214.2	13.0	201.2	10.9	22.524	-0.434	5.62	37.8
17.5	289.2	23.2	266.1	15.6	26.191	-0.400	6.16	37.1
21.6	367.0	36.1	330.9	20.7	29.413	-0.849	6.53	37.7
23.4	403.5	43.0	360.5	23.0	31.085	-1.379	6.83	39.0
25.0	434.8	49.2	385.6	25.7	32.071	-2.021	6.94	39.2
26.6	466.4	55.9	410.6	28.3	33.244	-2.551	7.16	40.1
28.4	504.5	64.3	440.2	31.9	34.397	-2.971	7.40	41.2
30.0	330.0	70.3	259.8	17.7	25.563	-0.831	6.31	37.1
31.6	336.6	76.2	260.4	18.1	25.447	-0.838	6.33	37.1
33.4	344.6	83.5	261.2	18.5	25.258	-0.808	6.36	37.1
35.0	351.6	89.8	261.8	19.0	25.098	-0.809	6.39	37.0
36.6	358.7	96.3	262.5	19.4	24.999	-0.779	6.42	37.1
38.4	367.4	104.1	263.2	20.0	24.905	-0.766	6.45	37.1
40.0	374.8	111.0	263.9	20.5	24.792	-0.729	6.48	37.1
41.6	382.5	118.0	264.5	21.2	24.716	-0.719	6.46	36.7
43.4	391.8	126.5	265.3	21.8	24.925	-0.645	6.52	36.9
45.0	399.8	133.9	265.9	22.3	25.103	-0.588	6.58	37.1
46.6	408.0	141.4	266.5	22.9	25.252	-0.554	6.63	37.2
48.4	417.9	150.6	267.3	23.6	25.448	-0.562	6.69	37.3
54.4	451.4	181.7	269.7	26.4	25.862	-0.528	6.87	37.7
60.4	487.4	215.3	272.2	30.0	26.039	-0.315	7.05	38.1
61.6	494.5	221.9	272.6	30.8	26.054	-0.239	7.08	38.1
63.4	506.3	233.0	273.4	32.7	25.982	-0.249	7.07	37.7
63.8	508.4	234.9	273.5	33.0	25.975	-0.252	7.07	37.7
64.1	510.5	236.8	273.7	33.2	25.957	-0.271	7.08	37.8
65.0	516.5	242.5	274.0	34.1	25.927	-0.263	7.10	37.7

Total Continuous Driving Time 27.00 minutes; Total Number of Blows 1250

California D.O.T.
Mojave River Bridge D62-02 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

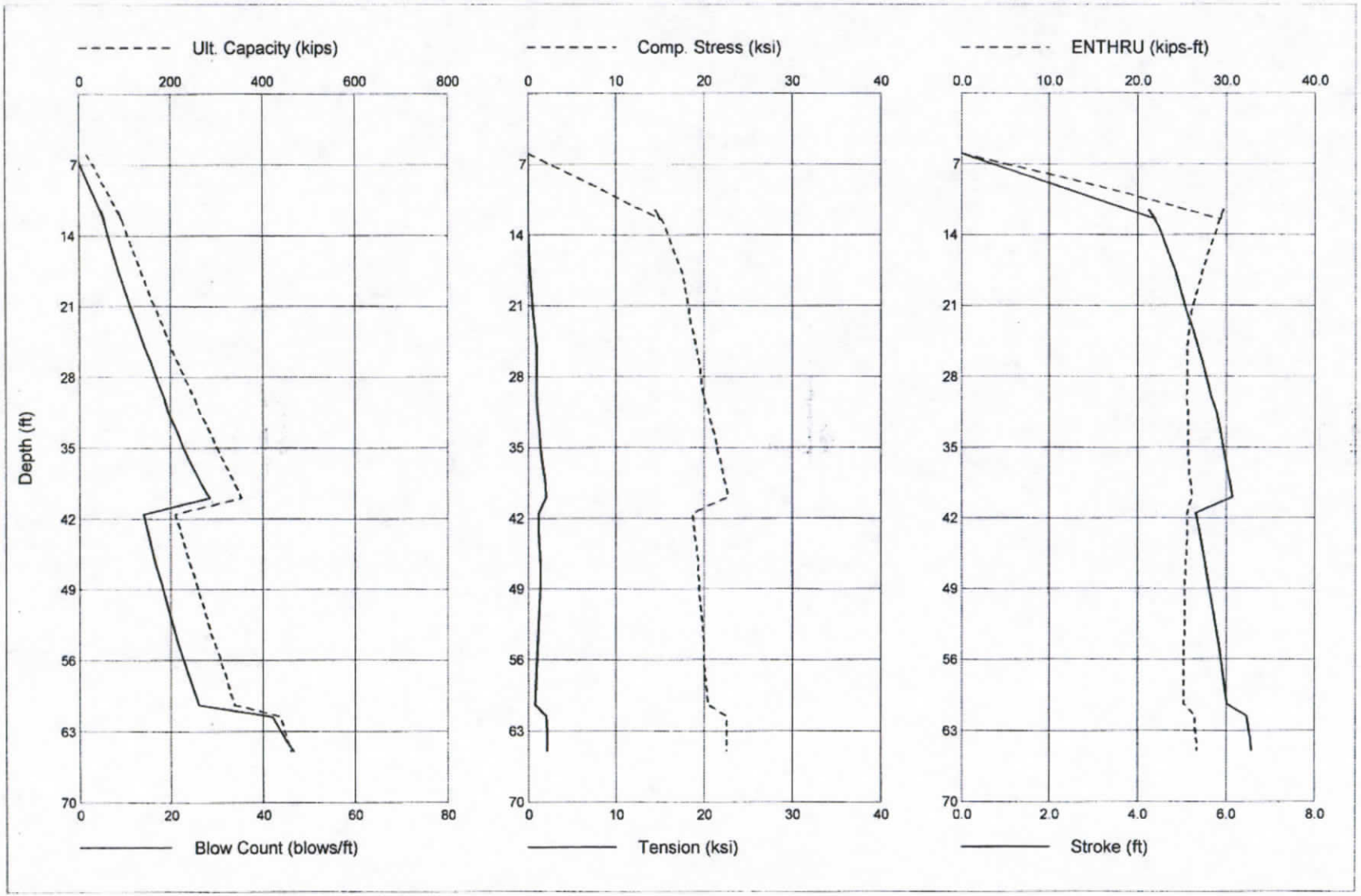
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	-1.0	0.000	0.000	0.00	0.0
12.5	197.0	10.7	186.4	7.7	22.487	0.000	5.11	48.2
11.6	180.5	9.0	171.6	6.9	21.928	0.000	4.94	49.1
13.4	213.7	12.5	201.2	8.6	23.116	0.000	5.25	47.2
17.5	288.3	22.2	266.1	12.7	27.027	0.000	5.85	45.1
21.6	365.6	34.7	330.9	16.9	30.837	0.000	6.29	45.3
23.4	401.8	41.3	360.5	18.9	32.363	0.000	6.49	46.0
25.0	432.8	47.2	385.6	20.7	33.574	0.000	6.68	46.8
26.6	464.2	53.6	410.6	22.7	34.702	0.000	6.85	47.6
28.4	502.0	61.7	440.2	25.3	35.933	0.000	7.06	48.5
30.0	327.3	67.5	259.8	14.4	26.640	0.000	6.02	44.7
31.6	333.6	73.2	260.4	14.7	26.578	0.000	6.05	44.7
33.4	341.3	80.2	261.2	15.1	26.427	0.000	6.08	44.6
35.0	348.0	86.2	261.8	15.5	26.289	0.000	6.11	44.5
36.6	354.9	92.4	262.5	15.8	26.183	0.000	6.14	44.5
38.4	363.2	100.0	263.2	16.2	26.118	0.000	6.17	44.5
40.0	370.4	106.6	263.9	16.6	26.055	0.000	6.20	44.5
41.6	377.8	113.3	264.5	17.0	25.938	0.000	6.22	44.5
43.4	386.8	121.5	265.3	17.5	26.043	0.000	6.26	44.4
45.0	394.5	128.6	265.9	17.9	26.170	0.000	6.29	44.5
46.6	402.4	135.8	266.5	18.3	26.325	0.000	6.34	44.6
48.4	411.9	144.6	267.3	18.8	26.472	0.000	6.39	44.7
54.4	444.2	174.5	269.7	20.7	26.851	0.000	6.54	45.0
60.4	478.9	206.7	272.2	23.2	27.022	0.000	6.68	45.0
61.6	485.8	213.1	272.6	23.8	27.015	0.000	6.70	45.0
63.4	497.1	223.7	273.4	24.7	27.034	0.000	6.74	45.0
63.8	499.1	225.6	273.5	24.8	27.031	0.000	6.75	45.0
64.1	501.1	227.4	273.7	25.0	27.029	0.000	6.75	45.0
65.0	506.9	232.9	274.0	25.6	27.024	0.000	6.78	45.0

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 970

California D.O.T.
Mojave River Bridge D36-23 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

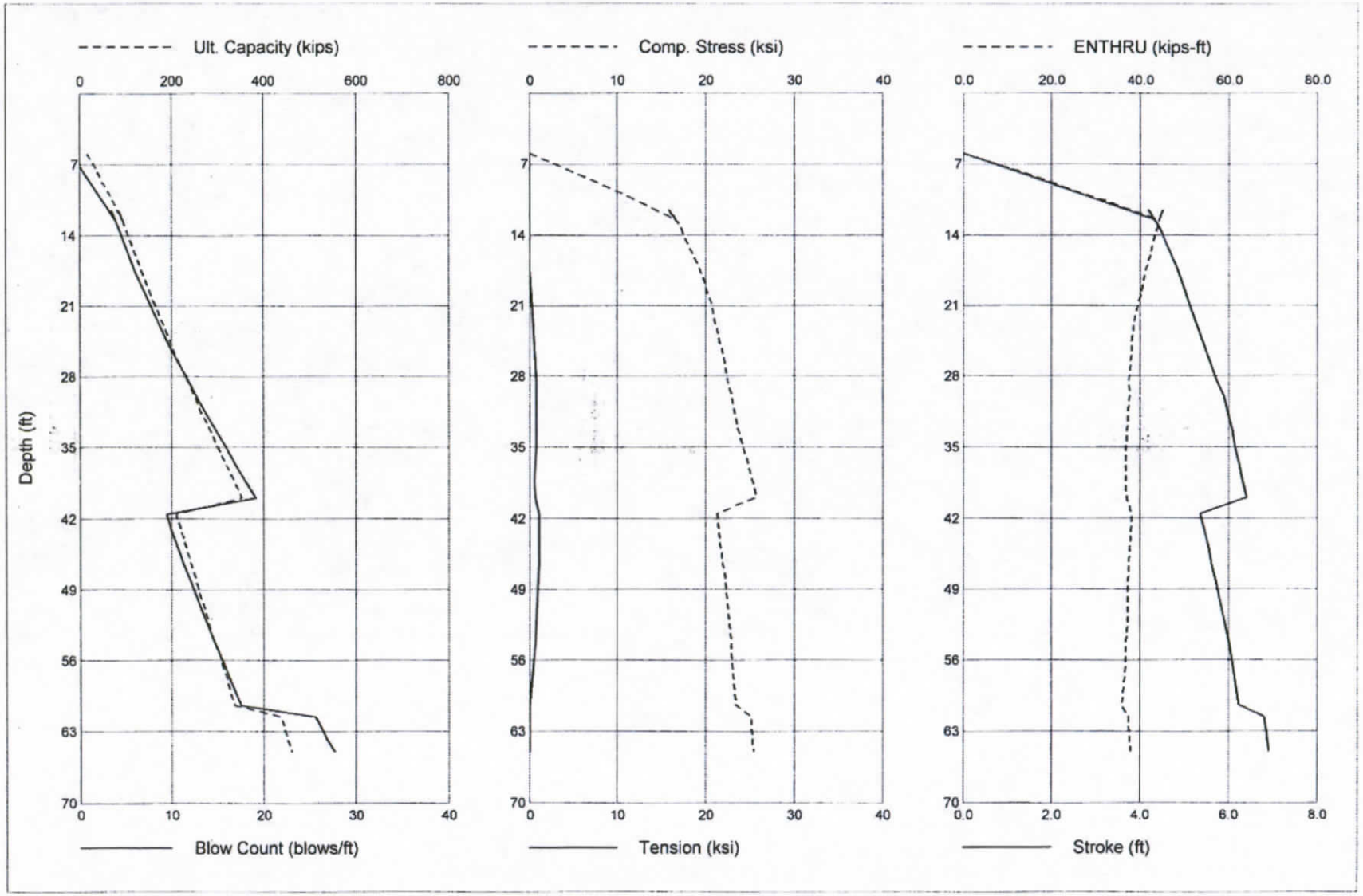
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	5.5	15.033	0.000	4.40	29.4
11.6	85.8	5.9	79.9	5.0	14.461	0.000	4.26	29.7
13.4	100.7	8.2	92.5	6.0	15.582	0.000	4.49	29.0
17.5	134.6	14.6	120.0	8.7	17.407	-0.230	4.86	27.4
21.6	170.2	22.7	147.5	11.6	18.297	-0.548	5.10	26.1
23.4	187.1	27.0	160.1	13.0	18.771	-0.853	5.25	25.9
25.0	201.6	30.9	170.7	14.3	19.074	-0.975	5.36	25.7
26.6	216.4	35.0	181.4	15.6	19.419	-0.973	5.47	25.7
28.4	234.2	40.3	193.9	17.1	19.696	-0.969	5.58	25.6
30.0	249.6	45.0	204.6	18.5	19.934	-1.053	5.66	25.5
31.6	265.2	50.0	215.2	19.6	20.519	-1.160	5.79	25.8
33.4	284.0	56.2	227.8	21.3	21.082	-1.307	5.87	25.8
35.0	300.2	61.8	238.4	22.8	21.511	-1.485	5.94	25.8
36.6	316.6	67.6	249.0	24.4	21.909	-1.687	6.01	25.9
38.4	336.4	74.8	261.6	26.5	22.338	-1.921	6.09	26.0
40.0	353.4	81.2	272.2	28.5	22.748	-2.109	6.16	26.2
41.6	210.4	87.0	123.5	14.0	18.760	-1.208	5.32	25.7
43.4	221.8	92.3	129.5	15.0	18.979	-1.255	5.41	25.7
45.0	231.5	97.0	134.5	15.9	19.131	-1.364	5.48	25.5
46.6	241.4	101.9	139.6	16.8	19.317	-1.392	5.54	25.4
48.4	253.4	107.9	145.6	18.0	19.439	-1.394	5.60	25.3
54.4	293.9	128.9	165.0	21.6	20.015	-1.130	5.84	25.2
60.4	336.9	152.6	184.3	26.0	20.408	-0.789	6.02	25.2
61.6	438.9	159.7	279.2	42.0	22.530	-2.126	6.48	26.5
63.4	451.0	171.8	279.2	44.4	22.567	-2.172	6.54	26.6
63.8	453.1	173.9	279.2	44.9	22.572	-2.174	6.55	26.6
64.1	455.2	176.0	279.2	45.3	22.585	-2.178	6.56	26.7
65.0	461.3	182.1	279.2	46.7	22.579	-2.183	6.59	26.7

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 1037

California D.O.T.
Mojave River Bridge D46-32 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D46-32 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

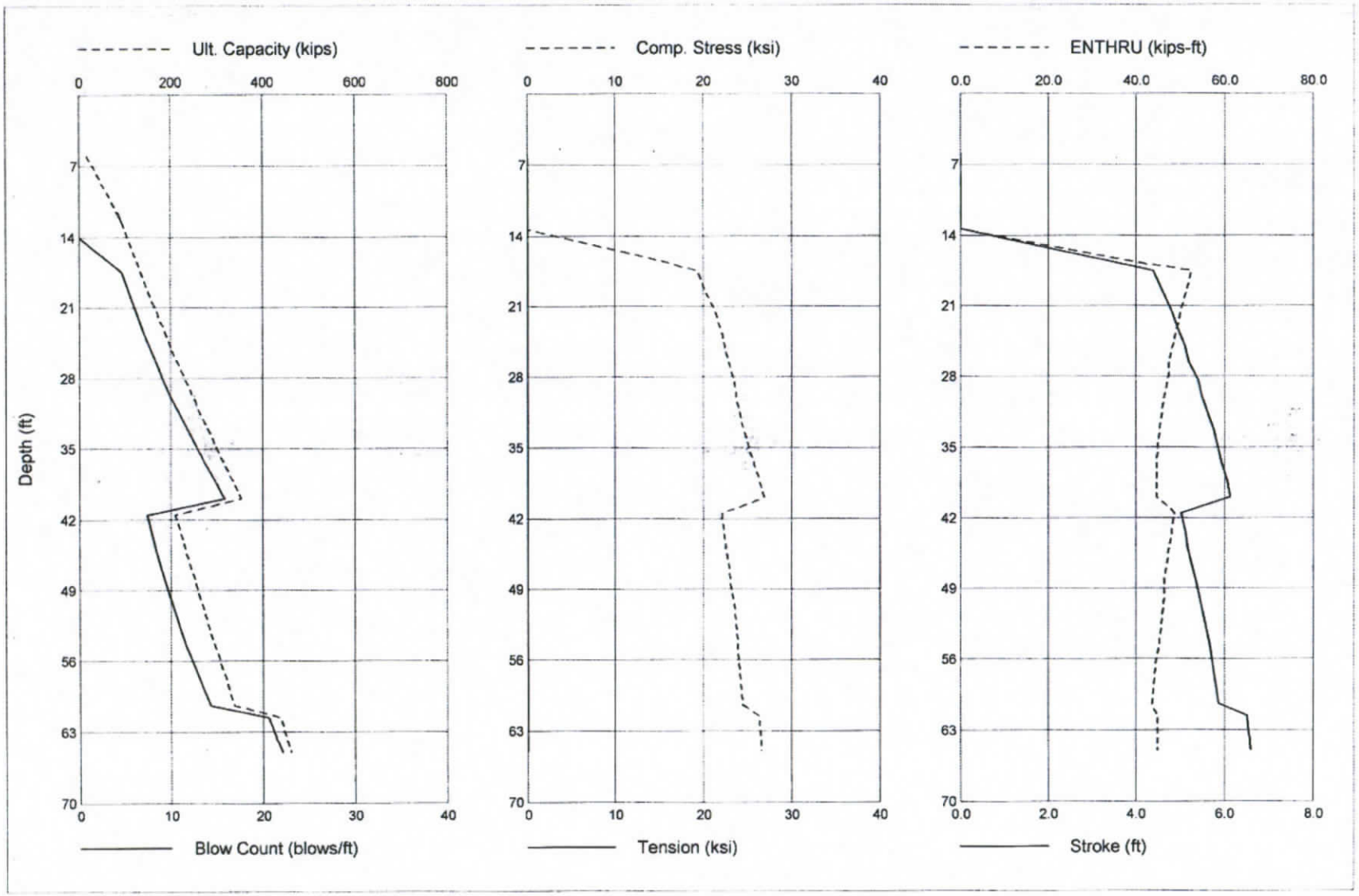
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	3.9	16.551	0.000	4.31	44.3
11.6	85.8	5.9	79.9	3.5	15.795	0.000	4.20	45.2
13.4	100.7	8.2	92.5	4.3	17.228	0.000	4.45	43.9
17.5	134.6	14.6	120.0	6.0	19.349	0.000	4.86	41.2
21.6	170.2	22.7	147.5	8.1	20.814	-0.403	5.17	39.1
23.4	187.1	27.0	160.1	9.0	21.318	-0.521	5.32	38.5
25.0	201.6	30.9	170.7	9.8	21.660	-0.605	5.45	38.1
26.6	216.4	35.0	181.4	10.7	22.091	-0.664	5.58	37.8
28.4	234.2	40.3	193.9	11.8	22.500	-0.764	5.72	37.5
30.0	249.6	45.0	204.6	12.7	22.942	-0.816	5.90	37.7
31.6	265.2	50.0	215.2	13.7	23.261	-0.823	5.98	37.3
33.4	284.0	56.2	227.8	14.8	23.703	-0.809	6.08	37.1
35.0	300.2	61.8	238.4	15.9	24.261	-0.771	6.15	36.9
36.6	316.6	67.6	249.0	16.9	24.779	-0.660	6.23	36.8
38.4	336.4	74.8	261.6	18.1	25.380	-0.605	6.33	36.9
40.0	353.4	81.2	272.2	19.2	25.783	-0.650	6.41	37.1
41.6	210.4	87.0	123.5	9.5	21.276	-1.072	5.37	38.1
43.4	221.8	92.3	129.5	10.1	21.494	-1.091	5.47	37.9
45.0	231.5	97.0	134.5	10.7	21.730	-1.107	5.55	37.7
46.6	241.4	101.9	139.6	11.3	21.934	-1.082	5.63	37.5
48.4	253.4	107.9	145.6	12.1	22.215	-1.026	5.72	37.2
54.4	293.9	128.9	165.0	14.7	22.921	-0.736	6.03	36.7
60.4	336.9	152.6	184.3	17.6	23.371	0.000	6.23	36.0
61.6	438.9	159.7	279.2	25.7	25.212	-0.071	6.82	37.5
63.4	451.0	171.8	279.2	26.7	25.325	-0.043	6.88	37.7
63.8	453.1	173.9	279.2	26.9	25.339	-0.037	6.89	37.7
64.1	455.2	176.0	279.2	27.1	25.384	-0.009	6.90	37.7
65.0	461.3	182.1	279.2	27.7	25.401	0.000	6.93	37.8

Total Continuous Driving Time 15.00 minutes; Total Number of Blows 698

California D.O.T.
Mojave River Bridge D62-02 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

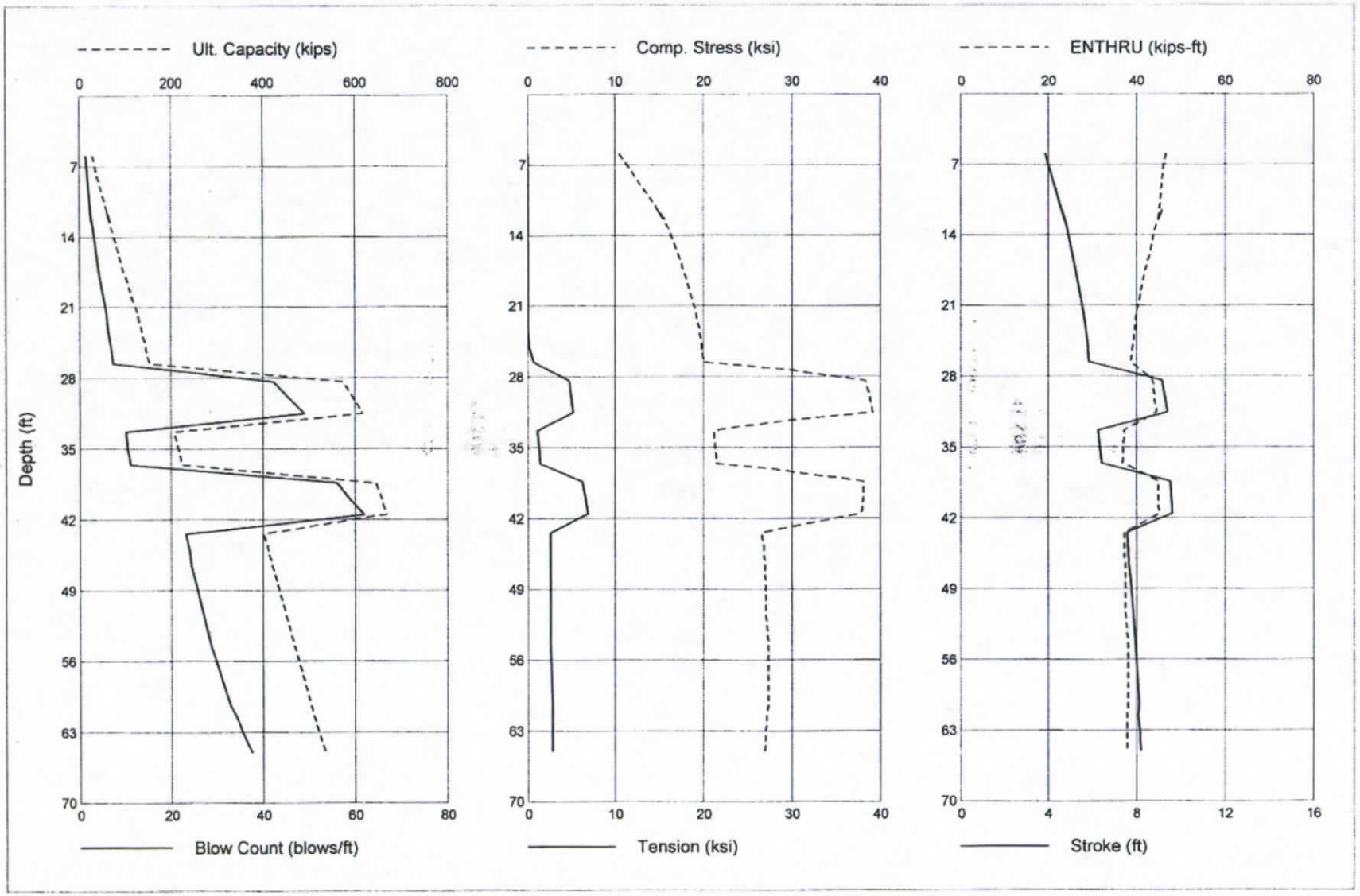
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	-1.0	0.000	0.000	0.00	0.0
11.6	85.8	5.9	79.9	-1.0	0.000	0.000	0.00	0.0
13.4	100.7	8.2	92.5	-1.0	0.000	0.000	0.00	0.0
17.5	134.6	14.6	120.0	4.7	19.364	0.000	4.39	52.5
21.6	170.2	22.7	147.5	6.3	21.424	0.000	4.80	50.1
23.4	187.1	27.0	160.1	7.0	22.033	0.000	4.96	49.1
25.0	201.6	30.9	170.7	7.7	22.499	0.000	5.10	48.3
26.6	216.4	35.0	181.4	8.5	22.862	0.000	5.20	47.4
28.4	234.2	40.3	193.9	9.3	23.499	0.000	5.41	47.2
30.0	249.6	45.0	204.6	10.1	23.762	0.000	5.49	46.3
31.6	265.2	50.0	215.2	11.0	24.123	0.000	5.63	45.9
33.4	284.0	56.2	227.8	12.0	24.735	0.000	5.76	45.3
35.0	300.2	61.8	238.4	12.9	25.234	0.000	5.85	44.9
36.6	316.6	67.6	249.0	13.8	25.756	0.000	5.95	44.7
38.4	336.4	74.8	261.6	14.9	26.449	0.000	6.06	44.6
40.0	353.4	81.2	272.2	15.8	26.974	0.000	6.14	44.6
41.6	210.4	87.0	123.5	7.4	22.063	0.000	5.02	48.7
43.4	221.8	92.3	129.5	7.9	22.398	0.000	5.13	48.2
45.0	231.5	97.0	134.5	8.4	22.539	0.000	5.17	47.4
46.6	241.4	101.9	139.6	8.9	22.829	0.000	5.26	47.1
48.4	253.4	107.9	145.6	9.5	23.085	0.000	5.36	46.5
54.4	293.9	128.9	165.0	11.6	23.975	0.000	5.67	45.4
60.4	336.9	152.6	184.3	14.3	24.488	0.000	5.87	43.6
61.6	438.9	159.7	279.2	20.6	26.428	0.000	6.52	44.9
63.4	451.0	171.8	279.2	21.4	26.539	0.000	6.57	45.0
63.8	453.1	173.9	279.2	21.5	26.533	0.000	6.58	44.9
64.1	455.2	176.0	279.2	21.7	26.566	0.000	6.59	45.0
65.0	461.3	182.1	279.2	22.1	26.593	0.000	6.61	45.0

Total Continuous Driving Time 11.00 minutes; Total Number of Blows 538

California D.O.T.
Mojave River Bridge D36-23 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

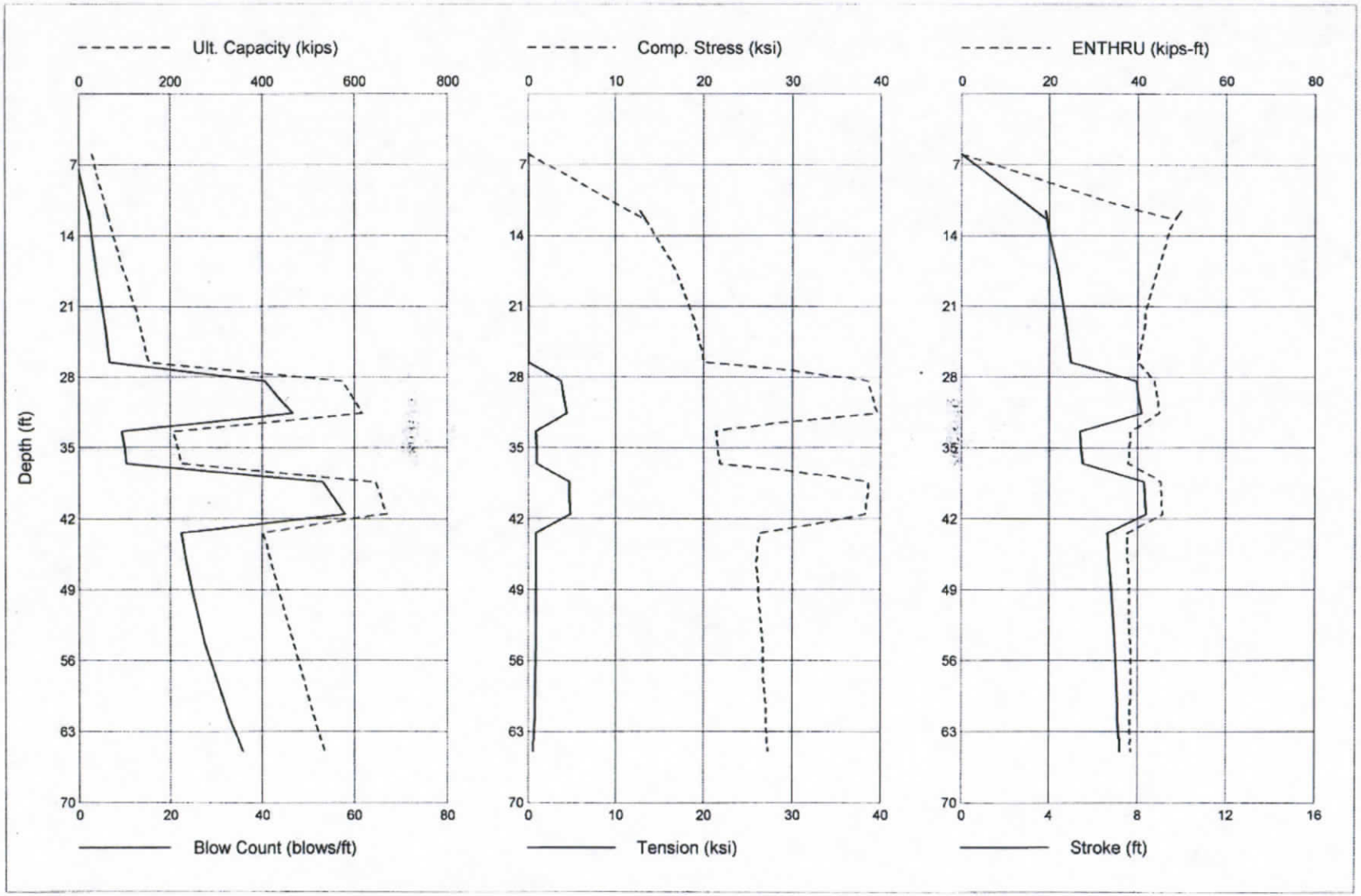
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	1.5	10.523	-0.018	3.87	46.7
12.5	66.9	8.3	58.6	2.8	15.616	0.000	4.73	45.0
11.6	61.3	7.1	54.2	2.5	14.930	0.000	4.62	45.8
13.4	72.5	9.6	62.9	3.1	16.081	0.000	4.84	44.3
17.5	98.2	16.2	82.0	4.4	17.801	0.000	5.24	41.9
21.6	125.7	24.7	101.1	5.9	19.199	0.000	5.57	40.0
23.4	136.0	29.0	107.0	6.4	19.549	0.000	5.68	39.5
25.0	144.2	32.9	111.2	6.9	19.805	-0.184	5.76	39.1
26.6	152.5	36.9	115.5	7.3	19.974	-0.728	5.84	38.8
28.4	574.9	43.1	531.8	42.4	38.354	-4.701	9.14	43.6
30.0	595.5	51.9	543.6	45.6	38.833	-4.923	9.26	44.0
31.6	616.4	61.1	555.3	49.2	39.233	-5.169	9.40	44.5
33.4	205.8	68.1	137.7	10.2	21.128	-1.150	6.27	37.2
35.0	215.0	73.1	141.9	10.7	21.255	-1.302	6.35	37.0
36.6	224.4	78.2	146.2	11.3	21.473	-1.402	6.43	36.9
38.4	647.8	89.3	558.5	56.3	38.150	-6.282	9.53	44.8
40.0	658.9	100.4	558.5	58.9	38.091	-6.561	9.58	45.0
41.6	670.3	111.8	558.5	62.0	37.934	-6.880	9.63	45.1
43.4	402.6	123.3	279.2	23.2	26.634	-2.591	7.58	37.2
45.0	411.7	132.5	279.2	23.9	26.777	-2.601	7.62	37.3
46.6	421.0	141.7	279.2	24.5	26.912	-2.604	7.67	37.5
48.4	432.0	152.8	279.2	25.4	27.040	-2.576	7.74	37.5
54.4	468.4	189.2	279.2	28.6	27.380	-2.655	7.95	38.0
60.4	505.9	226.7	279.2	32.9	27.380	-2.825	8.13	38.1
61.6	513.2	233.9	279.2	34.3	27.191	-2.842	8.09	37.8
63.4	525.1	245.8	279.2	36.0	27.077	-2.828	8.15	37.8
63.8	527.2	247.9	279.2	36.3	27.041	-2.825	8.16	37.8
64.1	529.2	250.0	279.2	36.6	27.047	-2.819	8.17	37.8
65.0	535.2	256.0	279.2	37.6	26.973	-2.798	8.20	37.9

Total Continuous Driving Time 32.00 minutes; Total Number of Blows 1322

California D.O.T.
Mojave River Bridge D46-32 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D46-32 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

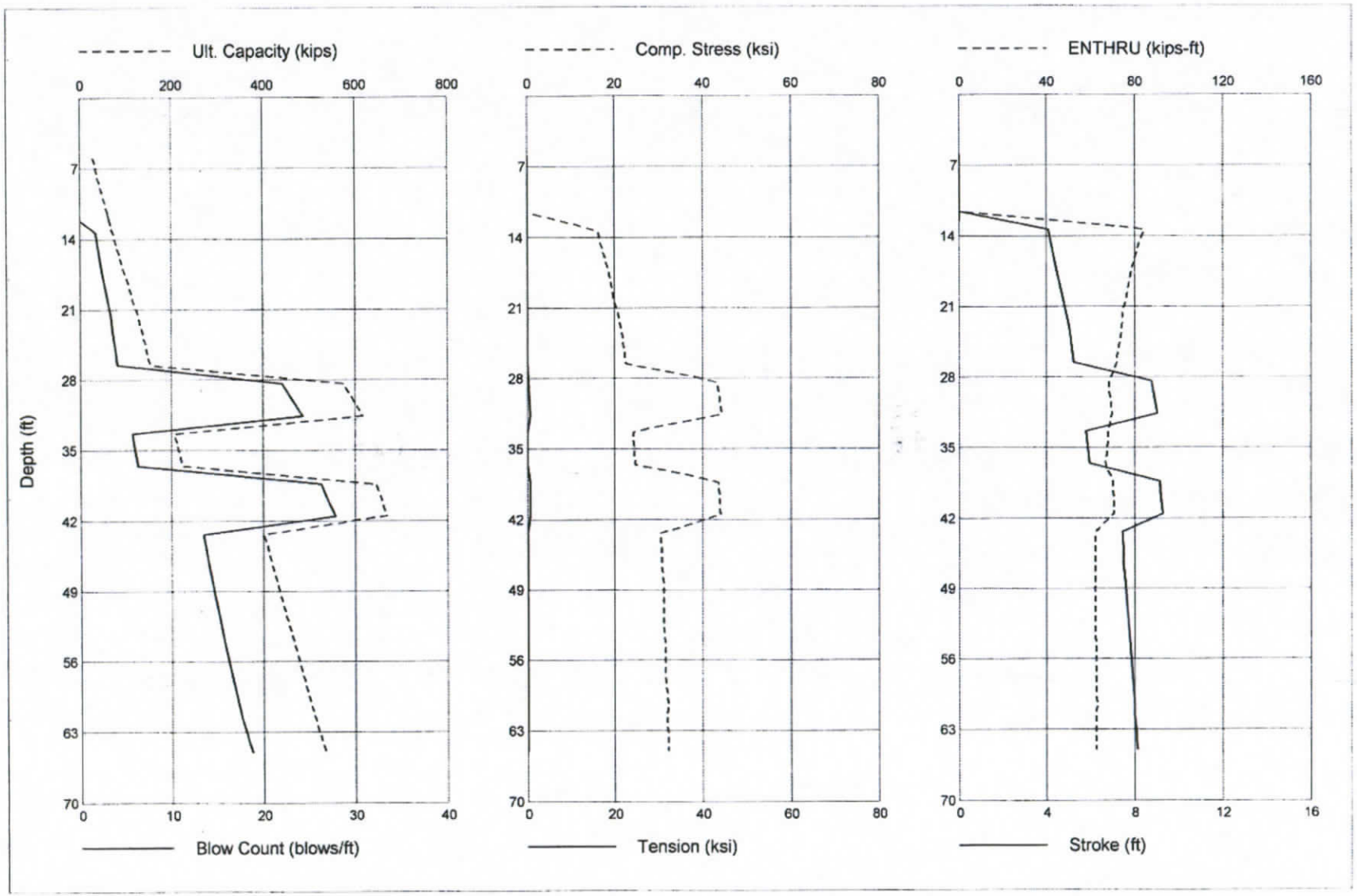
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	-1.0	0.000	0.000	0.00	0.0
12.5	66.9	8.3	58.6	2.5	13.438	0.000	3.90	48.6
11.6	61.3	7.1	54.2	2.3	12.753	-0.070	3.81	49.8
13.4	72.5	9.6	62.9	2.8	14.027	0.000	3.96	47.3
17.5	98.2	16.2	82.0	4.0	16.950	0.000	4.39	44.5
21.6	125.7	24.7	101.1	5.4	18.566	0.000	4.68	41.7
23.4	136.0	29.0	107.0	5.9	19.243	0.000	4.82	41.4
25.0	144.2	32.9	111.2	6.3	19.682	0.000	4.87	40.6
26.6	152.5	36.9	115.5	6.8	19.985	0.000	4.95	40.2
28.4	574.9	43.1	531.8	40.6	38.624	-3.740	7.94	43.8
30.0	595.5	51.9	543.6	43.5	39.176	-4.081	8.06	44.4
31.6	616.4	61.1	555.3	46.7	39.588	-4.447	8.18	45.0
33.4	205.8	68.1	137.7	9.5	21.399	-0.914	5.38	38.2
35.0	215.0	73.1	141.9	10.0	21.553	-0.979	5.46	38.0
36.6	224.4	78.2	146.2	10.5	21.762	-1.043	5.54	37.8
38.4	647.8	89.3	558.5	53.1	38.655	-4.713	8.31	45.4
40.0	658.9	100.4	558.5	55.5	38.596	-4.797	8.35	45.6
41.6	670.3	111.8	558.5	58.1	38.366	-4.839	8.40	45.8
43.4	402.6	123.3	279.2	22.4	26.304	-0.880	6.62	37.6
45.0	411.7	132.5	279.2	23.0	26.061	-0.866	6.68	37.7
46.6	421.0	141.7	279.2	23.6	25.957	-0.879	6.74	37.9
48.4	432.0	152.8	279.2	24.4	26.175	-0.880	6.80	38.0
54.4	468.4	189.2	279.2	27.4	26.726	-0.952	6.99	38.5
60.4	505.9	226.7	279.2	31.9	27.026	-0.827	7.09	38.3
61.6	513.2	233.9	279.2	32.8	27.078	-0.771	7.12	38.3
63.4	525.1	245.8	279.2	34.4	27.140	-0.689	7.16	38.3
63.8	527.2	247.9	279.2	34.7	27.158	-0.668	7.17	38.4
64.1	529.2	250.0	279.2	35.0	27.173	-0.636	7.17	38.3
65.0	535.2	256.0	279.2	35.8	27.206	-0.574	7.20	38.4

Total Continuous Driving Time 29.00 minutes; Total Number of Blows 1248

California D.O.T.
Mojave River Bridge D62-02 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	-1.0	0.000	0.000	0.00	0.0
12.5	66.9	8.3	58.6	-1.0	0.000	0.000	0.00	0.0
11.6	61.3	7.1	54.2	-1.0	0.000	0.000	0.00	0.0
13.4	72.5	9.6	62.9	1.8	16.001	-0.203	4.08	84.1
17.5	98.2	16.2	82.0	2.5	18.682	0.000	4.47	78.3
21.6	125.7	24.7	101.1	3.4	20.795	0.000	4.88	74.5
23.4	136.0	29.0	107.0	3.6	21.585	0.000	5.05	73.9
25.0	144.2	32.9	111.2	3.9	22.090	0.000	5.14	72.9
26.6	152.5	36.9	115.5	4.1	22.503	0.000	5.23	72.0
28.4	574.9	43.1	531.8	22.1	43.209	-0.405	8.78	68.4
30.0	595.5	51.9	543.6	23.2	43.738	-0.611	8.90	69.1
31.6	616.4	61.1	555.3	24.4	44.249	-0.800	9.03	69.7
33.4	205.8	68.1	137.7	5.7	24.213	0.000	5.77	68.0
35.0	215.0	73.1	141.9	6.0	24.462	0.000	5.87	67.5
36.6	224.4	78.2	146.2	6.3	24.703	0.000	5.96	66.9
38.4	647.8	89.3	558.5	26.4	43.720	-0.777	9.16	70.3
40.0	658.9	100.4	558.5	27.1	43.835	-0.770	9.21	70.6
41.6	670.3	111.8	558.5	27.9	43.957	-0.812	9.26	70.8
43.4	402.6	123.3	279.2	13.5	30.326	0.000	7.43	62.0
45.0	411.7	132.5	279.2	13.8	30.531	0.000	7.47	62.1
46.6	421.0	141.7	279.2	14.1	30.687	0.000	7.50	62.0
48.4	432.0	152.8	279.2	14.5	30.957	0.000	7.58	62.2
54.4	468.4	189.2	279.2	15.8	31.552	0.000	7.79	62.6
60.4	505.9	226.7	279.2	17.4	32.015	0.000	7.98	62.8
61.6	513.2	233.9	279.2	17.7	31.962	0.000	8.01	62.7
63.4	525.1	245.8	279.2	18.3	32.055	0.000	8.07	62.7
63.8	527.2	247.9	279.2	18.4	32.085	0.000	8.08	62.7
64.1	529.2	250.0	279.2	18.5	32.077	0.000	8.09	62.7
65.0	535.2	256.0	279.2	18.8	32.046	0.000	8.12	62.7

Total Continuous Driving Time 16.00 minutes; Total Number of Blows 679

Memorandum

To: MR. DAN ADAMS, CHIEF
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES MS#9-48I
OFFICE OF BRIDGE DESIGN CENTRAL
STRUCTURES DESIGN BRANCH - 10

Date: November 04, 2013

File: 08-SBd-15-PM 43.93
EA 08-355561
E-FIS 0800000621

Attention: Mr. Ryan Stiltz

Mojave River Bridge
(Widen)
Br. No. 54-0483

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: Revised Foundation Report

Introduction

This report supersedes the Foundation Report dated August 15, 2013 and presents the foundation and seismic design recommendations for the proposed widening of the existing Mojave River Bridge (Br. No. 54-0483).

The foundation and seismic recommendations contained in this report are based on our review of available General plan (December 5, 2012) and Foundation plans (September 5, 2012), Structures Loads (May 2, 2013), subsurface explorations (1955, 1995, 2001, 2010 and 2012), Hydraulic Report dated July 31, 2008 and your request letter dated April 21, 2008. Elevations referenced in this report are based on the NGVD29 vertical datum, unless otherwise indicated

Project/Site Description

The existing bridge is located on Interstate 15, at Post Mile 43.93 in San Bernardino County in the city of Victorville. The original Mojave River bridges were built in 1958 and consisted of two separate bridges, a Left Bridge and a Right Bridge. Both (left and right) bridges are supported on precast reinforced concrete piles. The original Mojave River Bridges are a continuous eight-span Reinforced

Concrete "T" girder supported on Reinforced Concrete pier walls and seat abutments founded on 45-ton concrete driven piles.

The pier walls are extended approximately 20 feet (elevation 2673 feet) below the channel bottom to the top of pile cap.

The initial widening of the original bridge occurred in 1971; both northbound and southbound bridges were widened 46 feet each. The widening was 11 feet on each side and 22 feet in the center. The widened portion was built identical to the existing bridge structure.

In the 1971 widening, it was recommended to use Class I concrete pile; and at the option of the Contractor, steel piling of 10BP42 section could be substituted. The contractor chose the 10BP42 option for both abutments and piers, and the average minimum pile tip elevation was 2658 feet.

The total length and width of the existing bridge are approximately 575 feet and 92 feet, respectively.

Proposed Improvements

The existing Mojave River Bridge will be widened both northbound and southbound to accommodate additional lane(s). The proposed widening at the northbound (Right Widening) varies from approximately 31 to 45 feet along the existing bridge alignment. The southbound (Left Widening) is about 25 feet. The widening portions of the proposed bridge structure will be built identical to the existing bridge structure.

Geology of the Proposed Site

The proposed site is located within the Mojave Desert Geomorphic Province of California. The Mojave desert is situated between the Transverse Ranges across the San Andreas fault on the southwest, the Sierra Nevada Mountains and Basin and Range province on the north across the Garlock fault, and the Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region.

The local geology consists of recent Mojave River wash alluvial soils that is incised into the older alluvial valley fill and fan deposits, with granitic bedrock at depth.

Geotechnical Investigation

The 1955 as-built Log of Test Borings (LOTB) sheet shows that four 3-inch diameter rotary borings and seven 2-1/4 inches diameter cone penetrometer soundings were performed prior to the construction of the original bridges. The borings were drilled to depths approximately ranging from 46 to 80 feet (elevation 2644 to 2609 feet) and the cone penetrometer borings were advanced to depths approximately ranging from 44 to 55 feet (elevation 2649 to 2637 feet) below the existing natural grades. There was not any subsurface investigation for the 1971 widening.

Since the original (1955) subsurface geotechnical investigations, two previous (2001 and 2010) geotechnical explorations were conducted to evaluate the subsurface soil conditions for the proposed widening. The Office of Geotechnical Design South-2 performed the first geotechnical investigation from October 23 through December 13 in 2001. This subsurface geotechnical exploration included twelve 3.75-inch and one 4.25-inch diameter rotary wash borings (total of 13 borings) and seven 2.25 inch diameter cone penetration soundings. The maximum depth of the investigation was approximately 93.0 feet (elevation 2598 feet) below the existing ground surface.

In addition to the (2001) geotechnical subsurface investigation, the Office of Geotechnical Design South-2 performed two additional rotary wash borings at abutment locations of the existing Mojave River Bridge 54-0483 to obtain deeper subsurface information of the area, in April 2010. Both of these borings were converted into Groundwater monitoring wells to mesaure the Groundwater elevation.

These boring borings were advanced to a maximum depth of 181.5 feet (approximate elevation 2536 feet) below the existing road grade. Refer to Log of Test Borings (LOTB) for boring locations, top of borehole elevations, depths, groundwater level measurements and other details.

In October 2012, the piezometric pipes installed in 2010 for groundwater monitoring wells were removed, and downhole geophysical logging was conducted. Primary Wave/Shear Wave (P-S) Suspension Log measurements were collected. For geophysical measurements, refer to the P-S Borehole Logging Report, Dated March 1, 2013, by the Office of Geotechnical Support (Appendix A).

Subsurface Conditions

The subsurface characterization of the site is based on borings drilled in 1955, 2001 and 2010. The soil materials at the site consist of recent alluvial deposits (late Holocene, Qw) of the Mojave River and older alluvial valley fill.

These wash deposits are streambed alluvium of variable thickness, consisting of loose to very dense interbedded soil layers of silts, sands and combinations of silty sands and clayey sands, with trace gravel and cobbles to full depth of the borings.

The thickness of loose to medium dense soil is approximately 30 to 36 feet deep (elevations 2662 to 2656 feet). Below elevation 2656 feet, the soils generally consist of dense to very dense fine to coarse sand, with fine to coarse gravels, and cobbles.

Bedrock was not encountered to the maximum explored depth of 181.5 feet.

Based on the 2012 p-s wave testing (Appendix A), the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30} = 314 m/s (1030 ft/s).

Groundwater

During both 2001 and 2010 subsurface geotechnical investigations, groundwater was encountered in several borings. Groundwater elevation fluctuated from 2681 feet to 2691 feet. It should be noted that at the time of the 2001 and 2010 subsurface explorations, water was flowing in an adjacent portion of the Mojave River.

Groundwater elevations on specified dates are shown on the LOTB sheets. The groundwater elevations may fluctuate due to seasonal conditions, water levels in the Mojave River, as well as quick condition caused by the excavation process below the groundwater surface during construction.

Liquefaction Potential Evaluation

The soil profile at each boring location was analyzed for liquefaction potential in accordance with the procedure suggested by Seed et al (1985) and modified by Youd et al (2001). The results of our analysis indicate that the loose to medium dense sandy soil layers below the groundwater level in most of the borings for both right and left bridge widening are prone to liquefaction.

The thickness of potentially liquefiable soils for both right and left bridges at abutments 1 and 9 and pier walls 2 through 8 are studied underneath the pile cap elevations. The total estimated seismically induced ground surface settlement at the support locations are also summarized in Table 1.

The seismically induced ground surface settlements were calculated based on the procedure suggested by Tokimatsu and Seed (1987).

The maximum differential settlement of approximately 2 inches is located among pier walls 3, 4 and pier walls 5 and 6 for the right bridge, and the maximum differential settlement of approximately 2 inches is located along pier walls 6 and 7 and pier wall 8 and abutment 9 for left bridge.

The shear strength of the liquefiable soils was ignored in our analysis of the pile axial capacity under earthquake loading conditions.

The estimated seismically induced ground settlement ranges from 2 to 3 inches. The piles are expected to settle about 1 to 2 inches or less. It is not necessary to use downdrag loads under the extreme limit state because the kinematic load from 1 to 2 inches of pile settlement, cannot compromise the structure integrity under the "no collapse criteria". Also, the structural capacity of the steel piles will not be compromised by this transient load. However, the structural designer should consider this additional settlement of the piles (1 to 2 inches) when they perform the lateral (push over) analysis of the structure.

TABLE 1. RESULTS OF LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSES

Support Locations		Approx. Elevation of Liquefiable Soils (feet)	Approx. Thickness of Liquefying Soils (feet)	Total Estimated Seismically-Induced Ground Surface Settlement (inch)
Right (North Bound) Bridge	Abut. 01	2680 to 2660	20	2
	Piers 2 and 3	2675 to 2650	25	3
	Piers 4 and 5	2655 to 2650	5	1
	Pier 6	2680 to 2675 2660 to 2655	5 5	1
	Piers 7, 8 and Abut. 09	2690 to 2670	20	2
Left (South Bound) Bridge	Abut. 01, Piers 2, and 3	2670 to 2660	10	1
	Piers 4	2670 to 2665	5	1
	Piers 7 and 8	2650 to 2645	5	1
	Abut. 09	2690 to 2685	5	1

Note: Although, our liquefaction studies indicate that there may be some deep and local liquefaction potential in some of the borings, the adverse liquefaction effect(s) to the structure is negligible. Those deep, potentially liquefiable soils layers are located at different depths (not as a continuous uniform layer) along the bridge alignment.

Lateral Spread

It is anticipated that the lateral spread may occur at abutment 1 and 6 locations due to local earthquakes. The additional lateral force generated by the lateral spread should be considered in design.

Kinematic approach is used to estimate the lateral spreading forces in this report. Kinematic approach is a displacement-controlled method. It accounts directly for the interaction between the moving soil and the pile displacement and includes the available mobilized soil resistance since it accounts for the residual strength of

liquefied soils. Computer programs LPILE v5 and GSTABLE were used during analyses.

The results of these analyses show that a lateral spreading force is about 35 kip and should be applied on the top of each Class 200 driven pile at the abutments.

Scour Evaluation

The Office of Structure Hydrology and Hydraulics provided a "Final Hydraulic Report" and scour evaluation for the above proposed bridge widening on July 31, 2008 by Ginger Lu, PE. According to the e-mail dated June 26, 2009, the potential scour depth is 6 feet (elevation 2683 feet) below the thalweg elevation of 2689 feet at all pier locations. The scour is not applicable for abutment locations. It must be noted that all elevations given in the Hydrology/Hydraulic study are based on NGVD 1929 datum. A copy of the Final Hydraulic Report is attached as Appendix B.

Seismic Data Evaluation

Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v2.0.5, USGS 2008 Interactive Deaggregations (Beta), 2001 and 2010 geotechnical investigations and 2012 p-s wave seismic testing for the existing and proposed widen bridge.

Seismicity

Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 9.8 miles (15.8 km) from the Helendale-So Lockhart fault. This fault (Fault ID 241, MMax = 7.4, strike-slip, dip = 90 degrees, vertical, Bottom and Top of Rupture Plane approximately 8.0 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure. A map showing the location of the bridge and the nearby faults is attached in Figure 1.

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response spectra, but is not less than a minimum deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km).

The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectrum calculated using the 2008 Campbell-Bozorgnia

and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to 975 year return period).

For this site, the design response spectrum is controlled by probabilistic method. The corresponding peak horizontal ground acceleration is 0.49g. The recommended acceleration response spectrum is attached in Figure 2.

Laboratory Testing

During the 2010 geotechnical investigation, selected soil samples from different depths of the borings of the recent deposits (late Holocene, Qw) of the streambed alluvium samples have been tested for mechanical analysis, moisture content and Atterberg limits (plasticity).

All tests were performed in accordance with American Society for Testing and Material (ASTM) standards, and results of the tests are included in Appendix C.

Corrosion Evaluation

Representative soil samples collected from the 2001 field investigation were tested to determine the corrosion potential of the in-situ soils. The results of these tests are presented in Table 2. Caltrans considers a site to be corrosive for structural elements, if one or more of the following conditions exist for the representative soil and /or water samples taken at the site: Chloride concentration is 500 ppm or greater, or sulfate concentration is 2000 ppm, or minimum resistivity of less than 1000 ohm-centimeters, or the pH is 5.5 or less.

TABLE 2. SUMMARY OF CORROSION TESTS

Boring No.	Top of Borehole Elevation (feet)	Sample at Elevation (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B04-01	2,690.9	2,688	Sands	2,650	7.0	N/A	N/A
		2,677	Sands	3,800	7.0	N/A	N/A
		2,667	Sands	4,000	7.8	N/A	N/A
		2,647	Sands	7,400	6.9	N/A	N/A
		2,622	Sands	3,950	7.2	N/A	N/A
		2,607	Sands	5,950	7.1	N/A	N/A
B5-01	2,691.2	2,689	Sands	5,350	7.4	N/A	N/A
		2,662	Sands	1,700	6.9	N/A	N/A
		2,647	Sands	4,900	6.9	N/A	N/A
		2,622	Sands	4,300	7.5	N/A	N/A
		2,607	Sands	6,100	7.7	N/A	N/A
B12-01	2,692.8	2,690	Sands	13,500	8.7	N/A	N/A
		2,657	Sands	6,300	6.8	N/A	N/A
		2,634	Sands	5,600	7.0	N/A	N/A
		2,609	Sands	5,400	7.6	N/A	N/A

The laboratory test results indicate that the streambed alluvium underlying the site will be non-corrosive to the proposed pile foundations.

Settlement

Subsurface soils are composed of predominantly granular material. Therefore, long-term consolidation settlement is not expected. A fill delay period of 15 days is recommended to overcome effects of any immediate settlement.

Foundation Recommendations

The following recommendations are for the proposed widening of the Mojave River Bridge (Bridge No. 54-0483) as shown on the General Plan dated July 11, 2013. At all support locations, the proposed bridge will be supported on Caltrans Standard Class 200 Alternative "W" piles. These should be installed in accordance with Section 49-1 and 49-2 of the Caltrans' Standard Specifications (Caltrans' 2010).

The specified pile tip elevations are listed below in Tables 3 trough 7. The calculated geotechnical capacities of all Caltrans Standard Class 200 Alternative "W" piles are based on skin friction and end-bearing.

The API method was used to estimate both, the skin friction and the end bearing. Pile friction resistance within the liquefiable layers (table 1) was ignored in our analyses for the extreme event limit state loading.

The three controlling LRFD limit states loads provided by Structures Design (Service-I Limit State, Strength Limit State, and Extreme Event Limit State) are shown in the table 9 through 12.

As per section 49-2.01C (4) of standard specifications, driven piles should be installed through predrilled holes drilled to elevation 2695 ft at abutments 1 and 9.

Driveability Study:

The Office of Geotechnical Support provided driveability study for the above recommended piles dated July 8, 2013. The result of drivability is included in Appendix D.

TABLE 3. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS 1 AND 9

Mojave River (Widen), Br # 54-0483-Right Abutment Foundations Design Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt. "W"	2,707.0	1,000	650	190	380	2,665 (a) 2,650 (d)	2,650	520
Abut. 9	Class 200 Alt. "W"	2,703.5	900	550	200	400	2,665 (a) 2,660 (d)	2,660	520

Notes:

1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for lateral.
3) The nominal driving resistance required is higher than required nominal resistance for compression, as the specified pile tip is controlled by lateral load.

TABLE 4. FOUNDATION RECOMMENDATIONS FOR RIGHT PIERS 2 THROUGH 8

Mojave River (Widen), Br # 54-0483-Right
Piers Foundations Design Recommendations

Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance Per Pile (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Pier 2	Class 200 Alt. "W"	2,670	2,100	1	280	0	360	130	2,628 (a-I), 2,627 (a-II) 2,634 (b-II), 2,635 (d)	2,627	410
Pier 3	Class 200 Alt. "W"	2,669	2,000	1	280	0	350	130	2,627 (a-I), 2,626 (a-II) 2,633 (b-II), 2,634 (d)	2,626	420
Pier 4	Class 200 Alt. "W"	2,669	1,900	1	280	0	380	130	2,628 (a-I), 2,632 (a-II) 2,635 (b-II), 2,634 (d)	2,628	400
Pier 5	Class 200 Alt. "W"	2,671	1,700	1	270	0	350	100	2,630 (a-I), 2,634 (a-II) 2,637 (b-II), 2,636 (d)	2,630	390
Pier 6	Class 200 Alt. "W"	2,672	1,800	1	270	0	330	100	2,632 (a-I), 2,632 (a-II) 2,646 (b-II), 2,637 (d)	2,632	390
Pier 7	Class 200 Alt. "W"	2,672	1,800	1	270	0	320	100	2,632 (a-I), 2,636 (a-II) 2,644 (b-II), 2,637 (d)	2,632	390
Pier 8	Class 200 Alt. "W"	2,672	1,800	1	270	0	310	100	2,632 (a-I), 2,636 (a-II) 2,644 (b-II), 2,637 (d)	2,632	390

Notes: 1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral Load

2) The specified tip elevation shall not be raised above the design tip elevations for tension, or lateral.

3) The nominal driving resistance required is higher than required nominal resistances for Piers 2 and 3. For these locations, the extreme compression load control the pile tip, the skin resistance of liquefiable layers were ignored in the design calculation, but were included in driving resistance.

TABLE 5. FOUNDATION RECOMMENDATIONS FOR RIGHT PIERS NOSE 2 THROUGH 8

Mojave River (Widen), Br # 54-0483-Right Nose Piers Foundations Design Recommendations											
Support Location	Pile Type	Cut-off-Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance Per Pile (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Pier 2 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,650 (a-I), 2,650 (a-II) 2,655 (d)	2,650	150
Pier 3 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,650 (a-I), 2,650 (a-II) 2,655 (d)	2,650	150
Pier 4 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,650 (a-I), 2,650 (a-II) 2,655 (d)	2,650	150
Pier 5 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,650 (a-I), 2,650 (a-II) 2,655 (d)	2,650	150
Pier 6 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,655 (a-I), 2,655 (a-II) 2,655 (d)	2,655	150
Pier 7 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,665 (a-I), 2,655 (a-II) 2,655 (d)	2,655	150
Pier 8 Nose	Class 200 Alt. "W"	2,682	130	1	100	0	100	0	2,665 (a-I), 2,655 (a-II) 2,655 (d)	2,655	150

Notes:

1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral Load
2) The specified tip elevation shall not be raised above the design tip elevations for tension, or lateral.

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TABLE 6. FOUNDATION RECOMMENDATIONS FOR LEFT ABUTMENTS 1 AND 9

Mojave River (Widen), Br # 54-0483-Left Abutment Foundations Design Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt. "W"	2,707.0	650	450	200	400	2,665 (a) 2,650 (d)	2,650	510
Abut. 9	Class 200 Alt. "W"	2,703.5	650	450	200	400	2,665 (a) 2,660 (d)	2,660	500

Notes:

1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.
3) The nominal driving resistance required is higher than required nominal resistance for compression, as the specified pile tip is controlled by lateral load..

TABLE 7. FOUNDATION RECOMMENDATIONS FOR LEFT PIERS 2 THROUGH 8

Mojave River (Widen), Br # 54-0483-Left
Piers Foundations Design Recommendations

Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Pier 2	Class 200 Alt. "W"	2,670	1,300	1	280	0	380	130	2,631 (a-I), 2,627 (a-II) 2,638 (b-II) 2,635 (d)	2,627	440
Pier 3	Class 200 Alt. "W"	2,669	1,300	1	280	0	380	130	2,631 (a-I), 2,627 (a-II) 2,638 (b-II) 2,634 (d)	2,627	440
Pier 4	Class 200 Alt. "W"	2,669	1,300	1	280	0	380	130	2,629 (a-I), 2,627 (a-II) 2,637 (b-II) 2,634 (d)	2,627	440
Pier 5	Class 200 Alt. "W"	2,671	1,300	1	280	0	380	130	2,626 (a-I), 2,626(a-II) 2,642 (b-II) 2,636 (d)	2,626	400
Pier 6	Class 200 Alt. "W"	2,672	1,300	1	280	0	380	130	2,627 (a-I), 2,627 (a-II) 2,642 (b-II) 2,637 (d)	2,627	400
Pier 7	Class 200 Alt. "W"	2,672	1,300	1	280	0	380	130	2,632 (a-I), 2,622 (a-II) 2,638 (b-II) 2,634 (d)	2,622	500
Pier 8	Class 200 Alt. "W"	2,672	1,300	1	280	0	380	130	2,632 (a-I), 2,622 (a-II) 2,638 (b-II) 2,634 (d)	2,622	500

Notes: 1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral Load

2) The specified tip elevation shall not be raised above the design tip elevations for tension, lateral, and tolerable settlement.

3) The nominal driving resistance required is higher than required nominal resistances for Piers 2,3,4,7 and 8. For these locations, the extreme compression load control the pile tip, the skin resistance of liquefiable layers were ignored in the design calculation, but were included in driving resistance.

TABLE 8. PILE DATA TABLE

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1 Lt	Class 200	400	0	2,665 (a), 2,650 (d)	2,650	510
Abut 1 Rt	Alt "W"	380	0	2,665 (a), 2,650 (d)	2650	520
Pier 2 Lt	Class 200	400	130	2,627 (a), 2,638 (b), 2,635 (d)	2627	440
Pier 2 Rt	Alt "W"	400	130	2,627 (a), 2,634 (b), 2,635 (d)	2627	410
Nose Ext.		150	0	2,650 (a), 2,655 (d)	2650	150
Pier 3 Lt	Class 200	400	130	2,627 (a), 2,638 (b), 2,634 (d)	2627	440
Pier 3 Rt	Alt "W"	400	130	2,626 (a), 2,633 (b), 2,634 (d)	2626	420
Nose Ext.		150	0	2,650 (a), 2,655 (d)	2650	150
Pier 4 Lt	Class 200	400	130	2,627 (a), 2,637 (b), 2,634 (d)	2627	440
Pier 4 Rt	Alt "W"	400	130	2,628 (a), 2,635 (b), 2,634 (d)	2628	400
Nose Ext.		150	0	2,650 (a), 2,655 (d)	2650	150
Pier 5 Lt	Class 200	400	130	2,626 (a), 2,642 (b), 2,636 (d)	2626	400
Pier 5 Rt	Alt "W"	385	100	2,630 (a), 2,637 (b), 2,636 (d)	2630	390
Nose Ext.		150	0	2,650 (a), 2,655 (d)	2650	150
Pier 6 Lt	Class 200	400	130	2,627 (a), 2,642 (b), 2,637 (d)	2627	400
Pier 6 Rt	Alt "W"	390	100	2,632 (a), 2,646 (b), 2,637 (d)	2632	390
Nose Ext.		150	0	2,655 (a), 2,655 (d)	2655	150
Pier 7 Lt	Class 200	400	130	2,622 (a), 2,638 (b), 2,634 (d)	2622	500
Pier 7 Rt	Alt "W"	390	100	2,632 (a), 2,644 (b), 2,637 (d)	2632	390
Nose Ext.		150	0	2,655 (a), 2,655 (d)	2655	150
Pier 8 Lt	Class 200	400	130	2,622 (a), 2,638 (b), 2,634 (d)	2622	500
Pier 8 Rt	Alt "W"	385	100	2,632 (a), 2,644 (b), 2,637 (d)	2632	390
Nose Ext.		150	0	2,655 (a), 2,655 (d)	2655	150
Abut 9 Lt	Class 200	400	0	2,665 (a), 2,660 (d)	2,660	500
Abut 9 Rt.	Alt "W"	400	0	2,665 (a), 2,660 (d)	2660	520

Notes:

1) Design tip elevations for **Abutments** are controlled by: (a) Compression , (d) Lateral
2) Design tip elevations for **Bents** are controlled by: (a) Compression , (b) Tension, (d) Lateral

TABLE 9. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Mojave River (Widen), Bridge No. 54-0483-Right Foundation Design Data Sheet								
Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)*	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt. "W"	2,711.5	2,707.0	6.0	47.4	1	8
Pier 2	LRFD	Class 200 Alt. "W"	2,695.0	2,670.0	9.0	41.6	1	18
Pier 2 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 3	LRFD	Class 200 Alt. "W"	2,695.0	2,669.0	9.0	39.5	1	18
Pier 3 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 4	LRFD	Class 200 Alt. "W"	2,695.0	2,669.0	9.0	38.0	1	16
Pier 4 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 5	LRFD	Class 200 Alt. "W"	2,695.0	2,671.0	9.0	36.3	1	16
Pier 5 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 6	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	34.5	1	16
Pier 6 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 7	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	32.9	1	16
Pier 7 Nose			2,695.0	2,682.0	3.0	20.0		2
Pier 8	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	31.3	1	16
Pier 8 Nose			2,695.0	2,682.0	3.0	20.0		2
Abut 9	WSD	Class 200 Alt. "W"	2,708.0	2,703.5	6.0	33.4	1	6

TABLE 10. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Mojave River Right (Widen), Br # 54-0483-Right Foundation Design Loads											
Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	1000	190	650	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pier 2	2,100	N/A	1,500	3,900	280	0	0	2,100	360	0	130
Pier 2 Nose	130	N/A	130	200	100			200	100		0
Pier 3	2,000	N/A	1,600	3,900	280	0	0	2,000	350	0	130
Pier 3 Nose	130	N/A	130	200	100			200	100		0
Pier 4	1,900	N/A	1,400	3,600	280	0	0	2,000	380	0	130
Pier 4 Nose	130	N/A	130	200	100			200	100		0
Pier 5	1,700	N/A	1,200	3,400	270	0	0	1,900	350	0	100
Pier 5 Nose	130	N/A	130	200	100			200	100		0
Pier 6	1,800	N/A	1,300	3,300	270	0	0	1,800	330	0	100
Pier 6 Nose	130	N/A	130	200	100			200	100		0
Pier 7	1,800	N/A	1,300	3,400	270	0	0	1,750	320	0	100
Pier 7 Nose	130	N/A	130	200	100			200	100		0
Pier 8	1,800	N/A	1,300	2,300	270	0	0	1,700	310	0	100
Pier 8 Nose	130	N/A	130	200	100			200	100		0
Abut 9	900	200	550	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 11. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Mojave River (Widen), Br # 54-0483-Left Foundation Design Data Sheet								
Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)*	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt. "W"	2,711.5	2,707.0	6.0	26.4	1	4
Pier 2	LRFD	Class 200 Alt. "W	2,695.0	2,670.0	9.0	34.5	1	14
Pier 3	LRFD	Class 200 Alt. "W"	2,695.0	2,669.0	9.0	34.5	1	14
Pier 4	LRFD	Class 200 Alt. "W"	2,695.0	2,669.0	9.0	34.5	1	14
Pier 5	LRFD	Class 200 Alt. "W"	2,695.0	2,671.0	9.0	34.5	1	14
Pier 6	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	34.5	1	14
Pier 7	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	34.5	1	14
Pier 8	LRFD	Class 200 Alt. "W"	2,695.0	2,672.0	9.0	34.5	1	14
Abut 9	WSD	Class 200 Alt. "W"	2,708.0	2703.5	6.0	26.4	1	4

TABLE 12. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Mojave River Widen Left, Br # 54-0483 Left Foundation Design Loads											
Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	650	200	450	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pier 2	1,300	N/A	950	3,200	280	0	0	1,800	380	0	130
Pier 3	1,300	N/A	950	3,000	280	0	0	1,800	380	0	130
Pier 4	1,300	N/A	950	3,000	280	0	0	1,800	380	0	130
Pier 5	1,300	N/A	950	3,000	280	0	0	1,800	380	0	130
Pier 6	1,300	N/A	950	3,000	280	0	0	1,800	380	0	130
Pier 7	1,300	N/A	950	3,000	280	0	0	1,800	380	0	130
Pier 8	1,300	N/A	950	3,200	280	0	0	1,800	380	0	130
Abut 9	650	200	450	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:
1. Support loads shown are per column.
2. Service I loads are reported as net loads
3. Strength and Extreme loads are reported as gross loads.

General Notes:

1. The structural engineer shall show the pile data table with the specified pile tip elevations on the foundation plan.

2. Support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

Construction Considerations

1. If necessary to attain the specified tip elevation, drilling through the center of the recommended pile (center relief drilling) may be used. Center relief drilling shall not extend lower than 10 feet above the pile tip during installation of the piles. To avoid quick conditions, water elevation inside the pile shall be maintained at or above groundwater or water elevation flowing in an adjacent portion of the Mojave River, as determined by the contractor.
2. The structure excavation for the pile footings should be constructed in conformance with all applicable sections of the 2010 Caltrans Standard Specifications, including 19-3.03C, 19-3.03D and 19-3.03E. Type D structure excavation should be shown on the plans for the pile footings at Piers 2 through 8.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South, Branch 10. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to attention of Asef Wardak (916) 227-1219 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 11-4-2013

Awardak.

Asef Wardak
Transportation Engineer

REGISTERED PROFESSIONAL ENGINEER
ASEF WARDAK
No. C 61960
Exp. 9-30-2015
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STATE OF CALIFORNIA

cc: District 08 Structure Construction R.E. – Pending File
District 08 Project Manager – Melecio Chalco (Electronic File)
Specs & Estimates – Ofelia Alcantara (Electronic File)
District 08 Materials Engineer – Farzad Tasbihgoo (Electronic File)
HQ GS Corporate – Project Coordination Engineer – Colyn L. Peterson (Electronic File)
HQ Geotechnical Design South-2 – Abbas Abghari – OGDS-2 (Electronic File)
HQ Geotechnical Design South-2 – Angel Perez-Cobo (Electronic File) APC
HQ Geotechnical Archive

FIGURES

Figure 1. Nearby Major Faults with Reference to the Project Site
Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

BOREHOLE GEOPHYSICAL LOGGING

APPENDIX B

FINAL HYDRAULIC REPORT

APPENDIX C

SOIL SAMPLE LABORATORY RESULT

APPENDIX D

DRIVEABILITY STUDY

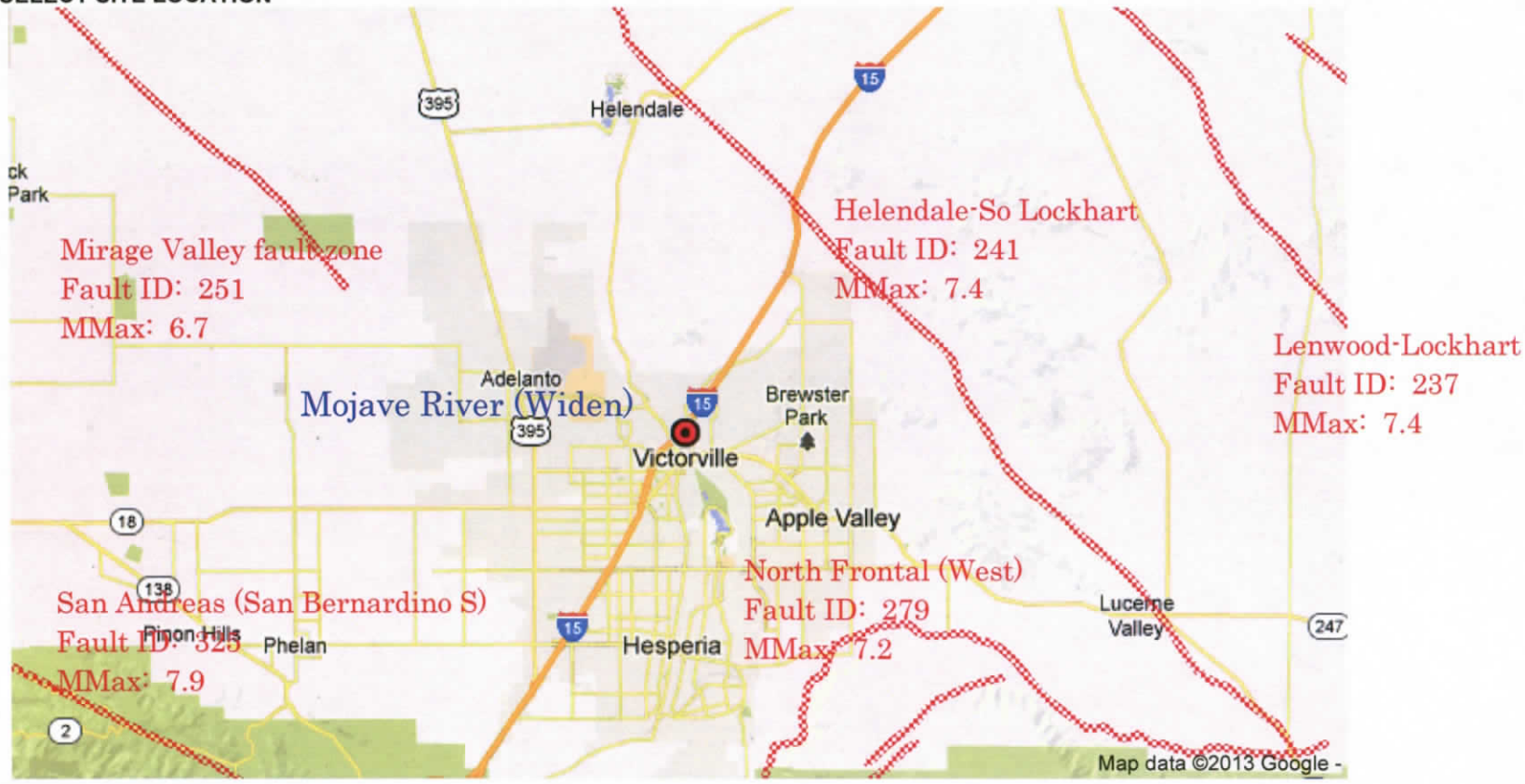
FIGURES

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.2.06)

This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

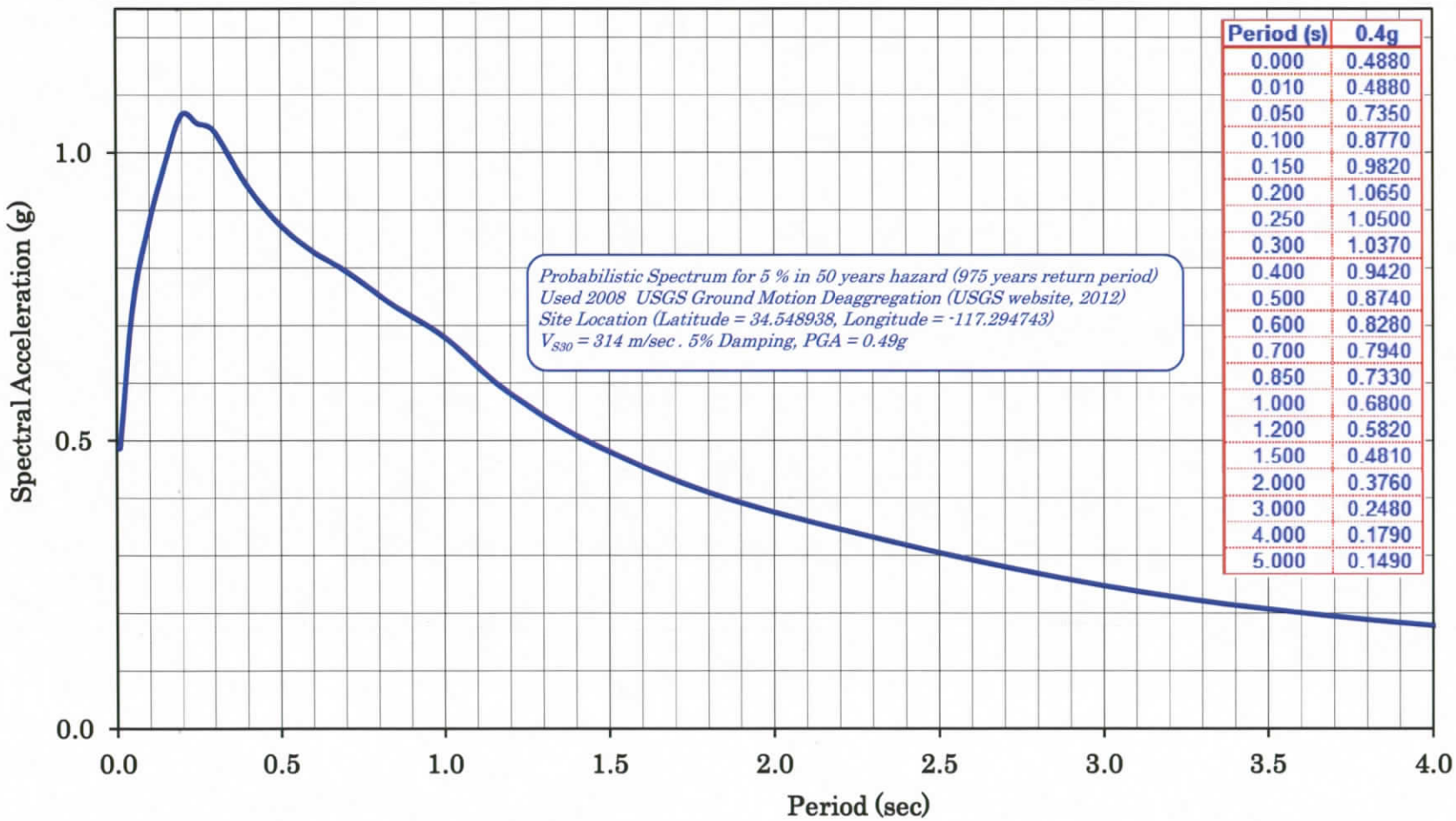
SELECT SITE LOCATION



Latitude: 34.548938 **Longitude:** -117.294743 ***Vs30:*** 314 m/s Calculate

Figure 1. Project site and the nearby faults is attached .

Recommended Acceleration Response Spectrum for the Mojave River Bridge (Widen) (Bridge # 54-0483)



Period (s)	0.4g
0.000	0.4880
0.010	0.4880
0.050	0.7350
0.100	0.8770
0.150	0.9820
0.200	1.0650
0.250	1.0500
0.300	1.0370
0.400	0.9420
0.500	0.8740
0.600	0.8280
0.700	0.7940
0.850	0.7330
1.000	0.6800
1.200	0.5820
1.500	0.4810
2.000	0.3760
3.000	0.2480
4.000	0.1790
5.000	0.1490

Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: **Angel Perez-Cobo**
Geotechnical Design, South-2
Division of Engineering Services

Date: March 1, 2013

File: 08_SBD_15_43.9_2012
Project 0800000621

Attention: Asef Wardak, Doug Cook

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES-MS#5

Subject: Borehole logging, SBD-15 Mojave River Bridge PM 43.93

Introduction

Attached are the results obtained from borehole geophysical logging at the Mojave River bridge (bridge #54-0483) in Victorville, San Bernardino County, California. Two borings in the westbound roadbed (R-10-001 and R-10-002) were logged in early October, 2012. Results include Natural Gamma /Induction, and P-S Suspension log measurements with Vs30 seismic velocity determination. Geophysical results are presented in both tabular and graphical format.

Based on geophysical results, stratigraphy at the site appears to consist of:

- Top section of engineered fill placed over the Mojave River floodplain as road embankment and bridge abutment,
- Softer or unconsolidated (disturbed?), lower seismic velocity, younger alluvial section that appears to be predominately coarse-grained scour and fill deposits of the Mojave River, and
- More consolidated (apparently cemented into rock-like material in places), older, lower alluvial section of coarse-grained to fine-grained Mojave River sediments.

Actual material depths are included in each boring discussion. Crystalline bedrock, or consistent rock-like material, was not encountered in either boring. Liquefaction potential, especially in the low-velocity, saturated, predominately coarse-grained scour and fill section, should be assessed. Please call with any questions.

Report by:

PROFESSIONAL GEOLOGIST
DAVID ALAN HUGHES
No. 7645
Exp. 09/14
STATE OF CALIFORNIA

David Hughes, PG 7645
Engineering Geologist
Geophysics and Geology Branch

SBD-15 Mojave River Bridge PM 43.9
Bridge No. 54-0483, boring R-10-001 (south abutment)
GPS location: North 34.55 degrees, West -117.30 degrees

Drilling was conducted by Caltrans Drilling Services. The boring was drilled in early October, 2012, drilling out a previously installed piezometer (R-10-001). Natural Gamma/Induction and PS Log measurements were collected in this boring. The depth of the boring was reported as 64.3 m/211 ft, and the boring was logged in the open hole. Due to apparent loose conditions, this boring was logged in stages, using the drill stem as a temporary casing. The driller noted apparent soft or unconsolidated conditions at approximately 17 m/56 ft depth (Norm Webb, CT Lead Driller, personal communication), and so the drill stem was pulled up to this interval. The bottom of the boring collapsed at 51.8 m/170 ft upon removal of the drill stem, and the section from approximately 50.3 m/165 ft to 18.0 m/59 ft depth (approximate bottom of the steel drill stem) was logged. The boring collapsed a second time at approximately 9 m/29.5 ft depth (approximate base of the engineered abutment fill) upon removal of the balance of the drill stem. Depths were measured relative to road grade surface, as ground surface elevation was not available.

Geophysical Logs

Induction Log: A plot of the Natural Gamma/Induction log is attached.

Engineered fill used to build up the roadbed/bridge abutment is suggested by higher gamma counts (i.e., more fine-grained material) in the interval from the surface to approximately 8 m/26.4 ft depth. The 2010 boring log notes fill to 7.6 m/25 ft depth.

Variations in the Natural Gamma and Conductivity/Resistivity (Induction) logs suggest interlayered stratigraphy of coarse-grained to fine-grained deposits below the engineered fill, interpreted as sedimentary deposits of the Mojave River.

"Spikes" in the Induction log at approximately 17 m/56 ft depth suggest changed subsurface conditions. These spikes are repeated at approximately the same interval in boring R-10-002. The driller noted apparent soft or unconsolidated conditions at approximately 17 m/56 ft depth, and a section above this interval collapsed on removal of the drill stem (blockage noted at 9 m/29.5 ft depth), suggesting softer or unconsolidated conditions. This may be the result of recent or disturbed alluvium over older, more consolidated sedimentary deposits. The Mojave River has flooded in the historic past (e.g., the 1938 peak flood flow at Victorville estimated at approximately 70,000 cubic feet/second [cfs], the January 1969 flood estimated at approximately 37,500 cfs, with over 10 ft of scour noted at the stream gage). Water pouring through the immediately-upstream Victorville water gap could result in deep scour and fill in the riverbed at this location. This interval is more coarse-grained than the interval above, and in general, more coarse-grained than the interval below.

Material below 17 m/56 ft depth appears to consist of interlayered sedimentary material.

P-S Suspension Log: Seismic velocities determined by the P-S Suspension Log are tabulated on Table 1 and plotted on Plate 2.

The upper, engineered fill section (surface-8 m/26.4 ft) was logged with a shear wave velocity (Vs) of approximately 285 m/s, and shows little variation within the interval logged. The P-

wave velocity (Vp) suggests unsaturated conditions, but the Vp results are questionable and are indicated as such on the Table of results. Rapid borehole fluid loss was noted during logging this section.

The intermediate (younger) alluvial section (8 m/26.4 ft to 17 m/56 ft) was not logged due to unstable conditions that collapsed and blocked the borehole. This suggests softer or unconsolidated conditions. The equivalent section logged in boring R-10-002 indicates Vs is lower than the sections above and below, with mean Vs of ~195 m/s.

The lower (older) section (17 m/56 ft, to the total depth logged at 48 m/157.5 ft) appears to contain more consolidated fluvial material. Rock-like material (Vs>785 m/s), probably cemented coarse-grained sediments, is noted intermittently below 36.5 m/119.8 ft depth, with coarse-grained material noted in the boring log and Natural Gamma log. Crystalline bedrock was not encountered in this boring.

Saturated conditions (Vp>1500 m/s) were noted at the acquisition of Vp signal at 18.5 m/60.7 ft depth. However, actual saturated conditions are probably located much higher in this boring, as Vp signal is missing above this depth, and surface water was noted in the Mojave River course.

Vs30 determination: Shear wave velocities were obtained from Table 2. Missing velocities from poor or missing signal were estimated from adjacent intervals, or mean velocities were obtained from stratigraphically similar intervals in boring R-10-002. Table 3 presents the seismic velocities used to determine the Vs30 in this boring, which is 299.3 m/s. Liquefaction potential, especially in the apparent coarser-grained, saturated, unconsolidated or disturbed younger alluvial section from 8 m/26.4 ft to 17 m/56 ft, should be assessed.

California Department of Transportation
Geophysical Services

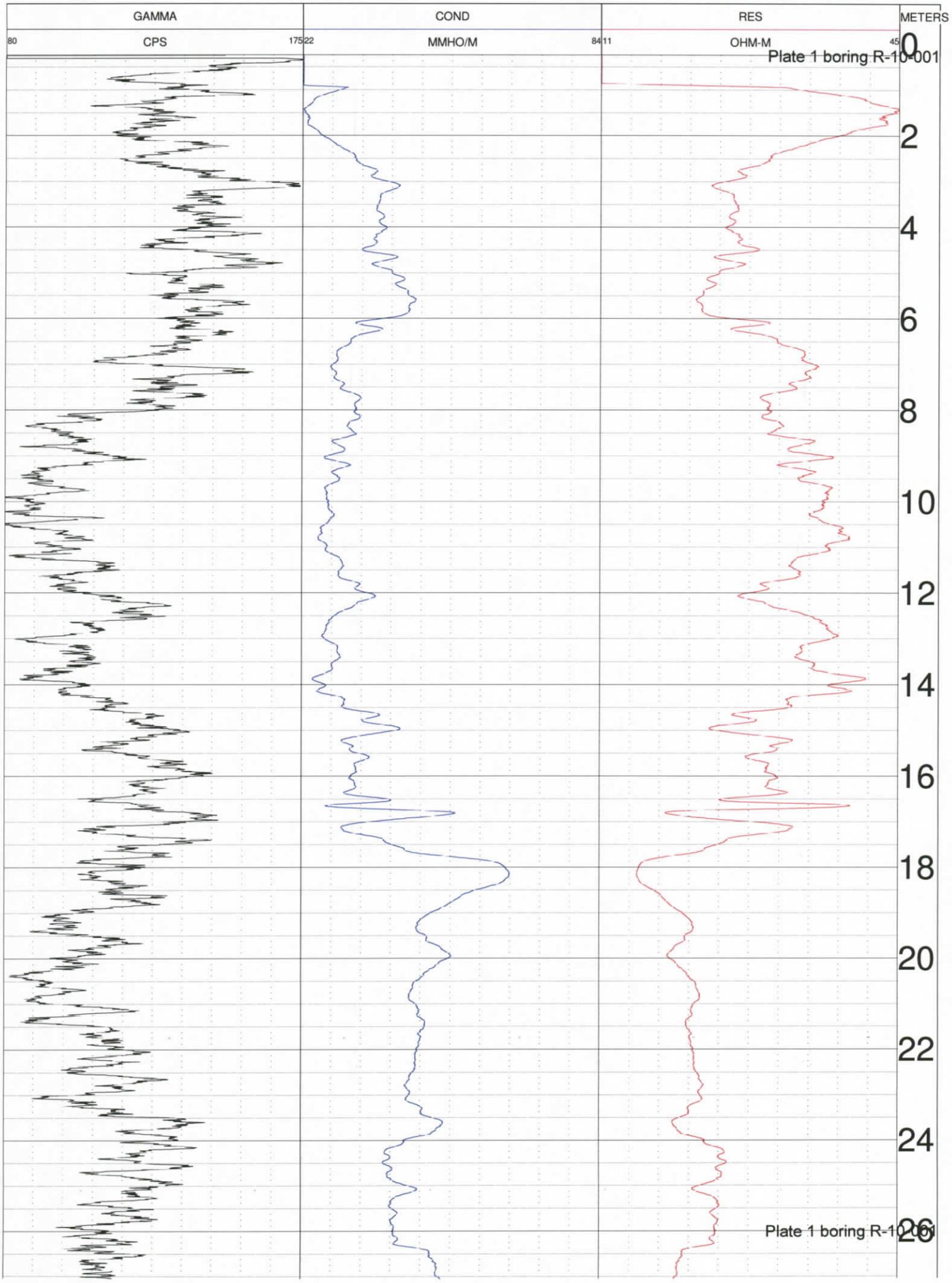
SBD-15 54-0483 R-10-001 S ABT

COMPANY	: Caltrans		OTHER SERVICES:
WELL	: SBD-15 54-0483 R-10-001 S ABT		
FIELD	: SBD-15 54-0483 R-10-001 S ABT		
COUNTY	: SBD-15 PM 43.9		
STATE	: CA		
LOCATION	:		
SECTION	:		
TOWNSHIP	:		
RANGE	:		
API NO.	:		
UNIQUE WELL ID.	:		
PERMANENT DATUM	:	ELEVATION KB	:
LOG MEASURED FROM	: GL	ELEVATION DF	:
DRL MEASURED FROM	: GL	ELEVATION GL	:
DATE	: 10/10/12	RIG NUMBER	:
DEPTH DRILLER	:	LOGGER TD	:
BIT SIZE	: 10	ARRIVAL TIME	:
LOG TOP	: 0.25	DEPARTURE TIME	:
LOG BOTTOM	: 51.83	CIRC STOPPED	: AM
CASING OD	:		
CASING BOTTOM	: TD		
CASING TYPE	: PVC		
BOREHOLE FLUID	: 0		
RM TEMPERATURE	: 0		
MUD RES	: 0		
MUD WEIGHT	:		
WITNESSED BY	:		
RECORDED BY	: DH/DG		
REMARKS 1	: Mojave R BR, Victorville		
REMARKS 2	: Open hole, logged in stages		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Plate 1 boring R-10-001

Plate 1 boring R-10-001


GAMMA
CPS
80
175
COND
MMHO/M
22
84
RES
OHM-M
11
45
METERS
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Plate 1 boring R-10-001
Plate 1 boring R-10-001

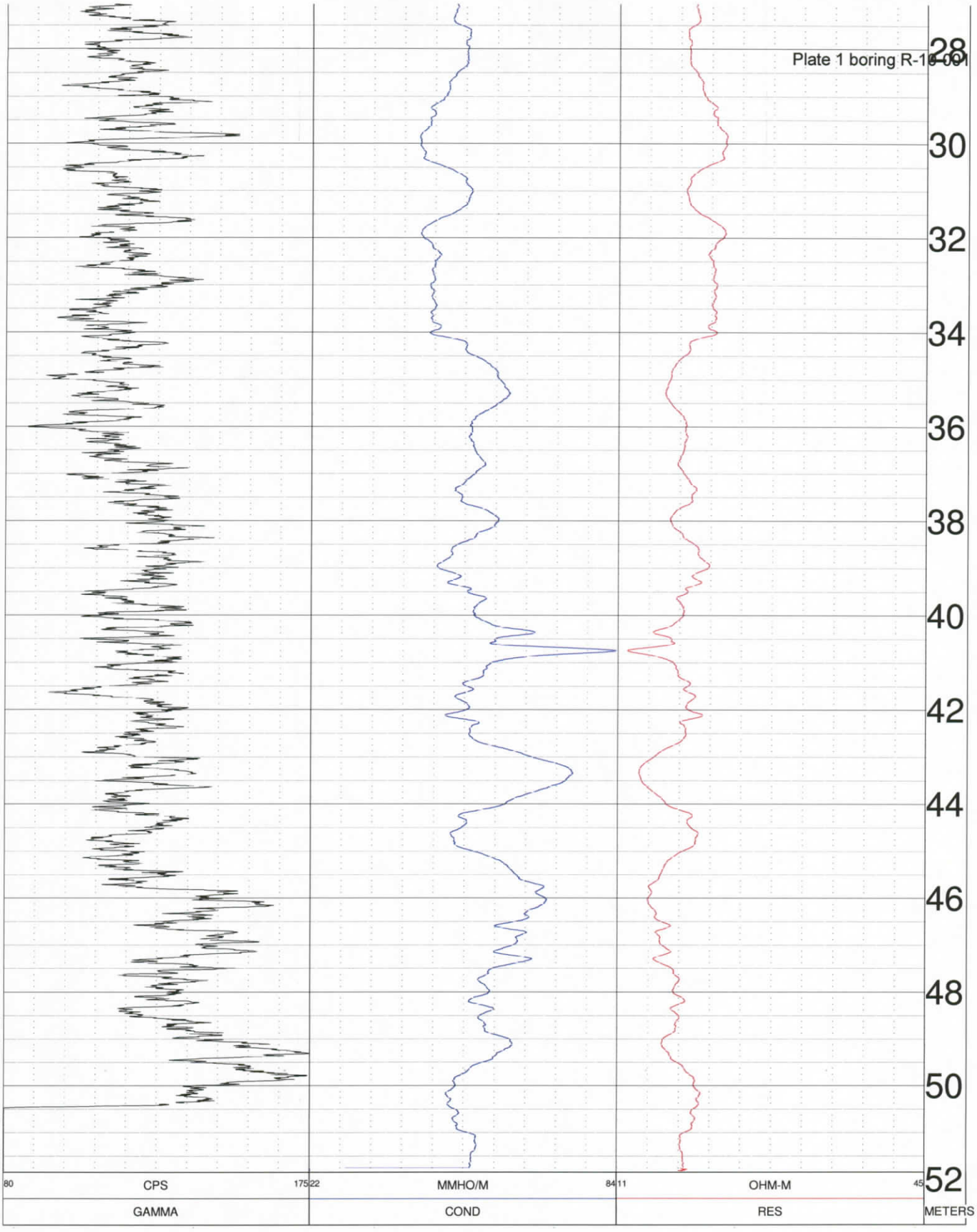
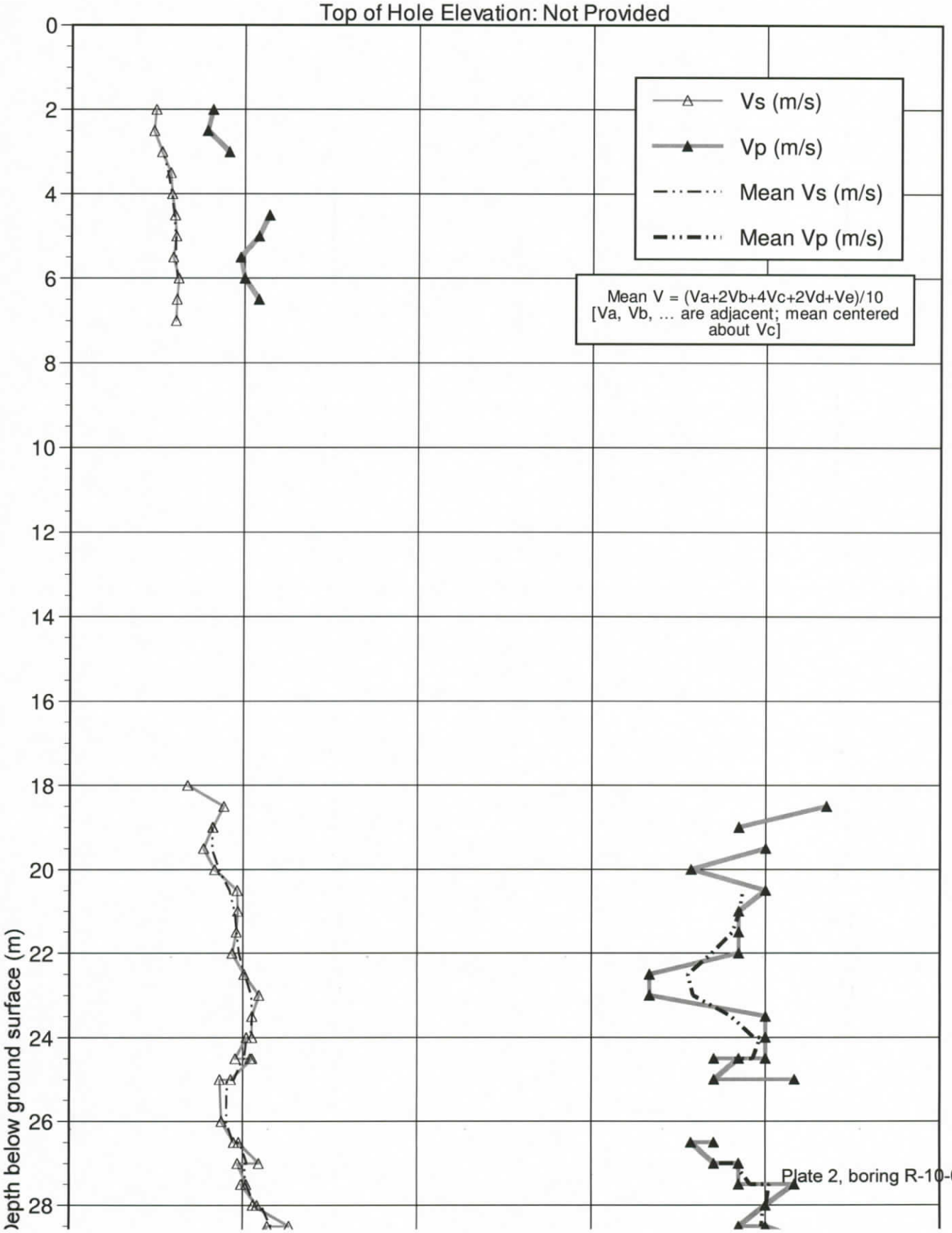


Plate 1 boring R-10-001
28
30
32
34
36
38
40
42
44
46
48
50
52
80
CPS
175
GAMMA
22
MMHO/M
84
COND
11
OHM-M
45
RES
METERS

Plate 2
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
Downhole Interval Velocities



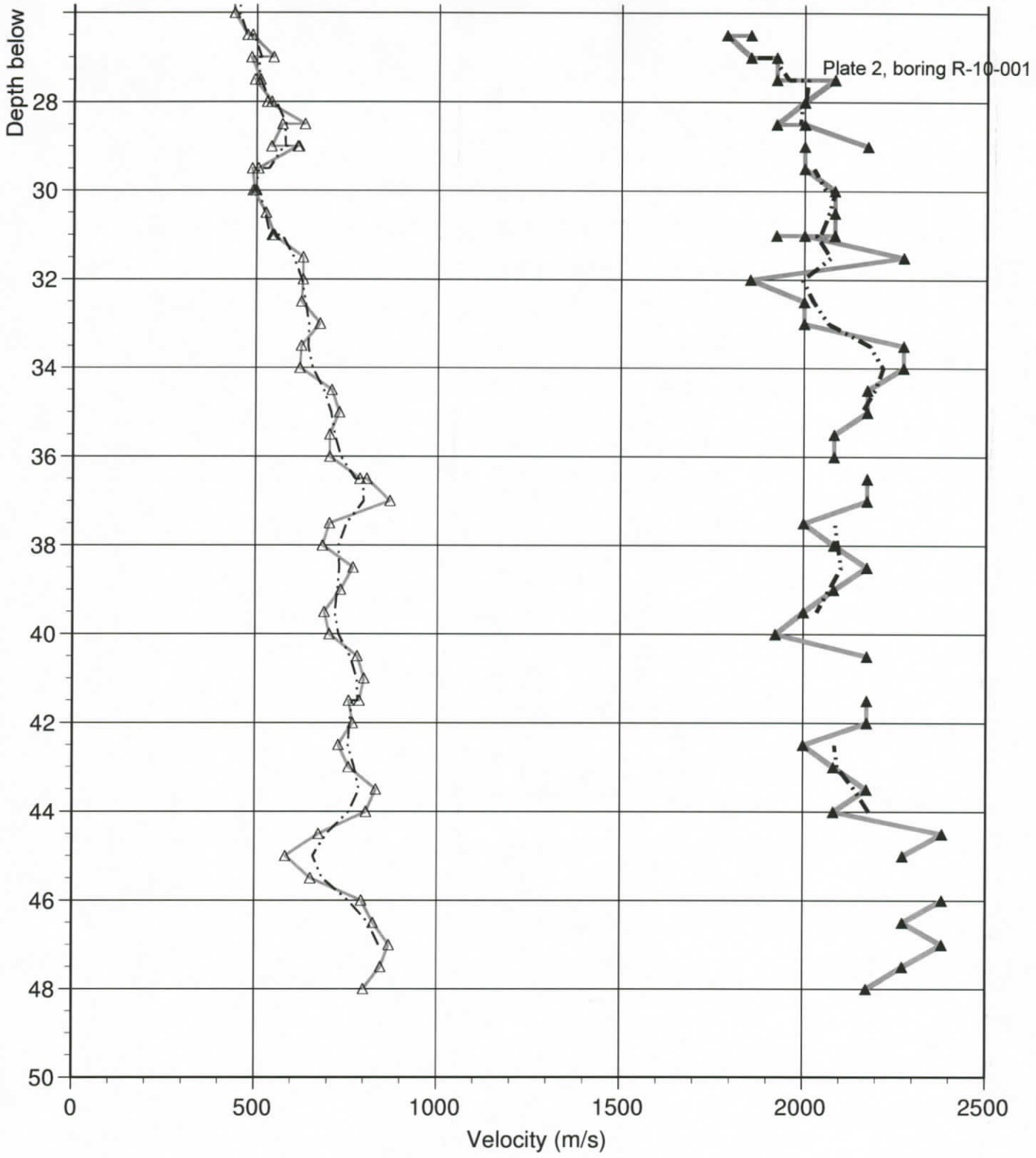


Plate 2, boring R-10-001
Depth below
28
30
32
34
36
38
40
42
44
46
48
50
0
500
1000
1500
2000
2500
Velocity (m/s)

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

	GPS Boring location: North 34.55 degrees, West -117.30 degrees														
Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
Not Provided	2	6.6	244	800	408	1339	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2.5	8.2	238	781	392	1287	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3	9.8	261	858	455	1491	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3.5	11.5	286	937		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	13.1	290	951		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.5	14.8	299	979	571	1875	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	16.4	303	994	541	1773	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5.5	18.0	294	965	488	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	19.7	310	1017	500	1640	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6.5	21.3	305	1002	541	1773	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7	23.0	303	994		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7.5	24.6		NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	18	59.1	340	1116		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	18.5	60.7	444	1458	2174	7132	0.48	2.26	141.40	0.447	1.323	10.108	9344	27625	211098
	19	62.3	413	1356	1923	6309	0.48	2.14	133.69	0.366	1.079	7.432	7637	22542	155228
	19	62.3	412	1350		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	19.5	64.0	386	1267	2000	6562	0.48	2.18	136.25	0.325	0.963	8.296	6795	20122	173269
	20	65.6	418	1373	1786	5859	0.47	2.06	128.62	0.361	1.061	6.089	7533	22161	127164
	20.5	67.3	483	1585	2000	6562	0.47	2.18	136.25	0.509	1.496	8.051	10638	31255	168146
	21	68.9	485	1593	1923	6309	0.47	2.14	133.69	0.505	1.480	7.247	10540	30902	151358
	21.5	70.5	481	1577	1923	6309	0.47	2.14	133.69	0.495	1.452	7.260	10338	30325	151627
	22	72.2	469	1540	1923	6309	0.47	2.14	133.69	0.472	1.386	7.291	9859	28951	152266
	22.5	73.8	503	1649	1667	5468	0.45	1.98	123.58	0.500	1.450	4.832	10440	30277	100927
	23	75.5	546	1793	1667	5468	0.44	1.98	123.58	0.591	1.702	4.711	12346	35551	98387
	23.5	77.1	526	1727	2000	6562	0.46	2.18	136.25	0.605	1.769	7.924	12627	36941	165494
	24	78.7	526	1727	2000	6562	0.46	2.18	136.25	0.605	1.769	7.924	12627	36941	165494
	24	78.7	510	1674	2000	6562	0.47	2.18	136.25	0.568	1.665	7.973	11865	34770	166509
	24.5	80.4	478	1570	2000	6562	0.47	2.18	136.25	0.500	1.469	8.064	10435	30672	168416
	24.5	80.4	521	1709	1852	6076	0.46	2.10	131.15	0.570	1.661	6.445	11902	34684	134596
	24.5	80.4	526	1727	1923	6309	0.46	2.14	133.69	0.593	1.732	7.129	12390	36166	148891
	25	82.0	465	1526	1852	6076	0.47	2.10	131.15	0.454	1.333	6.598	9492	27836	137810
	25	82.0	433	1420	2083	6835	0.48	2.22	138.82	0.417	1.231	9.096	8703	25717	189965
	26	85.3	439	1439		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	26.5	86.9	474	1555	1852	6076	0.46	2.10	131.15	0.472	1.383	6.575	9855	28875	137326
	26.5	86.9	488	1600	1786	5859	0.46	2.06	128.62	0.490	1.431	5.916	10239	29891	123556
	27	88.6	546	1793	1852	6076	0.45	2.10	131.15	0.627	1.822	6.368	13102	38055	132997

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus

Shaded cells denote questionable data.

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^3lb/ft^2)	E (10^3lb/ft^2)	K (10^3lb/ft^2)
	27	88.6	485	1593	1923	6309	0.47	2.14	133.69	0.505	1.480	7.247	10540	30902	151358
	27.5	90.2	510	1674	1923	6309	0.46	2.14	133.69	0.557	1.630	7.177	11643	34047	149887
	27.5	90.2	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	28	91.9	541	1773	2000	6562	0.46	2.18	136.25	0.638	1.863	7.880	13318	38906	164572
	28	91.9	529	1736	2000	6562	0.46	2.18	136.25	0.611	1.787	7.915	12761	37322	165315
	28.5	93.5	633	2076	1923	6309	0.44	2.14	133.69	0.858	2.469	6.776	17917	51574	141522
	28.5	93.5	571	1875	2000	6562	0.46	2.18	136.25	0.713	2.075	7.780	14884	43329	162484
	29	95.1	541	1773	2174	7132	0.47	2.26	141.40	0.662	1.942	9.822	13822	40554	205128
	29	95.1	617	2025		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	29	95.1	613	2013	2000	6562	0.45	2.18	136.25	0.821	2.379	7.635	17156	49687	159455
	29.5	96.8	505	1657	2000	6562	0.47	2.18	136.25	0.557	1.632	7.988	11627	34089	166827
	29.5	96.8	488	1600	2000	6562	0.47	2.18	136.25	0.519	1.525	8.038	10846	31853	167868
	30	98.4	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	30	98.4	500	1640	2083	6835	0.47	2.22	138.82	0.556	1.634	8.910	11610	34122	186089
	30	98.4	490	1608	2083	6835	0.47	2.22	138.82	0.534	1.572	8.939	11160	32825	186690
	30.5	100.1	526	1727	2083	6835	0.47	2.22	138.82	0.616	1.806	8.830	12865	37717	184417
	31	101.7	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14021	41013	182875
	31	101.7	543	1783	1923	6309	0.46	2.14	133.69	0.633	1.843	7.077	13211	38486	147796
	31	101.7	546	1793	2000	6562	0.46	2.18	136.25	0.652	1.903	7.861	13611	39735	164181
	31.5	103.3	629	2063	2273	7456	0.46	2.31	143.99	0.912	2.661	10.697	19055	55584	223416
	32	105.0	629	2063	1852	6076	0.43	2.10	131.15	0.831	2.385	6.096	17355	49803	127325
	32.5	106.6	625	2051	2000	6562	0.45	2.18	136.25	0.853	2.465	7.593	17806	51490	158589
	33	108.3	676	2217	2000	6562	0.44	2.18	136.25	0.996	2.861	7.402	20810	59749	154583
	33.5	109.9	625	2051	2273	7456	0.46	2.31	143.99	0.901	2.629	10.712	18817	54912	223732
	34	111.5	621	2038	2273	7456	0.46	2.31	143.99	0.890	2.598	10.727	18584	54252	224043
	34.5	113.2	709	2327	2174	7132	0.44	2.26	141.40	1.139	3.282	9.185	23794	68548	191832
	35	114.8	730	2395	2174	7132	0.44	2.26	141.40	1.207	3.467	9.095	25204	72408	189952
	35.5	116.5	704	2310	2083	6835	0.44	2.22	138.82	1.103	3.166	8.181	23032	66124	170860
	36	118.1	704	2310	2083	6835	0.44	2.22	138.82	1.103	3.166	8.181	23032	66124	170860
	36.5	119.8	787	2583		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	36.5	119.8	806	2646	2174	7132	0.42	2.26	141.40	1.473	4.184	8.740	30765	87386	182537
	37	121.4	870	2853	2174	7132	0.40	2.26	141.40	1.713	4.812	8.421	35769	100494	175865
	37.5	123.0	704	2310	2000	6562	0.43	2.18	136.25	1.082	3.094	7.287	22606	64618	152188
	38	124.7	685	2247	2083	6835	0.44	2.22	138.82	1.043	3.003	8.260	21787	62721	172520
	38.5	126.3	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	39	128.0	735	2412	2083	6835	0.43	2.22	138.82	1.202	3.436	8.048	25109	71754	168091
	39.5	129.6	690	2263	2000	6562	0.43	2.18	136.25	1.038	2.974	7.346	21680	62114	153423

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 1
SBD-15 Victorville Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring R-10-001
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^3lb/ft^2)	E (10^3lb/ft^2)	K (10^3lb/ft^2)
	40	131.2	704	2310	1923	6309	0.42	2.14	133.69	1.062	3.022	6.504	22182	63110	135835
	40.5	132.9	781	2563	2174	7132	0.43	2.26	141.40	1.382	3.942	8.861	28873	82336	185061
	41	134.5	800	2625		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	41.5	136.2	787	2583		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	41.5	136.2	758	2485	2174	7132	0.43	2.26	141.40	1.300	3.720	8.971	27149	77695	187358
	42	137.8	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	42.5	139.4	730	2395	2000	6562	0.42	2.18	136.25	1.163	3.310	7.180	24286	69126	149948
	43	141.1	758	2485	2083	6835	0.42	2.22	138.82	1.276	3.634	7.950	26654	75900	166031
	43.5	142.7	833	2734	2174	7132	0.41	2.26	141.40	1.573	4.448	8.607	32850	92893	179757
	44	144.4	806	2646	2083	6835	0.41	2.22	138.82	1.446	4.084	7.723	30204	85288	161297
	44.5	146.0	676	2217	2381	7812	0.46	2.35	146.59	1.072	3.122	11.882	22390	65209	248168
	45	147.6	585	1919	2273	7456	0.46	2.31	143.99	0.789	2.310	10.862	16474	48254	226856
	45.5	149.3	654	2144		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	46	150.9	794	2604	2381	7812	0.44	2.35	146.59	1.479	4.252	11.340	30891	88812	236834
	46.5	152.6	826	2711	2273	7456	0.42	2.31	143.99	1.575	4.486	9.813	32902	93692	204952
	47	154.2	870	2853	2381	7812	0.42	2.35	146.59	1.776	5.053	10.944	37084	105543	228577
	47.5	155.8	847	2780	2273	7456	0.42	2.31	143.99	1.656	4.702	9.705	34596	98202	202693
	48	157.5	800	2625	2174	7132	0.42	2.26	141.40	1.450	4.122	8.771	30275	86083	183191

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 3
Vs30 Worksheet
SBD-15 Mojave River Bridge, South Abutment
Bridge No. 54-0483, boring RC-10-001

Depth (m)	Vs (m/s)	S-wave Travel Time, per 1m interval (sec)	Comments	Calculations	
0.5	250	0.004	Velocity estimated from adjacent measurement		
1.5	250	0.004	Velocity estimated from adjacent measurement	Total travel time (sec):	0.100244
2.5	238	0.004200004			
3.5	286	0.003500004		Total distance (m):	30
4.5	299	0.003349994			
5.5	294	0.003399996		Vs30 (m/s)=	30/ 0.100244
6.5	305	0.003274995		=	299.3 m/s
7.5	300	0.003333333	Velocity estimated from adjacent measurement		
8.5	195	0.005128205	Mean of similar interval in boring R-10-002		
9.5	195	0.005128205	Mean of similar interval in boring R-10-002		
10.5	195	0.005128205	Mean of similar interval in boring R-10-002		
11.5	195	0.005128205	Mean of similar interval in boring R-10-002		
12.5	195	0.005128205	Mean of similar interval in boring R-10-002		
13.5	195	0.005128205	Mean of similar interval in boring R-10-002		
14.5	195	0.005128205	Mean of similar interval in boring R-10-002		
15.5	195	0.005128205	Mean of similar interval in boring R-10-002		
16.5	400	0.0025	Velocity estimated from adjacent measurement		
17.5	400	0.0025	Velocity estimated from adjacent measurement		
18.5	444	0.002250002			
19.5	386	0.002590003			
20.5	483	0.002069999			
21.5	481	0.002080001			
22.5	503	0.001989998			
23.5	526	0.001899999			
24.5	521	0.001920001			
25.5	400	0.0025	Velocity estimated from adjacent measurement		
26.5	474	0.002109998			
27.5	495	0.002020002			
28.5	571	0.001749999			
29.5	505	0.001979998	Velocity estimated from adjacent measurement		

Shaded velocities are estimated from adjacent velocities and/or other data

Calculation of Vs30 follows methodology described in the Caltrans Geotechnical Services Design Manual, v.1.0, August 2009, p.14 .

SBD-15 Mojave River Bridge PM 43.9
Bridge No. 54-0483, boring R-10-002 (north abutment)
GPS location: North 34.55 degrees, West -117.30 degrees

Drilling was conducted by Caltrans Drilling Services. The boring was drilled in early October, 2012, drilling out a previously installed piezometer (R-10-002). This boring was cased with 3-inch diameter PVC casing and grouted from the bottom upon completion of the boring. There was a missing interval of grout from the surface to approximately 7.6 m/25 ft depth (probably from grout settling or grout migration after installation), and this interval is noted as questionable on the P-S Suspension Log data (Table 2). Natural Gamma/Induction and PS Log measurements were collected in this boring. The depth of the boring was reported as 170 ft/51.8 m. Depths were measured relative to road grade surface, as ground surface elevation was not available.

Geophysical Logs

Induction Log: A plot of the Natural Gamma/Induction log is attached.

Engineered fill used to build up the roadbed and bridge abutment is suggested by higher gamma counts (i.e., more fine-grained material) in the interval from the surface to approximately 7.5 m/24.6 ft depth. The 2010 boring log notes fill to 7.3 m/24 ft depth.

Variations in the Natural Gamma and Conductivity/Resistivity (Induction) logs suggest interlayered stratigraphy of coarse-grained to fine-grained deposits below the engineered fill, interpreted as sedimentary deposits of the Mojave River.

"Spikes" in the Induction log at approximately 13.5 m/44 ft depth suggest changed subsurface conditions. Similar spikes appear at approximately the same interval in boring R-10-001. Lower Natural Gamma readings suggest the interval between the base of the engineered fill and the Induction "spikes" is more coarse-grained than intervals above and below.

P-S Suspension Log: Seismic velocities determined by the P-S Suspension Log are tabulated on Table 1 and plotted on Plate 2.

Grout settled to approximately 7.6 m/25 ft depth after casing installation and grouting. This interval was regrouted on the morning of logging. The upper, engineered fill section (surface-7.5 m/24.6 ft) was logged through fresh grout, and the data is recorded as questionable on Table 2. Erratic Vs and poor to missing P-wave signal suggest poor grout bond. This interval is noted as questionable on Table 1.

The intermediate, possible disturbed younger alluvial sediments section (7.5m/24.6 ft to 13.5 m/44 ft), was logged at lower Vs than sections above or below, suggesting softer or more unconsolidated conditions, with mean Vs of ~195 m/s.

The lower, more consolidated older fluvial material section, was logged from 17 m/56 ft to the total depth logged at 48.5 m/159 ft. Rock-like material (Vs>785 m/s) was noted once at 48 m/157.5 ft depth. Crystalline bedrock was not encountered in this boring.

Saturated conditions (Vp>1500 m/s) were noted at the acquisition of Vp signal at 13 m/42.7 ft depth. However, actual saturated conditions are probably much higher in this boring, as Vp signal is poor/unusable/missing above this depth, and surface water was noted in the Mojave River course.

Vs30 determination: Shear wave velocities were obtained from Table 2. Missing velocities from poor or missing signal were estimated from adjacent intervals. Table 3 presents the seismic velocities used to determine the Vs30 in this boring, which is 314.4 m/s. Liquefaction potential, especially in the apparent coarser-grained, saturated, unconsolidated or disturbed younger alluvial section from 7.5 m/26.4 ft to 13.5 m/44 ft, should be assessed.

Plate 1, boring R-10-002

California Department of Transportation
Geophysical Services

SBD-15 54-0483 R-10-002 N ABT

COMPANY	: Caltrans	OTHER SERVICES:	
WELL	: SBD-15 54-0483 R-10-002 N ABT		
FIELD	: SBD-15 54-0483 R-10-002 N ABT		
COUNTY	: SBD-15 PM 43.9		
STATE	: CA		
LOCATION	:		
SECTION	:		
TOWNSHIP	:		
RANGE	:		
API NO.	:		
UNIQUE WELL ID.	:		
PERMANENT DATUM	:	ELEVATION KB	:
LOG MEASURED FROM	: GL	ELEVATION DF	:
DRL MEASURED FROM	: GL	ELEVATION GL	:
DATE	: 10/09/12	RIG NUMBER	:
DEPTH DRILLER	: 51.8m.	LOGGER TD	:
BIT SIZE	: 10	ARRIVAL TIME	:
LOG TOP	: -0.26	DEPARTURE TIME	:
LOG BOTTOM	: 51.52	CIRC STOPPED	: PM
CASING OD	:		
CASING BOTTOM	: TD		
CASING TYPE	: PVC		
BOREHOLE FLUID	: 0		
RM TEMPERATURE	: 0		
MUD RES	: 0		
MUD WEIGHT	:		
WITNESSED BY	:		
RECORDED BY	: DH/DG		
REMARKS 1	: I-15 Mojave R BR, North Abutment, Victorville		
REMARKS 2	: PVC cased and grouted, grout settled 7.8m, fresh grout (top off)		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

Plate 1, boring R-10-002

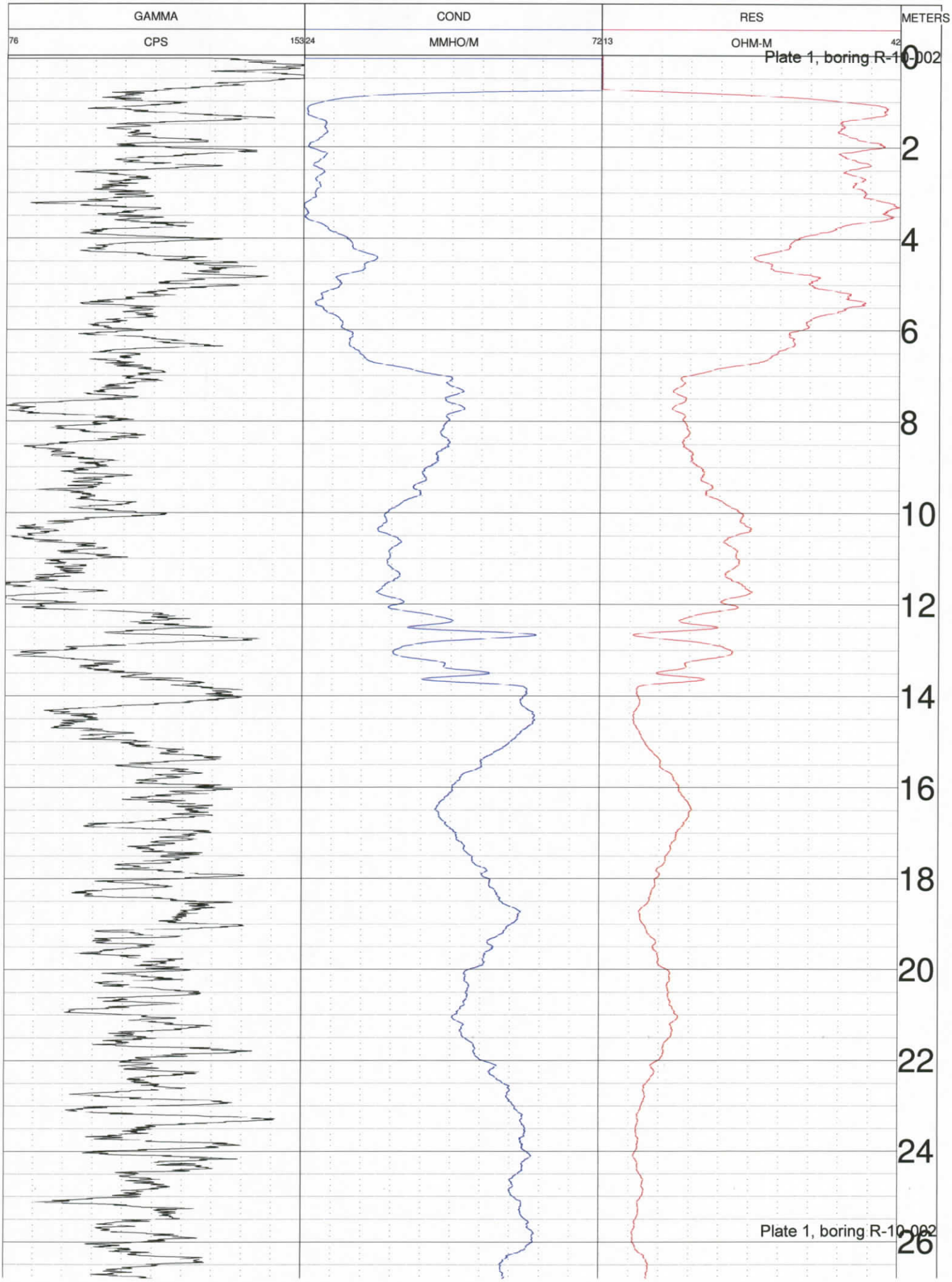


Plate 1, boring R-10-002
Plate 1, boring R-10-002

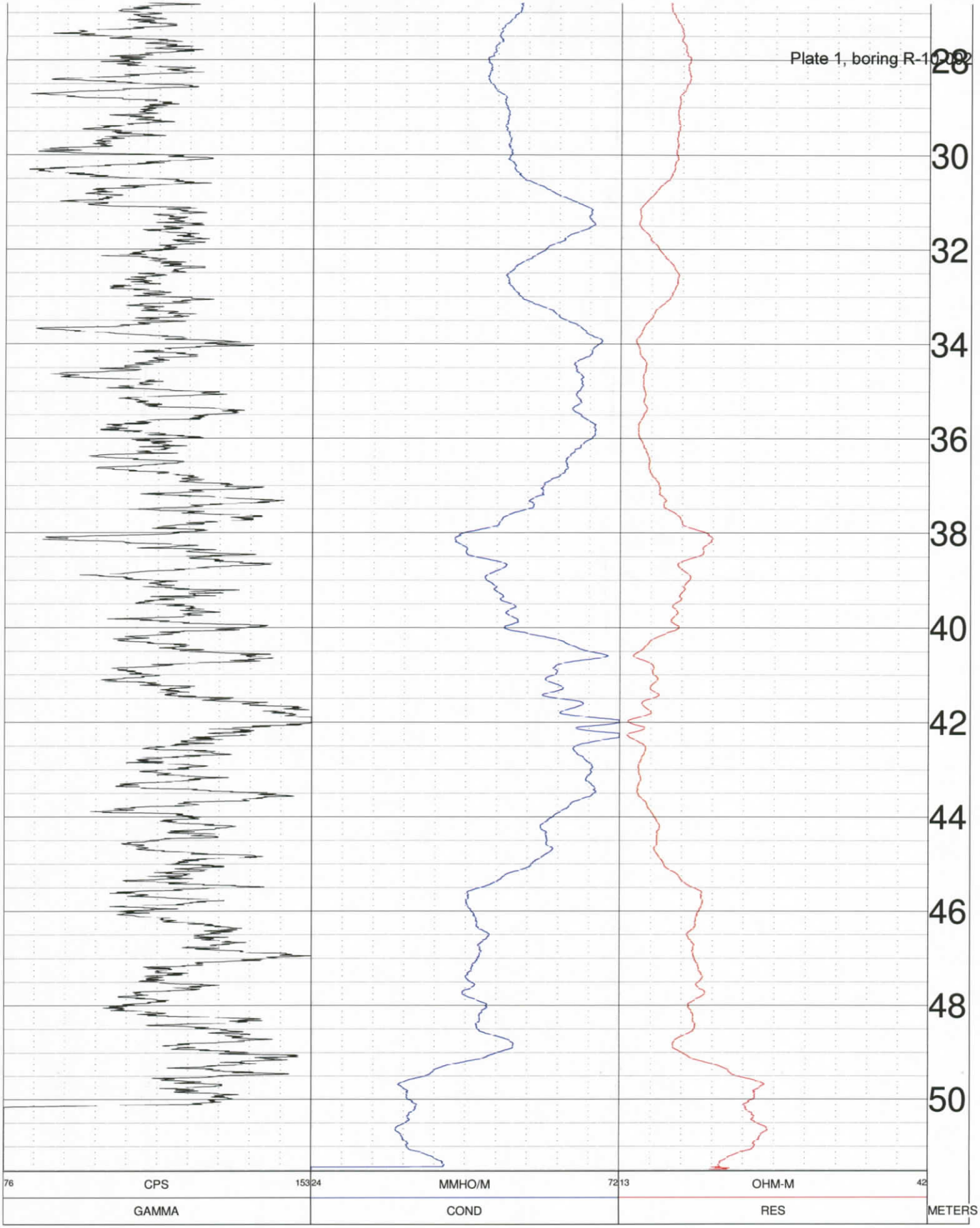
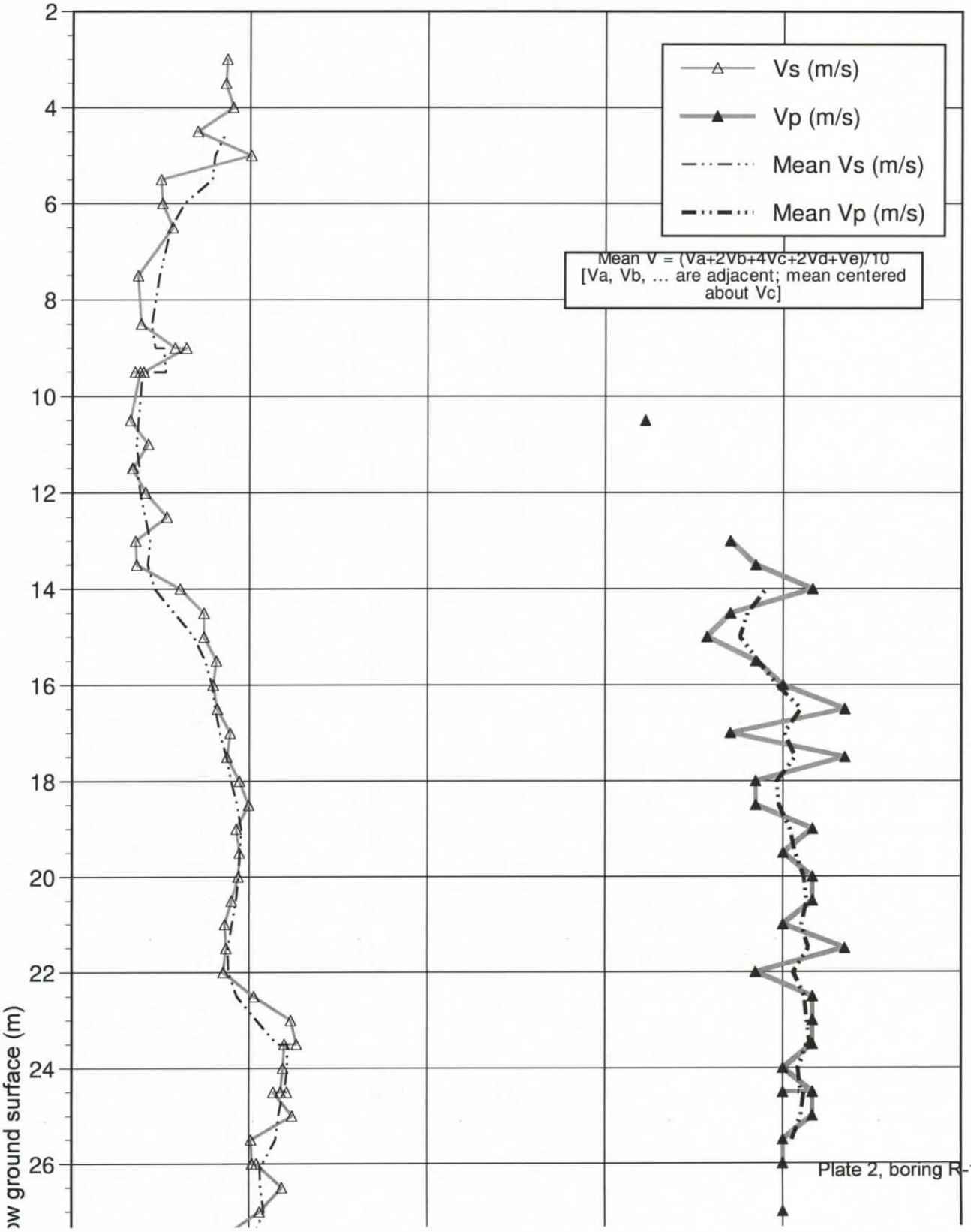


Plate 1, boring R-10-002

Plate 2
SBD-15 Victorville Mojave River Bridge, North Abutment
Bridge No. 54-0483, boring R-10-002
Downhole Interval Velocities

Top of Hole Elevation: Not Provided



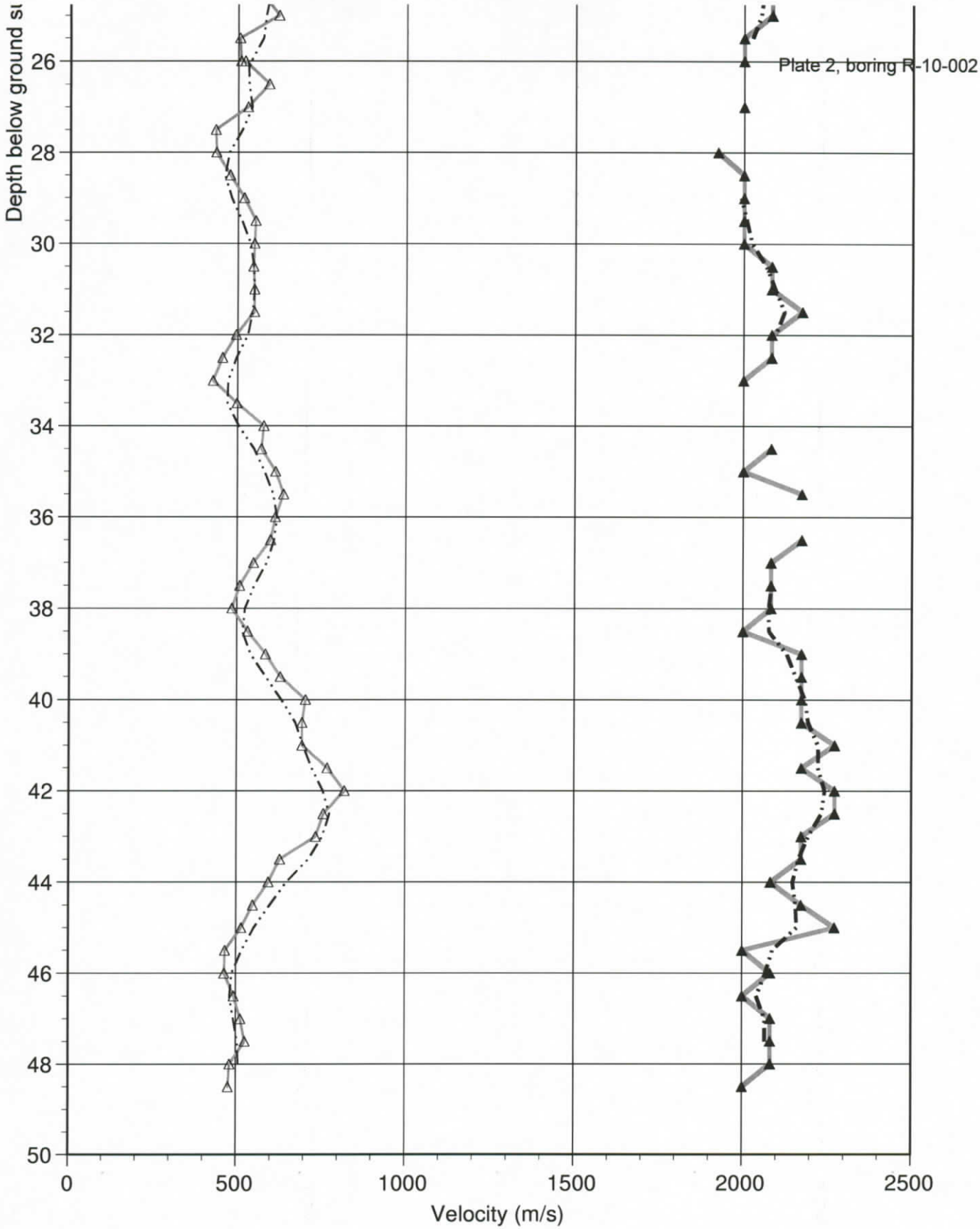


Plate 2, boring R-10-002
Depth below ground su
26
28
30
32
34
36
38
40
42
44
46
48
50
0
500
1000
1500
2000
2500
Velocity (m/s)

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

	Boring location: North 34.55 degrees, West -117.30 degrees														
Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
Not Provided	3	9.8	435	1426		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3.5	11.5	431	1414		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	13.1	452	1485		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4.5	14.8	352	1155		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5	16.4	503	1649		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	5.5	18.0	249	818		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	19.7	253	828		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6.5	21.3	282	927		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	7.5	24.6	185	608		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8.5	27.9	194	636		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9	29.5	289	948		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9	29.5	321	1052		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	201	659		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	177	580		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	9.5	31.2	191	626		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10.5	34.4	164	538	1613	5292	0.49	1.94	121.09	0.052	0.156	4.976	1089	3255	103932
	11	36.1	214	701		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11.5	37.7	172	563		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	11.5	37.7	170	558		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12	39.4	207	681		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	12.5	41.0	267	877		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	13	42.7	179	587	1852	6076	0.50	2.10	131.15	0.067	0.201	7.115	1404	4199	148594
	13.5	44.3	182	597	1923	6309	0.50	2.14	133.69	0.071	0.212	7.826	1479	4422	163440
	14	45.9	305	1000	2083	6835	0.49	2.22	138.82	0.207	0.616	9.376	4317	12856	195813
	14.5	47.6	372	1220	1852	6076	0.48	2.10	131.15	0.290	0.859	6.817	6063	17936	142381
	15	49.2	372	1220	1786	5859	0.48	2.06	128.62	0.285	0.841	6.190	5946	17570	129279
	15.5	50.9	407	1334	1923	6309	0.48	2.14	133.69	0.354	1.045	7.448	7391	21827	155556
	16	52.5	398	1307	2000	6562	0.48	2.18	136.25	0.346	1.025	8.268	7235	21407	172683
	16.5	54.1	410	1345	2174	7132	0.48	2.26	141.40	0.380	1.127	10.197	7946	23544	212963
	17	55.8	446	1465	1852	6076	0.47	2.10	131.15	0.419	1.230	6.646	8744	25694	138807
	17.5	57.4	437	1433	2174	7132	0.48	2.26	141.40	0.432	1.278	10.128	9021	26682	211530
	18	59.1	472	1548	1923	6309	0.47	2.14	133.69	0.476	1.399	7.285	9952	29218	152142
	18.5	60.7	498	1632	1923	6309	0.46	2.14	133.69	0.530	1.552	7.213	11071	32418	150650
	19	62.3	463	1519	2083	6835	0.47	2.22	138.82	0.477	1.405	9.016	9954	29345	188297
	19.5	64.0	472	1548	2000	6562	0.47	2.18	136.25	0.486	1.428	8.083	10142	29829	168807
	20	65.6	469	1540	2083	6835	0.47	2.22	138.82	0.490	1.444	8.998	10236	30161	187921

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
	20.5	67.3	450	1478	2083	6835	0.48	2.22	138.82	0.451	1.331	9.050	9423	27808	189005
	21	68.9	431	1414	2000	6562	0.48	2.18	136.25	0.405	1.197	8.189	8469	24994	171038
	21.5	70.5	435	1426	2174	7132	0.48	2.26	141.40	0.428	1.267	10.133	8942	26454	211634
	22	72.2	427	1402	1923	6309	0.47	2.14	133.69	0.391	1.153	7.398	8168	24081	154520
	22.5	73.8	513	1682	2083	6835	0.47	2.22	138.82	0.585	1.717	8.872	12213	35853	185285
	23	75.5	617	2025	2083	6835	0.45	2.22	138.82	0.847	2.460	8.522	17696	51385	177974
	23.5	77.1	633	2076	2083	6835	0.45	2.22	138.82	0.891	2.582	8.464	18603	53919	176765
	23.5	77.1	599	1965	2083	6835	0.45	2.22	138.82	0.797	2.320	8.588	16652	48457	179366
	24	78.7	595	1953	2000	6562	0.45	2.18	136.25	0.773	2.245	7.699	16150	46881	160796
	24.5	80.4	588	1930	2083	6835	0.46	2.22	138.82	0.769	2.242	8.625	16070	46817	180143
	24.5	80.4	606	1988	2000	6562	0.45	2.18	136.25	0.802	2.324	7.661	16743	48536	160006
	24.5	80.4	568	1864	2083	6835	0.46	2.22	138.82	0.718	2.096	8.694	14993	43774	181579
	25	82.0	621	2038	2083	6835	0.45	2.22	138.82	0.858	2.490	8.507	17917	52002	177680
	25.5	83.7	505	1657	2000	6562	0.47	2.18	136.25	0.557	1.632	7.988	11627	34089	166827
	26	85.3	508	1665	2000	6562	0.47	2.18	136.25	0.562	1.648	7.980	11745	34427	166669
	26	85.3	521	1709	2000	6562	0.46	2.18	136.25	0.592	1.733	7.941	12365	36195	165843
	26.5	86.9	592	1941		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	27	88.6	529	1736	2000	6562	0.46	2.18	136.25	0.611	1.787	7.915	12761	37322	165315
	27.5	90.2	433	1420		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	28	91.9	435	1426	1923	6309	0.47	2.14	133.69	0.405	1.193	7.380	8455	24910	154138
	28.5	93.5	476	1562	2000	6562	0.47	2.18	136.25	0.495	1.455	8.070	10336	30387	168548
	29	95.1	518	1700	2000	6562	0.46	2.18	136.25	0.586	1.716	7.949	12237	35831	166013
	29.5	96.8	552	1813	2000	6562	0.46	2.18	136.25	0.666	1.944	7.842	13914	40591	163778
	30	98.4	549	1803	2000	6562	0.46	2.18	136.25	0.659	1.923	7.852	13761	40160	163981
	30.5	100.1	546	1793	2083	6835	0.46	2.22	138.82	0.664	1.943	8.766	13868	40579	183079
	31	101.7	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14021	41013	182875
	31.5	103.3	549	1803	2174	7132	0.47	2.26	141.40	0.684	2.005	9.792	14281	41869	204516
	32	105.0	495	1624	2083	6835	0.47	2.22	138.82	0.545	1.602	8.925	11382	33464	186394
	32.5	106.6	455	1491	2083	6835	0.48	2.22	138.82	0.459	1.355	9.039	9595	28307	188775
	33	108.3	427	1402	2000	6562	0.48	2.18	136.25	0.399	1.177	8.199	8325	24576	171230
	33.5	109.9	498	1632		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	34	111.5	578	1896		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	34.5	113.2	571	1875	2083	6835	0.46	2.22	138.82	0.726	2.119	8.683	15165	44260	181350
	35	114.8	613	2013	2000	6562	0.45	2.18	136.25	0.821	2.379	7.635	17156	49687	159455
	35.5	116.5	637	2090	2174	7132	0.45	2.26	141.40	0.919	2.670	9.479	19191	55772	197969
	36	118.1	613	2013		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	36.5	119.8	599	1965	2174	7132	0.46	2.26	141.40	0.812	2.370	9.621	16962	49493	200941

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 1. SBD-15 Mojave River Bridge
Bridge No. 54-0483, Boring R-10-002, North Abutment
PS Suspension Log Data Summary

Top of Hole Elevation (m)	Depth (m)	Depth (ft)	Vs (m/s)	Vs (ft/s)	Vp (m/s)	Vp (ft/s)	γ	ρ(Vp) (g/cc)	ρ(Vp) (lb/ft^3)	G (GPa)	E (GPa)	K (GPa)	G (10^{3}lb/ft^2)	E (10^{3}lb/ft^2)	K (10^{3}lb/ft^2)
	37	121.4	549	1803	2083	6835	0.46	2.22	138.82	0.671	1.964	8.756	14020	41013	182875
	37.5	123.0	508	1665	2083	6835	0.47	2.22	138.82	0.573	1.683	8.887	11967	35145	185614
	38	124.7	485	1593	2083	6835	0.47	2.22	138.82	0.524	1.542	8.953	10944	32203	186977
	38.5	126.3	532	1745	2000	6562	0.46	2.18	136.25	0.618	1.806	7.907	12897	37709	165134
	39	128.0	585	1919	2174	7132	0.46	2.26	141.40	0.775	2.263	9.671	16178	47271	201987
	39.5	129.6	629	2063	2174	7132	0.45	2.26	141.40	0.896	2.606	9.509	18712	54426	198608
	40	131.2	704	2310	2174	7132	0.44	2.26	141.40	1.123	3.238	9.206	23460	67630	192277
	40.5	132.9	694	2278	2174	7132	0.44	2.26	141.40	1.092	3.153	9.248	22813	65846	193140
	41	134.5	694	2278	2273	7456	0.45	2.31	143.99	1.112	3.222	10.431	23231	67301	217847
	41.5	136.2	769	2524	2174	7132	0.43	2.26	141.40	1.340	3.829	8.917	27991	79967	186236
	42	137.8	820	2689	2273	7456	0.43	2.31	143.99	1.550	4.417	9.848	32365	92255	205668
	42.5	139.4	758	2485	2273	7456	0.44	2.31	143.99	1.324	3.806	10.149	27647	79484	211959
	43	141.1	735	2412	2174	7132	0.44	2.26	141.40	1.225	3.516	9.071	25576	73423	189456
	43.5	142.7	629	2063	2174	7132	0.45	2.26	141.40	0.896	2.606	9.509	18712	54426	198608
	44	144.4	595	1953	2083	6835	0.46	2.22	138.82	0.788	2.294	8.601	16455	47901	179630
	44.5	146.0	549	1803	2174	7132	0.47	2.26	141.40	0.684	2.005	9.792	14281	41869	204516
	45	147.6	515	1691	2273	7456	0.47	2.31	143.99	0.613	1.805	11.097	12799	37704	231756
	45.5	149.3	467	1533	2000	6562	0.47	2.18	136.25	0.477	1.402	8.095	9953	29285	169058
	46	150.9	465	1526	2083	6835	0.47	2.22	138.82	0.481	1.418	9.010	10047	29613	188173
	46.5	152.6	493	1616	2000	6562	0.47	2.18	136.25	0.530	1.555	8.024	11061	32469	167581
	47	154.2	513	1682	2083	6835	0.47	2.22	138.82	0.585	1.717	8.872	12213	35852	185285
	47.5	155.8	526	1727	2083	6835	0.47	2.22	138.82	0.616	1.806	8.830	12865	37717	184416
	48	157.5	481	1577	2083	6835	0.47	2.22	138.82	0.514	1.513	8.966	10734	31600	187257
	48.5	159.1	476	1562	2000	6562	0.47	2.18	136.25	0.495	1.455	8.070	10336	30387	168548

γ = Poisson's Ratio ρ(Vp) = Vp-derived density G = Shear Modulus E = Young's Modulus K = Bulk Modulus
Shaded cells denote questionable data.

Table 2
Vs30 Worksheet
SBD-15 Victorville Mojave River Bridge, North Abutment
Bridge No. 54-0483, boring R-10-002

Depth (m)	Vs (m/s)	S-wave Travel Time, per 1m interval (sec)	Comments	Calculations	
0.5	250	0.004	Velocity estimated		
1.5	250	0.004	Velocity estimated	Total travel time (sec):	0.09542
2.5	250	0.004	Velocity estimated		
3.5	431	0.002320003		Total distance (m):	30
4.5	352	0.002839997			
5.5	249	0.004009993		Vs30 (m/s)=	30/ 0.09542
6.5	282	0.003539998		=	314.4 m/s
7.5	185	0.005400005			
8.5	194	0.005160012			
9.5	191	0.005239992			
10.5	164	0.006100016			
11.5	172	0.00583002			
12.5	267	0.003739996			
13.5	182	0.005500006			
14.5	372	0.002690002			
15.4	407	0.00246			
16.5	410	0.00244			
17.5	437	0.002290001			
18.5	498	0.002009998			
19.5	472	0.002119996			
20.5	450	0.002220002			
21.5	435	0.002299998			
22.5	513	0.001949998			
23.5	599	0.001669998			
24.5	588	0.001699995			
25.5	505	0.001979998			
26.5	592	0.00169			
27.5	433	0.002309997			
28.5	476	0.002099998			
29.5	552	0.001810001			

Shaded velocities are estimated from adjacent velocities and/or other data

Calculation of Vs30 follows methodology described in the Caltrans Geotechnical Services Design Manual, v.1.0, August 2009, p.14 .

APPENDIX 1: GEOPHYSICS AND GEOLOGY BRANCH BOREHOLE GEOPHYSICAL LOGGING PROGRAM

This appendix summarizes the instruments and procedures used in the Borehole Geophysical Logging Program. Two logging units are currently deployed: a Century Geophysical system and an OYO Geosciences P-S Logging system. Both systems consist of downhole probes connected by a winch to a data acquisition system on the surface. Specific attributes of these systems are described below.

I. INSTRUMENTATION

A. Century system

The Century system is used to obtain caliper, natural gamma, and conductivity or resistivity measurements. These measurements constitute the basic logging suite. Three probes are used for these measurements: a caliper probe, a conductivity/gamma combination (induction probe), or a resistivity/gamma combination probe.

The caliper probe mechanically measures borehole diameter for assessment of hole quality (e.g., the presence of washouts or squeeze-ins). Caliper measurements are not collected in cased borings.

The gamma tools measure natural background radioactivity from decay of naturally occurring radioisotopes. These isotopes are commonly concentrated in clays and arkosic sands. The natural gamma log provides the best information concerning interpretation of material types, contacts, and thickness. Although a gamma reading is not generally repeatable in the sense of absolute precision, general trends can be seen from the log. This log provides sharp contrasts between units of sand (low gamma counts) and clay (high gamma spikes). The gamma log is thus useful for distinguishing between clayey and sandy beds.

The conductivity and resistivity tools measure formation conductivity or resistivity of the adjacent formation. Conductivity and resistivity are inversely related and are influenced by porosity and the amount of clay minerals present in the formation, as well as the salinity of pore fluids; thus, the conductivity and resistivity logs are useful for delineating sandy versus clayey zones and freshwater versus brackish/saltwater zones. Materials of high conductivity usually show up well in the conductivity log, and suggest clay-rich beds. Increases in resistivity, along with changes in the natural gamma, suggest subsurface lithologic changes.

Additional Century tools include the full wave sonic. The full wave sonic tool is designed to measure the time it takes for a compressional sound wave to travel a unit distance. The interval transit time for a formation depends on the elastic properties of the formation, which are related to lithology and porosity. In general, waves travel faster through denser formations. Therefore, an increasing travel time for a given type of material indicates increased porosity. Sonic-derived porosity is reported, and rock quality can be assessed using a tube-wave amplitude analysis. Cement bond logs (CBL) of steel or PVC cased borings can be obtained using this tool.

B. OYO P-S Logger

The OYO Model 170 Suspension P-S Logging system was used to obtain in-situ Vs and Vp measurements. The logging system consists of a downhole probe connected to a surface winch and seismograph. The probe contains a seismic source and two sets of oriented geophones separated by a fixed (1-meter) distance. Because the source is at a constant distance from the receivers, interval velocities can be recorded with greater detail and at greater depths than conventional (surface-source) downhole shear wave surveys.

The source is a self-contained, electronically activated hammer. The hammer transmits pulses through the borehole fluid into the adjacent medium. The pulse generates refracted P waves and converted shear waves. (The principle of wave conversion is discussed in detail in Telford et al., 1976, p. 249-255.) In addition to P waves and converted S waves, the pulse generates a surface wave on the borehole wall with a velocity equivalent to the formation shear wave (Kitsunezaki, 1980); this wave is often referred to as a **flexural wave** (other waves are also generated, but only those pertinent to our investigation are presented here.) The refracted P wave, P-converted S wave and flexural wave are transmitted back into the borehole fluid, where they are detected by the geophones. The arrival times of the different waves at each geophone are then used to calculate P- and S- wave velocities for the interval between them. To aid in identification of S waves, the hammer fires two oppositely-polarized pulses. The resulting change in S-wave polarity (recorded on separate geophone channels) can then be used to determine the onset of the S-wave and flexural wave. In low-velocity materials ($V_p \leq 1500$ m/s), body waves (P and S waves) cannot be directly measured due to refraction of those waves into the formation and away from the borehole. The ability to generate and detect the flexural wave enables measurement of shear-wave velocity for those materials.

To accommodate site-specific conditions, the distance between the source and the geophones can be varied via detachable spacers (filter tubes) of fixed lengths. The distance between source and geophones can be varied up to 3 meters, to maximize signal amplitude, minimize record length and provide a sufficient measurement interval to allow recognition of the source pulse at the geophones.

The seismograph consists of a central processing unit connected to a signal monitor and printer. Six channels (three for each geophone) are recorded with each measurement and displayed on the monitor. Recording gains are individually adjustable for each channel. Additionally, multiple shots may be recorded and stacked with each measurement for additional signal enhancement.

II. DATA ACQUISITION AND PROCESSING

A. Century system

Logging operations with the Century system requires two trips into the borehole. The caliper log is used first, to assess potential borehole instability that must be corrected prior to additional measurements. The caliper is calibrated before logging and checked immediately

afterward to assess instrument drift. If excessive drift is discovered, the caliper log is repeated. Conductivity or resistivity logs are recorded after the caliper log. A repeat section of conductivity or resistivity measurements is recorded after the run to check for drift. All logs are measured from the bottom to the top of the borehole, with measurements recorded continuously as the probe is raised.

Parameters for the full wave sonic (borehole diameter, gain, sampling interval) are downloaded into the tool from the surface. A repeat section can be recorded after changing the tool parameters, based on real-time observations, inspection of the lithologic log, and consultation with the drillers and geologist.

B. OYO P-S Logger

The general operation of the P-S logger is as follows: 1) the probe is lowered to a selected depth in the hole, 2) gains, number of stacks and display parameters are optimized, 3) the probe is then lowered to the bottom of the hole, and 4) measurement proceeds. Measurement usually proceeds from the bottom up. The probe is incrementally raised and measurements are collected and stored on floppy disk and hard copy printout. Signal quality is monitored throughout the process and recording parameters are re-adjusted as necessary.

Once collected and stored, data are processed using PSLog, a proprietary software package developed by OYO Corporation. PSLog is used to examine the trace data, pick arrival times and calculate P and S interval velocities. (Basic concepts of interval velocity are presented in Telford et al., 1976, p. 347-350.) Arrival times are picked manually. To refine arrival picks, signal filtering can be used to attenuate undesirable frequencies and enhance the S-wave signal. Pick quality can be grouped into four general categories (based on shear wave observation):

Excellent: first breaks easily identifiable from a single shot without filtering; little or no background noise;

Good: decreasing signal-to-noise ratio; amplitude peaks (immediately following first break) identifiable without filtering, but filtering required for accurate picking of arrivals; stacking of multiple shots may be needed;

Fair: low signal-to-noise ratio; filtering required for recognition of amplitude peaks; stacking required;

Poor: very noisy; filtering and stacking required for recognition of amplitude peaks; picking of identical peaks (or troughs) at upper and lower geophones possible by comparison to adjacent records;

Not Detected: no recognizable shear waves, or recognition of identical amplitude peaks at upper and lower geophones not possible; extremely noisy.

Once velocities have been obtained, the data are exported to a spreadsheet for additional calculations. These calculations may include mean velocities, cumulative travel times and elastic moduli. These data are subsequently tabulated and exported to a graphing program for final printing and reporting.

III. ADVANTAGES AND LIMITATIONS

A. Century system

The caliper log provides accurate, fast measurement of borehole diameter; however, because the caliper arms do not move independently, ellipticity or dipping irregularities cannot be detected. Instead, average borehole diameter is measured. The gamma log likewise provides rapid measurement and can be run through steel or plastic casing with little attenuation. However, since gamma decay is not a constant process, log repeatability is never exact. Additionally, arkosic sands or leukocratic lava beds may exhibit high gamma counts unrelated to clay or shale content. Conductivity (induction) logs can be easily run through plastic casing, but are less sensitive than some resistivity logs. Sensitivity is also reduced by saline drilling fluids. Resistivity logs require continuity with the formation, so they must be run in open, fluid-filled holes.

Borehole diameter, lithologic changes (i.e., hard material/soft material), condition of the drilling fluids, and tool decentralization affect the quality of the full wave sonic measurements.

B. OYO P-S Logger

Because the source is a constant distance from the geophones, an advantage of the P-S Logger over shear wave loggers using a surface source is the ability to collect data from greater depths in shorter times. Additionally, since the interval velocity is obtained over a shorter total distance, more detailed interval velocity data can be obtained. Data can be obtained from cased holes, provided plastic (e.g., PVC) casing is used. Because the <u>difference</u> in arrival times between the two geophones is used to calculate interval velocity, timing errors caused by shot delay and P-wave travel within the borehole fluid are eliminated, and pick accuracy up to ± 0.01 ms can be obtained. Finally, stacking and filtering capabilities allow optimal data collection in marginal environments.

The primary limitation of the P-S Logger is velocity error due to misalignment of the geophones in the borehole or lithologic heterogeneity between geophones, borehole eccentricity and washouts. This error can be partially compensated by averaging normal and reversed shear wave velocities and by increasing measurement density, but cannot be completely eliminated. Additional limitations are related to measurement environment and are not unique to the P-S Logger. These include noisy environments (low signal to noise ratio), hard rock (difficult P and S differentiation due to high S velocities) and borehole instability. Despite these limitations, the P-S Logger remains an efficient tool for in-situ determination of P and S velocities.

NOTES ON P-S LOG CALCULATIONS

Initial elastic moduli are derived from the velocity measurements. Calculations of elastic moduli use an empirical relationship between P-wave velocity and density (Owen and Vickery, 1997). The seismic source used for these measurements creates very low strain (10^{-6} to 10^{-7}); therefore, the derived elastic moduli represent maximum values. At higher strain, the moduli will decrease. If these data are used for purposes other than estimation of earthquake ground response (i.e., determination of qu [FHWA, 1988]), caution should be observed. Additionally, because these moduli assume elastic deformation in an isotropic medium, they may not be accurate for fractured rock, dipping sediments or other highly anisotropic rock or soil. These moduli should be considered tentative pending comparison to laboratory test results.

REFERENCES

FHWA, July 1988, Drilled Shafts, Publication No. FHWA-HI-88-042, p. 266.

Kitsunezaki, C., 1980, A new method for shear-wave logging, Geophysics, **45**, no. 10, p. 1489-1506.

Owen, W.P., and Vickery, D.K., *in* Bell, R.S., 1997, Borehole velocity logging for the Caltrans bridge retrofit program, Proceedings of the symposium on the application of geophysics to engineering and environmental problems, Environmental and Engineering Geophysical Society, p. 947-51.

Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys, D.A., 1976, Applied Geophysics, New York, Cambridge University Press.

APPENDIX B

State of California – Department of Transportation
Division of Engineering Services
Office of Design & Technical Services

FINAL HYDRAULIC REPORT

Mojave River Bridge (Widen)

Bridge No. 54-0483
08 - SBd - 15 - PM 43.86
EA 08-355561

Prepared by:

Juan Jauregui, PE
Structure Hydraulics & Scour Mitigation
July 31, 2008

General:

It is proposed to widen the existing Mojave River Bridge (Bridge No. 54-0483) on State Route 15 in San Bernardino County. The existing structure is to be widened 40' 9-3/4" on the left and a variable widening of approximately 50' to 60' on the right. The Office of Structure Design has proposed two structure alternatives for the widening. Alternative A is a cast-in-place T-beam super structure, similar to the existing structure, with a 5' 0" structure depth. Alternative B is also a cast-in-place T-beam superstructure for frames 1 and 3, with a precast girder superstructure for frame 2 (see General Plans). The precast girder superstructure has an assumed superstructure depth of 4' 4".

The existing bridge is supported by pier walls that are on a pile foundation. The pier walls extend approximately 20 feet below the channel bottom to the top of piles. The pier walls are to be extended for the bridge widening, and the General Plans indicate that the existing pier wall foundations will be matched.

This report supercedes the previously prepared Final Hydraulic Report, dated April 26, 2005, for the State Route 15 Mojave River Bridge Widening (Bridge No. 54-0483). This report is based on the General Plans provided by the Office of Structure Design on April 15, 2008.

The scope of this report is limited to providing recommendations for the widening of the Mojave River Bridge (Bridge No. 54-0483).

All elevations indicated in this report are based on Vertical Datum NGVD 1929.

Basin:

The watershed basin for the Mojave River Bridge encompasses approximately 513 square miles. The Mojave River Basin lies on the northern side of the San Bernardino Mountains, which are the source of the headwaters to the Mojave River. Elevations in the mountainous headwaters range from 3000 feet to 8500 feet and receive approximately 40 inches of mean annual precipitation, compared to 5 inches mean annual precipitation near the bridge site. Nearly all of the surface runoff in the Mojave River is contributed by the mountainous headwaters. According to the *Mojave River Flood Plain Maintenance Plan* (USACE 1997), the shallow surface soils, impervious bedrock, and steep gradients produce high runoff rates and rapid concentration of floodwaters.

The Mojave River is formed by the confluence of Deep Creek and West Fork Mojave River near the base of the San Bernardino Mountains. From the base of the mountains to the bridge site in the City of Victorville, the Mojave River overlies alluvial deposits primarily of sand and gravel with isolated lenses of silt and clay (USACE 1997). The river's sandy channel bottom is highly permeable over much of its length. Stream flow is intermittent in the river. Following rain events in the San Bernardino Mountains, flows can almost instantaneously vary from 0 to 23,000 cfs (USACE, 1997.), resulting in a particularly dangerous flooding source (FEMA, 1997).

Discharges:

Discharges are controlled by upstream flood control and diversions. Flood control is provided by the Mojave River Dam, located approximately 14 miles upstream of the bridge site, near the confluence of Deep Creek and West Fork Mojave River. The Mojave River Dam is operated by the U.S. Army Corps of Engineers (USACE). Under the dam's design flood, maximum outflow from the reservoir is 23,500 cfs.

Discharge information for this report was obtained from the study prepared by the USACE in the *Mojave River Floodplain Maintenance Plan*. The discharge values differ between the FEMA Flood Insurance Study and the USACE study (see Table 1 below). The discharge values listed for the USACE are the values used in their hydraulic analysis of the water surface profiles for the Mojave River near Victorville.

Table 1: Peak Discharges
Drainage Area: 513 mi^2

Frequency	FEMA Flood Insurance Study (cfs)	Army Corps of Engineers Study (cfs)	Discharge Used (cfs)
50-yr	20,000	25,500	25,500
100-yr	26,000	30,900	30,900

Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.

Flood History:

In reviewing the Caltrans' bridge files, there is no known record of bridge overtopping. Prior to the construction of the Mojave River Dam in 1971, there is a recorded discharge of 70,600 cfs in 1938 (prior to the bridge's construction in 1958). As previously discussed, with the flood control provided by the Mojave River Dam, the 100-yr discharge is determined to be 30,900 cfs.

In 1993 the left bank of the river, upstream of the Mojave River Bridge, was overtopped and required emergency channel clearing and levee repair. The overtopping of the levee is attributed to the dense woody vegetation and large sand bars in the vicinity of the bridge, which obstructed the channel. According to the *Mojave River Floodplain Maintenance Plan*, many of the bridge bays were almost completely blocked with debris and vegetation.

Channel Maintenance:

As a result of the flooding of 1993, the San Bernardino County Flood Control District, in coordination with the USACE, has been actively maintaining the river channel clear of vegetation in the vicinity of the Mojave River Bridge. The clearing limits consist of clearing vegetation and sedimentation along a 300-foot centerline extending approximately 4500 ft upstream of the bridge to approximately 1400 ft downstream of the bridge. Based on discussions with the Flood Control District, the clearing operations consist of grading the river

channel in order to remove vegetation and sedimentation using heavy equipment. Clearing operations occur about every 2 to 3 years when the river channel has built up debris or sedimentation beyond approximately two feet.

As part of the Flood Control District's agreement with the USACE, the Flood Control District is required to maintain a minimum downstream channel capacity of 23,500 cfs from the Mojave River Dam plus downstream tributary inflow and storm runoff.

Stage/Velocity:

The bridge hydraulics program BrEase was used to determine the water surface elevation and velocity at the upstream edge of deck for the proposed bridge widening. The 50-year and 100-year discharge stages were evaluated. A Manning's roughness coefficient of 0.033 for the channel bottom and 0.04 for the banks, and a slope of 0.3% were used in the analysis.

In order to pass drift, a minimum of 3 feet of freeboard is recommended. Based on the hydraulic analysis, adequate freeboard is maintained for both the 50-year and 100-year discharges for both bridge-widening alternatives. The controlling structure depth for Alternative B is 5 feet for frames 1 and 3, which is the same as the structure depth for Alternative A. For the purpose of the hydraulic analysis, both structure alternatives perform the same.

Velocities, water surface elevations, and freeboard values are summarized in Table 2 below.

Table 2: Hydraulic Summary
Proposed Bridge Soffit Elevation[1] = 2708.0 ft
Minimum Required Soffit Elevation[2] = 2703.1 ft

Frequency	Velocity (fps)	Water Surface Elevation (ft)	Available Freeboard (ft)
50-yr	9.4	2700.1	7.9
100-yr	10.0	2700.9	7.1

Notes: (1) As determined from the General Plans provided on April 15, 2008
(2) Based on a recommended minimum freeboard of 3 ft.

Streambed and Scour:

At the bridge site location, the streambed is a relatively uniform trapezoidal channel consisting of levees on both sides of the channel. In the immediate vicinity of the bridge, the levees are armored with grouted riprap. No hydraulic skew was observed at the bridge site. The channel bed material consists mostly of sand. A review of the Log of Test Borings in the 1959 bridge as-builts indicates the sand to extend beyond the depth of the existing pile caps. Some gravel within the sand is indicated at and below an elevation of approximately 2680 feet (approximately 10 to 15 feet below the channel bottom).

The total potential scour at the bridge site was determined in accordance with the procedures outlined in HEC-18, "Evaluating Scour at Bridges" (FHWA, 2001). Total scour at bridges consists of three components: long term aggradation and degradation, general scour, and local scour at piers or abutments.

A review of recent and historic channel cross-sections taken at the bridge indicates that the channel has been aggrading. Due to the channel grading that the Flood Control District has been performing since the early 1990s, it is difficult to accurately determine an aggradation rate. Nevertheless, channel capacity is not expected to be compromised due to the Flood Control District's agreement with the USACE to maintain channel capacity (see previous discussion under Channel Maintenance).

General scour consists of natural river scour and contraction scour (if any) at the bridge location. Based on a field review of the river near the bridge site and the ongoing channel grading by the Flood Control District, no evidence is apparent to indicate a potential for general river scour. Based on the bridge configuration in relation to the existing levees, minimal to no flow contraction is expected to occur. The existing abutment embankments are flush with the levees and do not protrude into the channel. Therefore, no contraction scour or local abutment scour is anticipated.

The existing bridge abutments are founded on piles. The existing abutment pile cap is relatively shallow with exposure of the pile cap at some locations. Due to the protection provided by the levee and grouted riprap, matching the existing abutment foundation for the bridge widening is acceptable.

Local pier scour was analyzed assuming thalweg migration for all piers (due to the sandy channel bottom) and incorporation of upstream pier nose extensions. The pier nose extensions are expected to avoid the accumulation of debris at the piers, and therefore minimize the potential local scour at the piers.

Potential scour depths are summarized below in Table 3. All new pier wall foundations should be placed below the total potential scour elevation.

Table 3: Potential Scour
Thalweg Elevation = 2691.0 ft

Scour Type	Scour Depth	Comments
Degradation	N/A	No channel degradation observed in the past 50 years.
General Scour	0 ft	The Flood Control District maintains the channel bottom. No, flow contraction due to the bridge.
Local Pier Scour	5.0 ft	Assuming no debris accumulation due to pier nose extensions.
Local Abutment Scour	N/A	Embankments for the abutments are flush with the channel levees and protected by grouted riprap.
Total Potential Scour Depth	5.0 ft	
Total Potential Scour Elevation	2686.0 ft	

Drift:

Vegetation within the river channel varies from dense woody stands of cottonwood and willows, to desert shrubs and grasses. River scour can locally alter the riverbed, often removing large stands of vegetation and sand bars (USACE, 1997). The potential for debris accumulation at the piers during a major flood event is determined to be high based on a review of the site, past history of debris at the site, and the guidelines presented in HEC-9, "Debris Control Structures, Evaluation and Countermeasures" (FHWA, 2005). Despite the Flood Control District's clearing of debris in the vicinity of the bridge, floating debris (i.e., drift) can still be generated upstream.

As discussed previously, three (3) feet of freeboard at the bridge soffit is recommended in order to pass drift. Additionally, Pier nose extensions (also known as "debris fins" or "debris noses") are also recommended for the proposed bridge widening in order to align debris with the waterway opening and to avoid the accumulation of debris on bridge piers. The original bridge constructed in 1958 was constructed with pier nose extensions. When the bridge was widened in 1971, the configuration of the pier nose extensions was modified. The resulting pier nose extensions are shorter and the top of the sloped face is lower than originally constructed. The new pier nose extensions should meet the Federal Highway Administration's design guidelines outlined in HEC-9 (see attachment).

Bank Protection:

According to the *Mojave River Flood Plain Maintenance Plan*, the earthen levees in this area typically consist of sand and loosely compacted dirt overlaid with dumped rock. The existing levees in the vicinity of the Mojave River Bridge are armored with grouted riprap extending approximately 200 feet upstream and 100 feet downstream of the bridge. Impacts to the existing levees should be avoided, if possible. Any disturbances to the grouted riprap should be replaced and any new abutment work that extends beyond the existing riprap should be protected by new riprap. Any new riprap that may be required should be coordinated with the District.

Summary & Recommendations:

Table 4: Hydrologic Summary
Mojave River Bridge (Br. No. 54-0483)
Drainage Area: 513 mi^2

	Design Flood	**Base Flood**	**Overtopping Flood / Flood of Record**
Frequency	50-yr	100-yr	*N/A*
Discharge	25,500 cfs	30,900 cfs	*N/A*
Water Surface Elevation at Bridge	2700.1 ft	2700.9 ft	*N/A*

Flood plain data are based upon information available when the plans were prepared and are shown to meet federal requirements. The accuracy of said information is not warranted by the State and interested or affected parties should make their own investigation.

1. Three (3) feet of minimum freeboard is recommended in order to pass drift. The minimum required soffit elevation is 2703.1 ft.

2. Pier nose extensions at the upstream end of the pier walls are recommended as a means to mitigate for the high level of possible floating debris. The pier nose extensions should be designed as per the guidelines in HEC-9 (see attachment).

3. The foundations for the pier wall and pier nose extensions are to be placed below the potential scour elevation. See Table 3 for potential scour depths.

4. The abutment widening should be protected by riprap (i.e., rock slope protection). Coordinate with the District on any new rock slope protection that may be required. Stream channel velocities are provided in Table 2 for use in the rock slope protection design.

References:

Federal Emergency Management Agency, 1997. "Flood Insurance Study: San Bernardino County, California and Incorporated Areas,"

Federal Highway Administration, 2001. "Evaluating Scour at Bridges," Hydraulic Engineering Circular No. 18, Fourth Edition, Washington, D.C.

Federal Highway Administration, 2005. "Debris Control Structures, Evaluation and Countermeasures," Hydraulic Engineering Circular No. 9, Third Edition, Washington, D.C.

U.S. Army Corps of Engineers, 1997. "Mojave River Floodplain Maintenance Plan," Los Angeles District.

U.S. Geological Survey, 1982. "Guidelines For Determining Flood Flow Frequency", Bulletin #17B of the Hydrology Subcommittee.

ATTACHMENT: PIER NOSE EXTENSION GUIDELINES

(Also known as Debris Fin and Debris Nose)

Source: HEC-9, "Debris Control Structures, Evaluation and Countermeasures"

6.3.2 Debris Fins for Bridges

1. FUNCTION – Debris fins are thin walls installed upstream of the bridge parallel with the flow (Figure 5.35). Debris fins have been successfully used to align debris with the waterway opening and to avoid the accumulation of debris on bridge piers. They are used when the debris consists mostly of floating material. Fins have also been successful in reducing ice clogging by displacing ice sheets upward along the sloping top surface.

2. TYPE OF MATERIAL – Debris fins are usually concrete, although they have been constructed of steel and treated timber piling and bracing.

3. LOCATION AND ORIENTATION – Debris fins are usually located on the centerline of the bridge piers, and they should be carefully aligned with the flow in order to avoid increasing the projected pier width and a corresponding greater depth of pier scour. The upstream end of the fin should be rounded and sloped upward toward the bridge to reduce impact, turbulence, and the probability of gathering debris.

4. DIMENSIONS – The debris fin consists of a vertical and sloped section. The vertical section exists from the upstream face of the pier to 1.8 m (6 ft) upstream and has a minimum height of 0.76 m (2.5 ft) above the maximum water surface elevation for the design flood event. The sloped section has a height equal to the maximum water depth at the upstream end of the vertical section. The sloped section extends upstream a distance of twice the maximum water depth. The profile of the sloped section consists of a 3:1 sloped segment and a curved segment with a point of intersection located one-half of the maximum water depth above and downstream of the upstream end of the fin. The overall width of the debris fin transitions from the width of the bridge pier to a width of 0.3 m (1 ft) at the upstream end of the fin. The debris fin foundation must be sufficient to withstand the predicted scour depth.

Juan J Jauregui/D03/Caltrans/CAGov

06/26/2009 12:58 PM

To Asef Wardak/HQ/Caltrans/CAGov@DOT, Ryan Stiltz/HQ/Caltrans/CAGov@DOT
cc Ginger Lu/HQ/Caltrans/CAGov@DOT
bcc
Subject Fw: Scour evaluation for Mojave River Bridge 54-0483, EA# 08-355561

History: This message has been replied to.

Asef,
Attached are the Final Hydraulic Reports for the Mojave River Bridge on SR 101 (Br. No. 54-0483) and the West Frontage Road Bridge over Mojave River (Br. No. 54C-0661). I'd just like to point out that there was a revision to the thalweg elevation for Br. No. 54-0483, which in turn revised the scour elevation. The table below is the updated information:

Mojave River Bridge (Widen) **Br. No. 54-0486** Thalweg Elevation = 2689.0 ft		
Scour Type	**Scour Depth**	**Comments**
Degradation	N/A	No channel degradation observed in the past 50 years.
General Scour	0 ft	The Flood Control District maintains the channel bottom. No, flow contraction due to the
Local Pier Scour	6.0 ft	Assuming no debris accumulation due to pier nose extensions.
Local Abutment Scour	N/A	Embankments for the abutments are flush with the channel levees and protected by grouted riprap.
Total Potential Scour Depth	6.0 ft	
Total Potential Scour Elevation	2683.0 ft	

FHR_54-0483.pdf FHR-54C-0661.doc

Ryan,
I'm thinking of sending you a revised FHR for Br. No. 54-0483 so as to avoid any confusion in the future. What are your thoughts?

Juan Jauregui
Division of Engineering Services
Structure Hydraulics & Scour Mitigation
(916) 227-9476

----- Forwarded by Juan J Jauregui/D03/Caltrans/CAGov on 06/26/2009 12:34 PM -----

Steve Ng/HQ/Caltrans/CAGov

06/26/2009 10:13 AM

To Juan J Jauregui/D03/Caltrans/CAGov@DOT
cc Ginger Lu/HQ/Caltrans/CAGov@DOT, Asef Wardak/HQ/Caltrans/CAGov@DOT

Subject Fw: Scour evaluation for Mojave River Bridge 54-0483, EA# 08-355561

Juan,

Please contact Asef. He needs a scour depth to complete his Geotechnical recommendations. Also check with Ginger for the County structure while you are at it.

Thank you.

Steve Ng
Branch Chief
Structure Hydraulics and Hydrology
Scour Mitigation
916-227-8018

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----- Forwarded by Steve Ng/HQ/Caltrans/CAGov on 06/26/2009 10:10 AM -----

Asef Wardak/HQ/Caltrans/CAGov
06/26/2009 10:07 AM

To Steve Ng/HQ/Caltrans/CAGov@DOT
cc Angel Perez-Cobo/HQ/Caltrans/CAGov@DOT
Subject Re: Scour evaluation for Mojave River Bridge 54-0483, EA# 08-355561

Hello Steve,

I am following on my telephone discussion early today regarding the above bridge scour evaluation. As I said, we have a Preliminary Hydraulic Report for Advance Planning Study dated June 18, 1999, this report or memo describes a preliminary estimate of the potential local pier scour at this bridge site, and it is written by W.B. Lindsey and you at the Office of Hydraulics / Hydrology. If you a final Hydraulic Report for the above bridge location, please forward it to me?

We also need the Hydraulic Report for the West Frontage Road Bridge (New), Bridge # 54C-0661. This is a new bridge, and will be built to the west side of the existing Mojave River Bridge.

You have a good weekend.

Thanks

Asef Wardak
(916)227-1219
Office of Geotechnical Design South-2

APPENDIX C

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 4/23/2013

To: Asef Wardak / GDS-2

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 08-355561
GL 10-043

Revised Final test results as per your request.

AASHTO R18

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 10-043
Dist - EA: 08-355561
Report Date: April 23, 2013

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R10-001_05								100	97	91	75	53	33	19	11	9	6		NP		17.1	
R10-001_06								100	99	93	77	58	32	15	9	7	4		NP		21.0	
R10-001_07								100	96	75	49	28	13	7	4	3	1		NP		19.8	
R10-001_08								100	98	94	80	53	32	17	8	6	3		NP		19.9	
R10-001_09				100	92	83	79	78	73	63	47	31	17	10	7	2	2		NP		14.4	
R10-001_10				100	92	73	60	58	48	40	31	23	16	10	7	2	1		NP		11.9	
R10-001_11				100	96	92	88	86	76	62	41	25	17	11	7	2	2		NP		15.6	
R10-001_12					100	97	97	96	92	86	79	69	55	39	27	11	6	18	2		16.5	
R10-001_13								100	99	97	94	89	80	46	20	9	5		NP		20.2	
R10-001_14									100	96	89	80	70	51	27	11	6		NP		22.4	
R10-001_15								100	99	92	79	57	36	22	14	3	1		NP		19.3	
R10-001_16						100	98	97	91	82	69	53	36	22	15	6	4		NP		15.7	
R10-001_17								100	96	91	80	60	39	24	17	8	4		NP		16.3	
R10-001_18								100	99	96	87	73	57	39	25	7	2	21	6		15.8	
R10-001_19								100	95	91	83	74	63	46	31	9	4				16.8	
R10-001_20								100	97	91	77	59	41	29	21	11	6				17.7	
R10-001_21							100	99	94	86	69	49	33	22	16	9	5	27	9		17.0	
R10-001_22				100	96	96	95	93	86	80	71	58	43	30	22	9	5	20	4		13.1	
R10-001_23									100	98	91	76	58	40	28	10	3	22	7		15.4	
R10-001_24								100	99	96	87	71	54	38	28	8	3	23	6		16.0	
R10-001_25								100	95	89	75	57	44	34	28	17	7	32	16		13.5	
R10-001_26						100	99	98	92	82	66	49	36	27	22	15	10	36	18		15.1	
R10-001_27						100	96	95	91	86	74	56	39	26	19	12	9	24	7		14.5	
R10-001_28					100	98	97	97	95	92	85	74	57	41	31	15	9	22	6		15.4	
R10-001_29					100	98	97	96	88	74	58	44	30	21	16	10	5	23	4		15.3	
R10-001_30						100	98	97	89	75	60	46	35	26	22	15	9	34	17		13.4	
R10-001_31						100	99	98	91	80	62	46	33	25	20	12	8	31	17		16.6	
R10-001_32							100	98	87	76	63	48	34	24	19	9	6	26	10		13.9	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 10-043
Dist - EA: 08-355561
Report Date: April 23, 2013
Page: 2/3

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R10-001_33						100	97	96	88	76	60	44	31	21	17	9	5	25	11		15.8	
R10-001_34							100	99	94	85	72	58	44	33	27	17	13	36	19		13.3	
R10-002_04								100	99	91	69	46	31	18	10	3	1		NP		16.8	
R10-002_05								100	99	95	84	66	42	21	13	3	1		NP		21.0	
R10-002_06					100	98	98	97	94	86	62	39	23	11	6	2	1		NP		17.4	
R10-002_07					100	84	80	78	75	62	37	22	14	9	6	2	1		NP		14.4	
R10-002_08				100	95	89	89	87	85	78	54	33	21	10	6	2	1		NP		16.2	
R10-002_09				100	86	83	81	77	77	73	66	59	52	36	18	7	4	20	2		15.8	
R10-002_10				100	94	94	92	92	90	86	77	63	47	29	18	7	3				15.9	
R10-002_12						100	98	98	95	91	82	66	51	38	28	14	9	26	10		15.4	
R10-002_13									100	97	88	72	51	33	23	4	1		NP		13.3	
R10-002_14								100	99	94	82	65	46	33	25	5	1	19	3		16.8	
R10-002_15							100	99	98	96	87	72	53	39	30	12	8	21	4		27.4	
R10-002_16									100	98	90	71	48	31	22	5	1	22	5		20.3	
R10-002_17								100	99	97	85	66	49	35	25	5	1	26	9		18.2	
R10-002_18									100	97	87	69	47	32	23	4	1	24	7		17.1	
R10-002_19									100	98	89	70	50	33	23	5	1	21	3		16.1	
R10-002_20									100	99	90	73	52	35	27	9	3	29	14		16.4	
R10-002_21						100	99	99	98	95	83	67	49	32	22	8	4		NP		14.2	
R10-002_22									100	98	89	71	50	31	21	17	7	22	7		16.6	
R10-002_23									100	98	91	74	56	40	30	11	4	24	8		16.3	
R10-002_24						100	96	95	90	87	78	68	54	39	29	10	5	21	6		12.4	
R10-002_25					100	98	93	92	88	82	70	53	39	28	22	11	6	25	9		33.5	
R10-002_26						100	99	97	90	80	65	48	33	24	20	13	8	30	13		19.8	
R10-002_27				100	97	95	92	89	76	66	52	40	29	21	17	12	9	33	17		15.9	
R10-002_28									100	97	88	71	49	33	25	12	5				13.5	
R10-002_29									100	96	85	70	54	39	29	12	5	26	9		14.7	
R10-002_30								100	96	90	78	63	45	28	18	5	1		NP		14.5	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 10-043
Dist - EA: 08-355561
Report Date: April 23, 2013

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R10-002_31							100	99	97	92	82	66	45	26	16	6	3		NP		14.7	
R10-002_32						100	99	97	90	81	66	49	35	26	21	11	5	23	8		14.3	
R10-002_33				100	96	92	86	84	70	57	44	32	21	15	11	6	2		NP		18.6	
R10-002_34						100	97	96	88	73	56	38	24	16	12	5	3		NP		14.6	
R10-002_35					100	98	92	89	78	66	51	39	28	20	16	9	6	24	9		14.5	
R10-002_36				100	95	93	88	83	69	56	42	33	27	22	19	14	11	40	24		13.5	

APPENDIX D

State of California
Department of Transportation

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: ANGEL PEREZ-COBO
Senior Transportation Engineer
Office of Geotechnical Design South 2
Division of Engineering Services

Date: July 8, 2013

File: 08-SBD-15-PM43.93
Mojave River Bridge (New)
08-355561 (08 0000 0621)
Bridge No. 54C-0661

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services - MS 5
Office of Geotechnical Support

Subject: Driveability Study: Mojave River Bridge (New)

Introduction

Per the request of Geotechnical Design South 2, this Office performed a pile driveability analyses for the proposed installation of Caltrans' Standard Class 200 Steel Pipe Piles with a wall thickness of 0.5-inch at the above-referenced project. The study was requested by Mr. Asef Wardak of the Office of Geotechnical Design - South 2. Personnel from the Foundation Testing Branch (FTB) of the Office of Geotechnical Support performed the analyses utilizing the GRLWEAP™ computer program, Version 2010. This study analyzes the pile-driving systems based on three (3) subject hammers identified as Delmag D36-23, Delmag D46-32 and Delmag D62-02 diesel hammers.

Description of Piling

The new Mojave River Bridge project includes the installation of approximately 65 feet length Class 200 Alt "W" Pipe Piles. For the driveability study, steel yield strength fy of 45 ksi will be used in the analysis (based on Caltrans Standard Plans dated 2010). The required maximum design loading for the subject piling, bottom of footing (BOF) elevation, specified tip elevation, and penetration length at the subject locations are included Table 1.

Table 1. Piling Information

Location	Pile Type	Nominal Controlling Resistance		Estimated Bottom Of Footing Elevation (ft)	Specified Tip Elevation (ft)	Pile Penetration Length Analyzed (ft)
		Compression (kips)	Tension (kips)			
Abut 1	16" Dia. PP Class 200 Alt "W"	300	250	2702	2637	65
Pier 2	16" Dia. PP Class 200 Alt "W"	400*	250	2674	2609	65
Pier 3	16" Dia. PP Class 200 Alt "W"	370	250	2674	2609	65
Pier 4	16" Dia. PP Class 200 Alt "W"	370	250	2674	2609	65
Pier 5	16" Dia. PP Class 200 Alt "W"	400*	250	2674	2609	65
Abut 6	16" Dia. PP Class 200 Alt "W"	300	250	2701	2636	65

Notes: Information provided by Geotechnical Designer per Pile Data Table from Foundation Report as used in the analyses.
*Controlling Design

Subsurface Conditions and Soil Resistance Parameters

Based on the provided Log of Test Borings, Boring R-10-001 was used to characterize the subsurface conditions at Abutment 1, Boring B-7-01 for Pier 2, Boring B-5-01 for Pier 3 and Pier 4, Boring B-11-01 for Pier 5 and Boring R-10-002 for Abutment 6. According to the borings, the foundation materials encountered at the subject site consists of poorly graded to well-graded sand, silty sand, medium to very dense sand and sandy silt, fine to medium sand and sand with gravel. For a complete description of the subsurface conditions, please refer to the Log of Test Borings included in the Appendix. Table 2 presents the soil resistance parameters that were used in the analyses.

Table 2: Soil Resistance Parameters

PARAMETER TYPE	QUAKE	DAMPING
Skin	0.10 inch	0.10 sec/ft
Toe	0.13 inch	0.15 sec/ft

Pile Driving Resistance

When installing driven piles, the piles must overcome resistance to penetration developed by the soil. The driving resistance determines the size of the required impact hammer and the stress magnitude imparted to the subject pile by the driving system. An estimated driving resistance is necessary to perform a driveability study when investigating the potential for pile damage due to overstressing during driving. Driving resistance can be related to static axial capacity using set-up and relaxation factors. These factors are applied to various soil layers penetrated while driving the subject pile.

The maximum driving resistance generated in the analysis was based on information from the boring logs provided by the Geotechnical Designer. According to the Geotechnical Designer (per Foundation Report), the maximum nominal resistance in compression for the subject piling is calculated to be 400 kips (Pier 2 and Pier 5). The analyses and output values rely upon the following assumptions:

- The piles are assumed to plug during driving and therefore modeled to be driven as displacement piles.
- The gain/loss soil resistance factor of 0.8 for skin and 1.0 for toe were used in modeling the driving installations.
- Site-specific soil profiles from Borings R-10-001, B-7-01, B-5-01, B-11-01 and R-10-002 with design parameters were used.
- All hammers are assumed to be operating at a minimum of 80% efficiency.

Description of Pile Driving Systems

This study involves modeling the performance of three (3) selected hammer/driving systems to reflect the range of rated energies possibly appropriate for the installation of the subject piles to the specified tip elevations at each support.

The analyses was performed using GRLWEAP™ recommended, and default parameters. For each subject hammer, the analysis was performed with the hammer operating at an 80% rated efficiency for determining driving-behavior stresses imparted to the subject pile(s). The analysis for each hammer was utilized to demonstrate the predicted blow counts and corresponding

maximum compressive stresses expected during pile driving. Standard configurations for each driving system and related components were based upon information published in GRLWEAP™ literature and its hammer database. The hammer descriptions are listed in Table 3.

Table 3: Summary of Hammer Systems

Hammer Manufacturer	Delmag	Delmag	Delmag
Hammer Model	D36-23	D46-32	D62-02
Hammer Type*	Open End Diesel	Open End Diesel	Open End Diesel
Rated Energy*	88.5 ft-kips	122.2 ft-kips	152.5 ft-kips
Ram Weight*	7.9 kips	10.1 kips	13.7 kips
Maximum Rated Stroke*	13.0 ft	13.1 ft	12.7 ft
Helmet Weight*	3.6 kips	3.6 kips	3.6 kips

Notes: *Based on information from hammer database (GRLWEAP Version 2010).

Discussion of Results

Printouts and charts of the analyses depicting predicted relationships between ultimate capacities/driving resistances and driving stresses versus blow counts for each of the hammers are included in the Appendix. The results of the analyses for the three hammers used in this study based on the driving conditions modeled are summarized in Table 4, respectively.

Table 4. Summary of Results

Hammer Model No.	Blow Count within allowable limit at all support locations(1) (yes/no)	Driving Stress less than Allowable Compression Limit(2)
D36-23	yes	yes
D46-32	yes	yes
D62-02	yes	no

Notes: 1) Blow count allowable limit = 96 blows/ft;
2) Allowable compression driving stress equivalent to {(0.9 * fy) = 40.5 ksi

The GRLWEAP™ wave equation program is a one-dimensional analysis and does not consider buckling or bending of the pile due to non-uniform blows or localized stresses at the pile tip, or position of the hammer helmet with the pile-reinforcement/pile cushion which may occur during pile driving. Also, it has been observed in the field that significantly harder or softer driving could occur than the GRLWEAP™ predictions.

Summary

Based on the submitted information from Geotechnical Designers (OGDS2), this Office recommends OGDS2 staff review the output results from this driveability study for the new Mojave River Bridge to determine if the results are in accordance to the design requirements.

If you have any questions regarding this report, please contact Toua Vang at (916) 227-7243.

REGISTERED PROFESSIONAL ENGINEER
DOUGLAS E. BRITTSAN
No. GE2459
Exp. 9/30/14
GEOTECHNICAL
STATE OF CALIFORNIA

TOUA VANG
Transportation Engineer, Civil
Foundation Testing Branch
Office of Geotechnical Support

DOUGLAS E. BRITTSAN, G.E.
Senior Transportation Engineer
Foundation Testing Branch
Office of Geotechnical Support

Attachments

C: A. Wardak – OGDS2 (Email)
M. DeSalvatore - OGDS1 (Email)
R. Stiltz - SD (Email)
Geodog

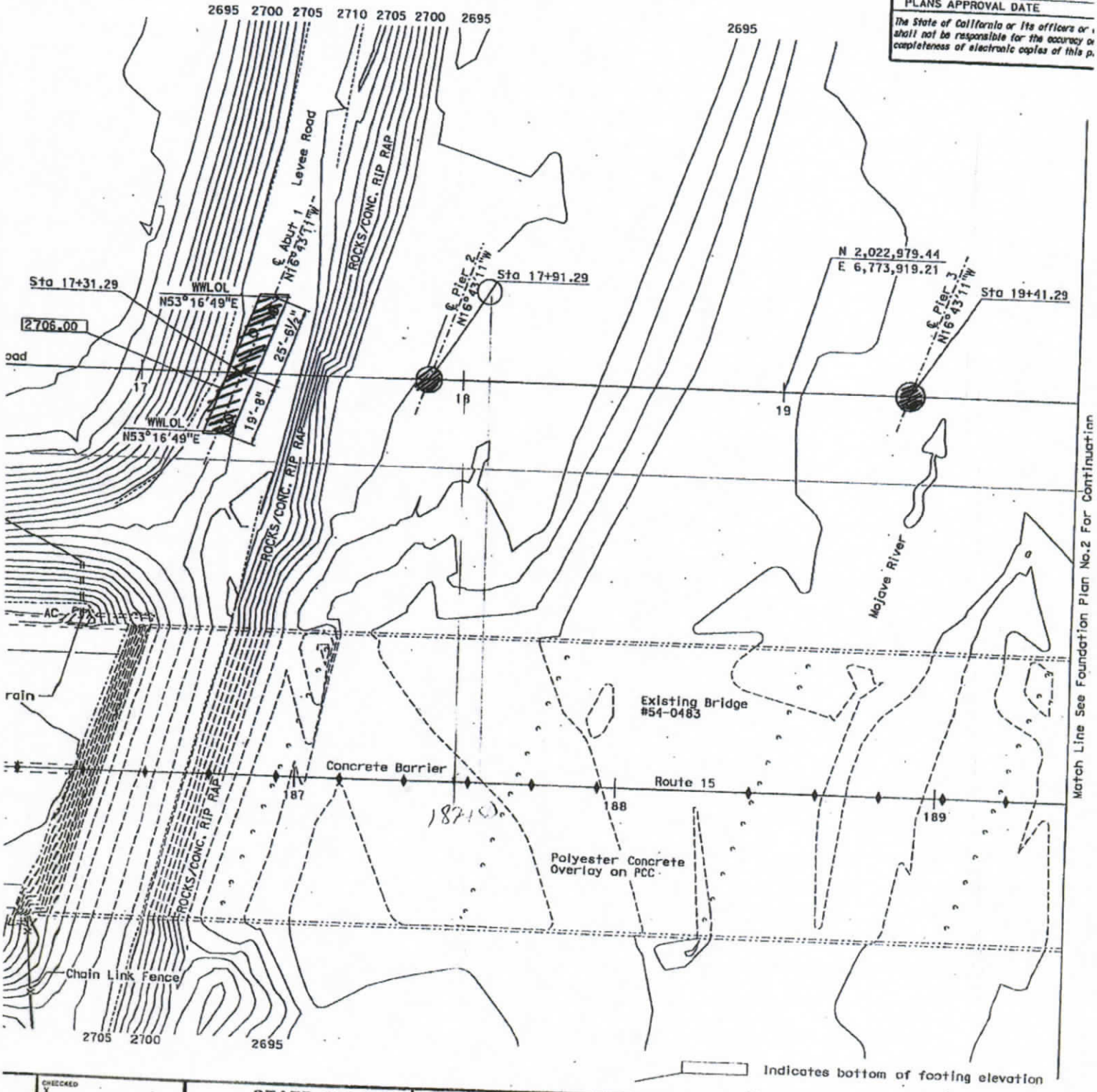
APPENDIX

DIST	COUNTY	ROUTE	P. TOT
08	SBd	15	

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

The State of California or its officers or shall not be responsible for the accuracy or completeness of electronic copies of this p.

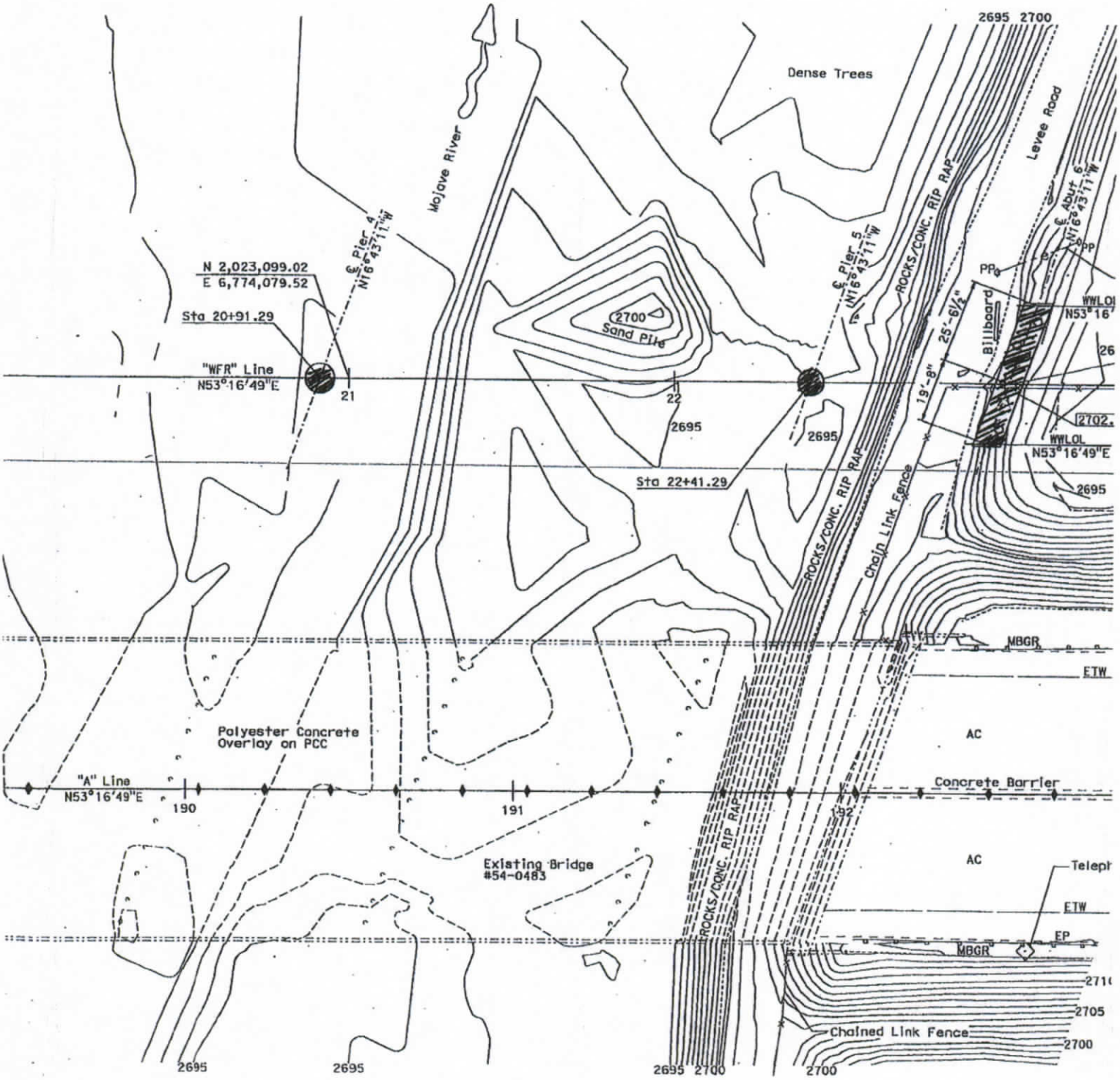


Indicates bottom of footing elevation

CHECKED X CHECKED X CHECKED X	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10	BRIDGE NO. 54C-0661 POST MILE 43.93	MOJAVE RIVER BRIDGE FOUNDATION PLAN N
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3		CU 08 EA 355561	DISREGARD PRINTS BEARING EARLIER REVISION DATES	REVISION DATES

CURVE DATA

Δ	T	L
30°26'44"	779.63	1522.39
30°26'44"	815.99	1593.41



IMINARY INVESTIGATION SECTION							
	PHOTOGRAMMETRY AS OF: X						
	SURVEYED	BY Dist./T.Gillett 2008	CHECKED	BY T.Gillet 10/2008			
Sheet	DRAFTED	BY J.Martinez 10/2008	CHECKED	BY T.Zolnikova 10/2008			

DESIGN	BY R. Stiltz	CHECKED X
DETAILS	BY G. Hallstrom	CHECKED X
QUANTITIES	BY X	CHECKED X

STATE OF
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

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ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 10 OF 11

UNIT: 3643 PROJ. No. & PHASE: 08000006211	CONTRACT No. 08-355561	BRIDGE No. 54-0483
VERT DATUM: NGVD 1929	Sheet	of

REGISTERED PROFESSIONAL ENGINEER Asef Wardak No. C61960 Exp. 9-30-13 CIVIL STATE OF CALIFORNIA

Caltrans Metric

DIST	COUNTY
08	SBd

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PLANS APPROVAL

The State of California shall not be responsible completeness of electron

For Boring locations in Imperial units, see table on "LOG OF TEST BORINGS 3 OF 11"

15.5 m Lt. Sta 58+39.0 C/L Rte. 15

B-11-01

820.54

GWS EL. 820.00 m 12-6-01

to d

95 mm

Well graded SAND (SW), loose, gray, dry to moist, fine to coarse SAND with scattered fine to coarse GRAVELS.

4 35

17 35

Poorly graded SAND (SP), medium dense, dark greenish gray, moist to wet, fine to medium grained.

ry loose, inantly

26 35

Becomes dense at elev. 815.72 m.

Well graded SAND (SW), very dense, greenish gray, moist to wet, with fine to coarse SAND and GRAVELS.

60 35

23 35

Poorly graded SAND (SP), dense, dark greenish gray, moist to wet, fine to medium grained, minor SILT.

k greenish race fine

30 35

44 35

Becomes very dense at elev. 809.63 m.

elev.

29 35

Become dense at elev. 808.1 m.

. 806.74 m,

19 35

Becomes medium dense, color changes to olive brown at elev. approx. 806.82 m.

34 35

Becomes very dense, color changes to yellowish brown at elev. approx. 805.30 m.

Scattered coarse SAND grains beginning at elev. approx. 804.69 m.

26 35

Becomes dense at elev. 803.53 m.

16 35

Becomes medium dense at elev. 802.10 m, fine to medium grained SAND.

32 35

Becomes dense at elev. approx. 800.48 m.

24 35

31 35

31 35

4.55 m.

42 35

Becomes very dense at elev. approx. 794.39 m.

Trace coarse SAND beginning at elev. approx. 794.02 m.

41 35

12-6-01

48 m Lt. Sta 58+79.0 C/L Rte. 15

B-1-01

821.49

23 35

108 mm

SILTY SAND (SM), medium dense, brown, grained, dry.

Well graded SAND (SW), medium dense, light gray, medium to coarse grained.

10 35

SILTY SAND (SM), loose, dark brown, trace CLAY,

11 35

Poorly graded SAND (SP), medium dense, bluish gr fine grained.

Trace coarse SAND at elev. 817.07 m. and scatter black organic lenses.

2 35

SILT (ML), very loose, dark bluish gray, wet

SILT with SAND (ML), very loose, bluish blac

20 35

Well-graded SAND (SW), medium dense, bluish gray with granitic GRAVELS and COBBLES, medium graine

31 35

Fine to coarse granitic GRAVELS at elev. 813.47

95 mm

E150 35

Well-graded SAND (SW) very dense, grayish brown, to wet, fine to medium grained.

46 35

Becomes dense at elev. 807.38 m, trace fine GRAV

E191 35

Becomes very dense at elev. 805.85 m.

41 35

Becomes dense at elev. 804.33 m.

Color change to yellowish brown at elev. 803.75

55 35

Becomes very dense at elev. 802.81 m.

39 35

Becomes dense at elev. 801.28 m, trace fine gran GRAVELS.

33 35

26 35

Becomes medium dense at elev. 798.23 m.

34 35

Becomes dense at elev. 796.71 m.

42 35

E104 35

Becomes very dense at elev. 793.66 m.

10-23-01

58+50 58+60 58+70 58+80

PI

H V

ALL DIMENSIONS ARE IN METE

S	FIELD INVESTIGATION BY: E. Neupert; F. Gerami	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483 KILOMETER POST 70.5	MOJAVE RIVER B LOG OF TE

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMI 9-15-03 1-18-05

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 8 OF 11

UNIT: 3643	CONTRACT No.	BRIDGE No.
PROJ. No. & PHASE: 08000006211	08-355561	54-0483
VERT DATUM: NGVD 1929	Sheet	of

REGISTERED PROFESSIONAL ENGINEER Asef Wardak No. C61960 Exp. 9-30-13 CIVIL STATE OF CALIFORNIA

Caltrans Metric

DIST 08 COU

REGISTE

PLANS A

The State of shall not be completeness

For Boring locations in Imperial units, see table on "LOG OF TEST BORINGS 3 OF 11"

17.5 m Lt. Sta 57+73.0 C/L Rte. 15

2691.1

B-5-01

820.27

.10 m

95 mm

Well graded SAND (SW), loose, light brownish gray, wet, fine to coarse SAND with trace fine GRAVELS.

Becomes medium dense at elev. 818.44 m.

Poorly graded SAND (SP), medium dense, dark gray, wet, fine to medium SAND, trace fine GRAVEL.

Becomes dense at elev. 815.39 m.

Well graded SAND (SW), dense, dark gray, wet, fine to coarse SAND with minor fine to coarse GRAVELS.

COBBLES and coarse GRAVELS at elev. 812.65 m.

Poorly graded SAND (SP), medium dense, dark greenish gray, moist, fine grained SAND, minor SILT, trace fine to coarse GRAVEL.

Becomes dense at elev. 810.82 m.

Becomes very dense at elev. 807.77 m.

Well graded SAND (SW), dense, dark grayish brown, moist to wet, fine to coarse SAND, trace fine GRAVELS.

Color changes to yellowish brown at elev. 801.98 m.

Becomes very dense at elev. 801.53 m.

Fine to medium grained SAND, no GRAVELS.

Becomes medium dense at elev. 798.63 m.

Becomes very dense at elev. 797.11 m.

Becomes dense at elev. 795.58 m.

Trace fine to coarse GRAVELS.

13 35 | 18 35 | 33 35 | E83 35 | 20 35 | 22 35 | 25 35 | 42 35 | 35 35 | 27 35 | 27 35 | 38 35 | 39 35 | 19 35 | 45 35 | 30 35 | 32 35 | 29 35

11-1-01

29 m Lt Sta 57+79.5 C/L Rte. 15

2691

B-6-01

2691

820.23

95 mm GWS EL 820.20 m 8-6-01

Well graded SAND (SW), loose, gray, wet, fine to

Poorly graded SAND with SILT (SP-SM), loose, dar grained SAND, trace fine to coarse GRAVEL.

Well graded SAND (SW), loose, gray, wet, fine to fine to coarse GRAVELS.

Becomes dense at elev. 813.92 m.

Poorly graded SAND with SILT (SP-SM), medium den fine grained SAND.

Color changes to dark greenish gray at elev. 811

Becomes dense at elev. 810.87 m.

Becomes very dense at elev. 807.83 m, SILT.

Well graded SAND (SW), very dense, dark greenish fine to coarse SAND and trace fine GRAVELS, mina

Becomes dense at elev. 803.25 m.

Becomes very dense at elev. 801.73 m, color chan brown, predominantly fine to medium grained SAND

Becomes medium dense at elev. 798.68 m.

Becomes very dense at elev. 797.16 m.

Becomes dense at elev. 795.63 m.

Becomes medium dense at elev. 794.11 m.

Becomes very dense at elev. 792.59 m.

6 35 | 5 35 | 6 35 | 21 35 | 18 35 | 25 35 | 28 35 | 47 35 | 41 35 | 42 35 | 28 35 | 73 35 | 26 35 | 19 35 | 36 35 | 27 35 | 18 35 | 48 35

11-7-01

70 57+80 57+90 58+00 58+10

ALL DIMENSIONS ARE

RVICES	FIELD INVESTIGATION BY: E. Neupert; F. Gerami	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483 KILOMETER POST 70.5	MOJAVE RIVI LOG OF

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 08 EA 355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DAT

:ations in Imperial units,
'LOG OF TEST BORINGS 3 OF 11"

DIVISION OF ENGINEERING SERVICES - MATERIALS AND GEOTECHNICAL SERVICES					
DIST.	COUNTY	ROUTE	POST MILE-TOTAL PROJECT	Sheet No.	Total Sheets
08	SBd	15			

REGISTERED CIVIL ENGINEER DATE

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 6 OF 11

UNIT: 3643	CONTRACT No.	BRIDGE No.
PROJ. No. & PHASE: 08000006211	08-355561	54-0483
VERT DATUM: NGVD 1929	Sheet	of

REGISTERED PROFESSIONAL ENGINEER
Asef Nardak
No. C61960
Exp. 9-30-13
CIVIL
STATE OF CALIFORNIA

Caltrans Metric

DIST	COUNTY
08	SBd

REGISTERED

PLANS APPRO

The State of Califo shall not be respon completeness of el

16.5 m Lt Sta 57+22.0 C/L Rte. 15

used B-7 + B-5 => for pier #4 L
O.G.E = 2691.4'
GWE = 2690.7
0.7 used

B-7-01

95 mm GWS EL. 820.20 11-8-01

Well graded SAND (SW), loose, gray, moist to wet, fine to coarse SAND, scattered fine to coarse GRAVELS.

Coarse GRAVEL clast at elev. 818.64 m.
Piece of concrete from elev. 818.41 to 817.97.

Poorly graded SAND (SP), medium dense, dark gray, moist, predominantly fine to medium grained SAND, minor SILT, trace fine GRAVELS.

Becomes very dense at elev. 814.22 m.

Well graded SAND (SW), medium dense, gray, wet, fine to coarse SAND.

Poorly graded SAND (SP), medium dense, dark greenish gray, moist to wet, predominantly fine to medium grained, minor SILT.

Becomes dense at elev. 809.65 m.

Becomes very dense at elev. 806.6 m.

Well graded SAND (SW), medium dense, dark greenish gray, moist to wet, fine to coarse SAND with scattered fine GRAVELS.

Trace coarse GRAVEL at elev. 803.71 m.
Become dense, color change to greenish gray at elev. 803.56 m.

Trace coarse GRAVELS at elev. 800.6 m.
Become dense, color changes to yellowish brown at elev. 800.45 m.

Becomes dense at elev. 797.46 m.

Becomes very dense at elev. 792.89 m.

11-8-01

40.0 m Lt Sta 57+26.5 C/L Rte. 15

B-20-01

820.94

300/0.27

11-7-01

100 200

0 57+30 57+40 57+50

PROFILE
HOR. 1:100
VER. 1:100
ALL DIMENSIONS ARE IN M

CES	FIELD INVESTIGATION BY: E. Neupert; F. Gerami	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES STRUCTURE DESIGN	BRIDGE NO. 54-0483 KILOMETER POST 70.5	MOJAVE RIVER LOG OF T

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 08
EA 355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES 9-15-03

REVISION DATES (PNE

R-10-002

2713.7'

3 6" Asphalt concrete pavement of road surface over well-graded SAND

Well-graded SAND with SILT (SW-SM); dense; yellowish brown; dry; few fin

Elev.	Depth	Sample	Description
2710	37	1.4	
2700	44	1.4	
	33	1.4	-moist.
2690	24	1.4	-medium dense; trace fine GRAVEL.
	19	1.4	GWS Elev 2688.5' 6-26-10 — Poorly-graded SAND with SILT (SP-SM); medium dens mostly fine and medium SAND; few fines; trace fin cementation; (NATIVE).
2680	15	1.4	Well-graded SAND with SILT (SW-SM); medium dense; gray; wet; few fine G
	19	1.4	-with GRAVEL; light gray.
2670	61	1.4	-very dense; dark gray.
	24	1.4	SILTY SAND with GRAVEL (SM); medium dense; gray; medium to fine SAND; coarse GRAVEL; little fines.
2660	52	1.4	SILTY SAND (SM); very dense; gray; well-graded SAND; few well-graded GRA strong cementation.
	40	1.4	-dense.
2650	26	1.4	SILTY SAND (SM); medium dense; gray; medium and fine SAND; little fines weak cementation.
	47	1.4	-very dense; yellowish brown; strong cementation.
2640	31	1.4	-dense; light brown; trace GRAVEL.
	35	1.4	-some fines.
2630	28	1.4	-brown; little fines.
	27	1.4	
2620	29	1.4	
	28	1.4	
2610	30	1.4	
	40	1.4	
2600	16	1.4	-medium dense; dark brown; weak to moderate cementation.
	26	1.4	-some fines.
2590	67	1.4	-very dense; strong cementation.
	48	1.4	-gray and light brown; well-graded SAND; moderate cementation.
2580	50	1.4	-light brown; few fine and coarse GRAVEL.
	72	1.4	-strong cementation.
2570	34	1.4	-dense; fine and medium SAND; little fines; medium cementation.
	23	1.4	-medium dense; some fines.
2560	62	1.4	-very dense; strong cementation.
	62	1.4	
2550	58	1.4	-few fine GRAVEL.
	66	1.4	Well-graded SAND with CLAY and GRAVEL (SW-SC); very dense; light brown; wet; some well-graded GRAVEL; little fines; strong cementation.
2540	51	1.4	-little fine GRAVEL.
	101	1.4	-light gray.
2530	104	1.4	Poorly-graded SAND with CLAY and GRAVEL (SP-SC); very dense; light gray; wet; coarse to medium SAND; some well-graded GRAVEL; little fines.

4-28-10
Terminated at Elev 2533.7'
ERi = 68%

PROFILE
Horiz: 1" = 20'
Vert: 1" = 10'

192+00 194+00

GEOTECHNICAL SERVICES
INVESTIGATION BY: Mardak

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH X

BRIDGE NO. 54-0483
POST MILE 43.93

MOJAVE RIVER BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 11

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

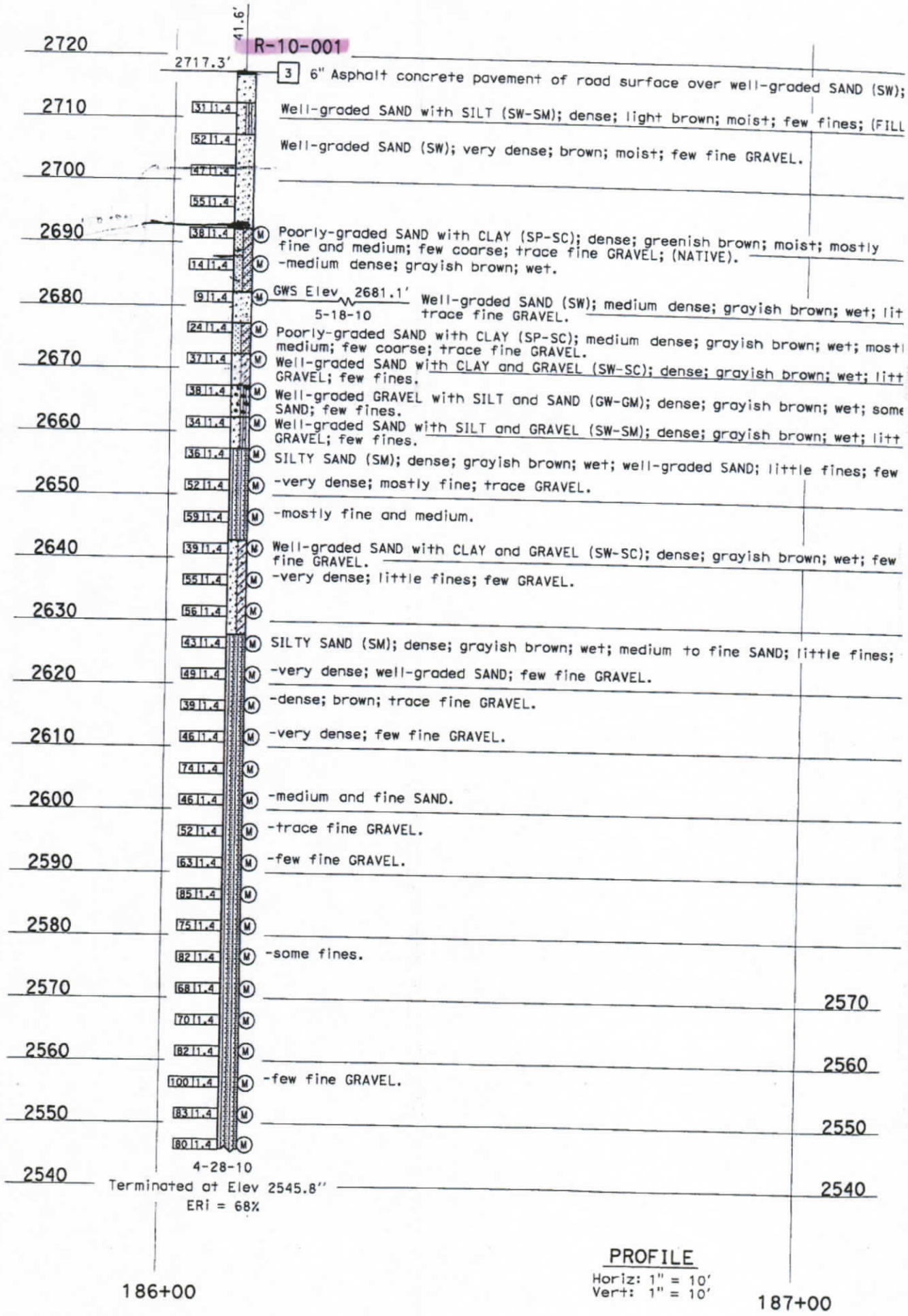
UNIT: 3643
PROJECT NUMBER & PHASE: 08000006211
CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 01-01-13 02-14-13 03-01-13

SHEET X OF X

USERNAME => 6116982 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 08:35



D GEOTECHNICAL SERVICES

D INVESTIGATION BY:

Ibrahim

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN

DESIGN BRANCH X

UNIT: 3643

PROJECT NUMBER & PHASE: 0800000211

BRIDGE NO. 54-0483

POST MILE 43.93

MOJAVE RIVER BRIDGE (WIDEN)

LOG OF TEST BORINGS 1 OF 11

DISREGARD PRINTS BEARING FAILED REVISION DATES

REVISION DATES

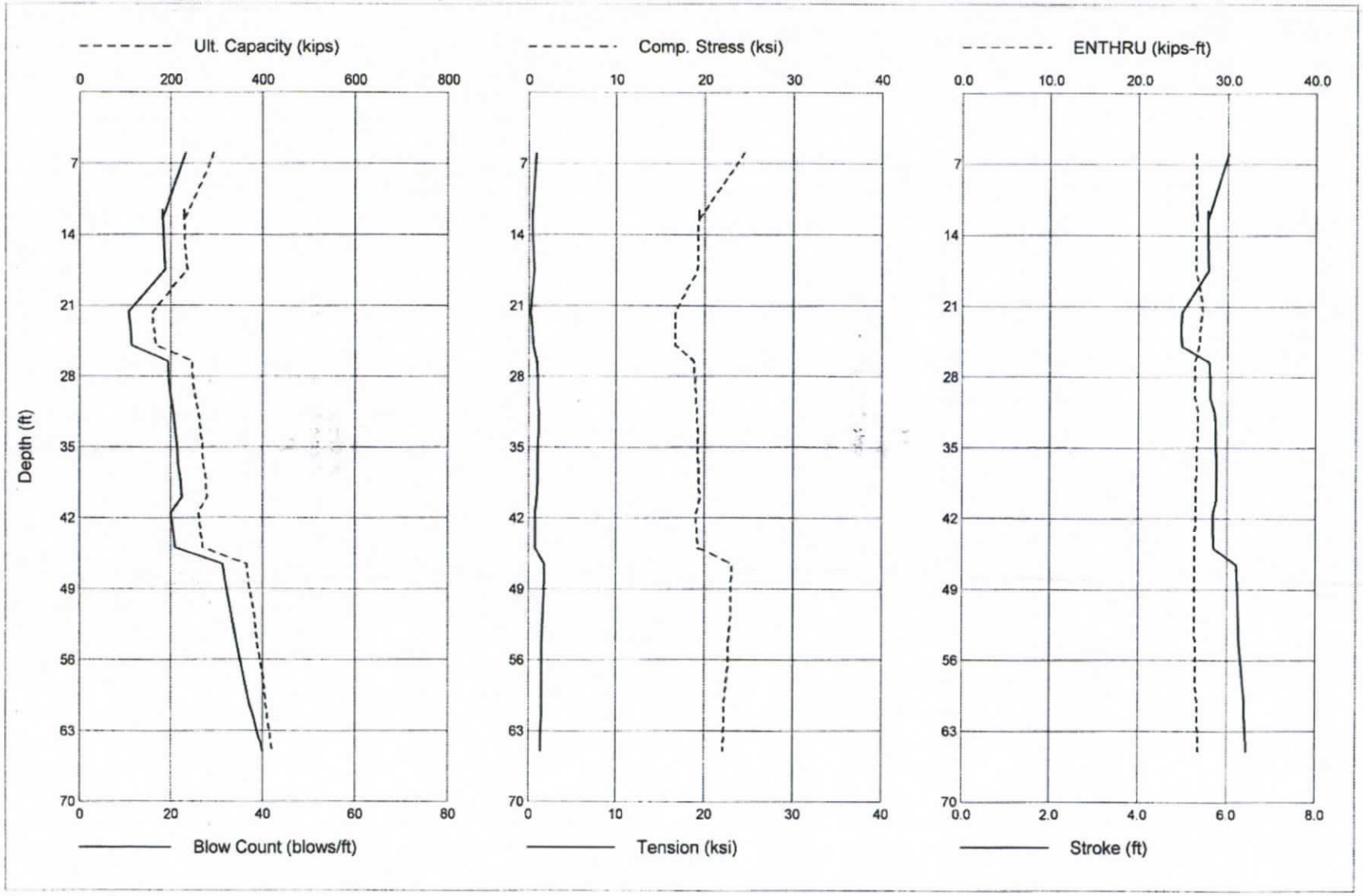
SHEET OF

RNAME => s116982 DATE PLOTTED => 01-MAR-2013 TIME PLOTTED => 08:35

California D.O.T.
Mojave River Bridge D36-23 (Abut 1)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Abut 1)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

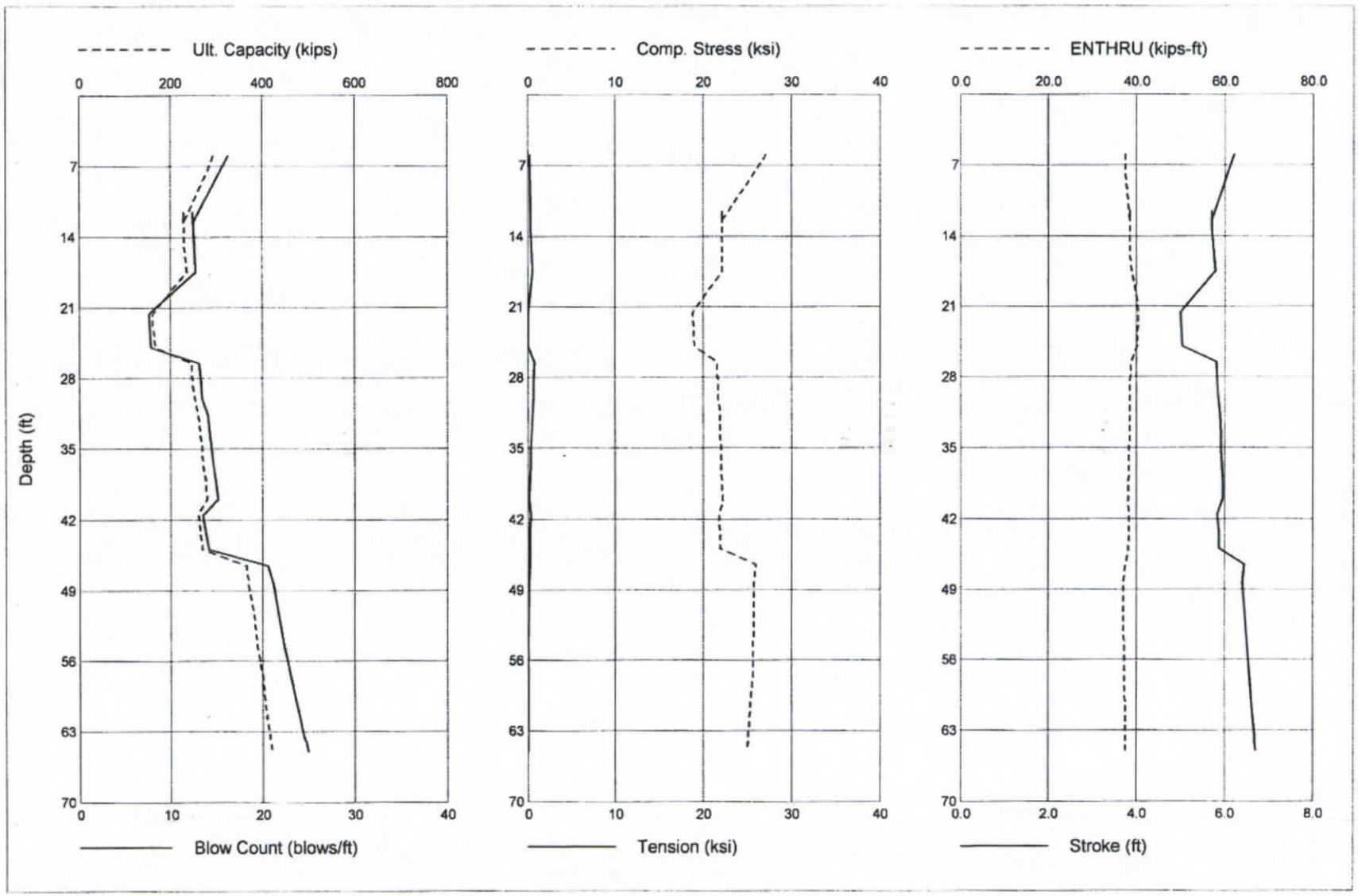
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	23.2	24.527	-0.903	6.02	26.5
12.5	229.3	7.6	221.6	18.2	19.313	-0.462	5.56	26.6
11.6	228.3	6.7	221.6	18.1	19.361	-0.427	5.55	26.6
13.4	230.3	8.7	221.6	18.3	19.298	-0.499	5.56	26.5
17.5	235.7	14.1	221.6	18.7	19.167	-0.689	5.58	26.5
21.6	160.6	20.7	140.0	10.9	16.686	-0.296	4.99	27.2
23.4	163.9	23.9	140.0	11.2	16.641	-0.436	4.96	26.9
25.0	166.7	26.8	140.0	11.4	16.697	-0.546	4.98	26.8
26.6	245.4	29.6	215.8	19.3	18.845	-1.056	5.61	26.4
28.4	248.8	33.0	215.8	19.6	18.909	-1.098	5.62	26.4
30.0	251.8	36.0	215.8	19.9	18.988	-1.133	5.63	26.4
31.6	260.8	39.1	221.6	20.6	19.196	-1.188	5.73	26.7
33.4	264.6	42.9	221.6	20.9	19.270	-1.183	5.74	26.7
35.0	267.9	46.2	221.6	21.3	19.302	-1.150	5.75	26.6
36.6	271.3	49.7	221.6	21.6	19.323	-1.111	5.76	26.6
38.4	275.5	53.9	221.6	22.1	19.387	-1.067	5.77	26.5
40.0	279.2	57.5	221.6	22.4	19.414	-1.025	5.78	26.5
41.6	259.7	61.4	198.3	20.0	19.088	-0.826	5.68	26.5
43.4	264.3	66.0	198.3	20.5	19.142	-0.794	5.69	26.4
45.0	268.4	70.1	198.3	20.9	19.211	-0.771	5.71	26.4
46.6	365.7	74.1	291.6	31.2	23.091	-1.878	6.21	26.4
48.4	370.6	79.0	291.6	31.9	22.972	-1.815	6.23	26.4
54.4	387.4	95.8	291.6	34.4	22.643	-1.589	6.29	26.5
60.4	405.9	114.3	291.6	37.2	22.263	-1.511	6.40	26.7
61.6	409.7	118.1	291.6	37.9	22.226	-1.502	6.41	26.7
63.4	416.0	124.4	291.6	39.0	22.183	-1.481	6.44	26.8
63.8	417.1	125.5	291.6	39.2	22.191	-1.478	6.44	26.8
64.1	418.2	126.6	291.6	39.5	22.176	-1.472	6.45	26.8
65.0	421.4	129.8	291.6	40.1	22.156	-1.458	6.46	26.8

Total Continuous Driving Time 31.00 minutes; Total Number of Blows 1496

California D.O.T.
Mojave River Br D46-32 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br D46-32 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

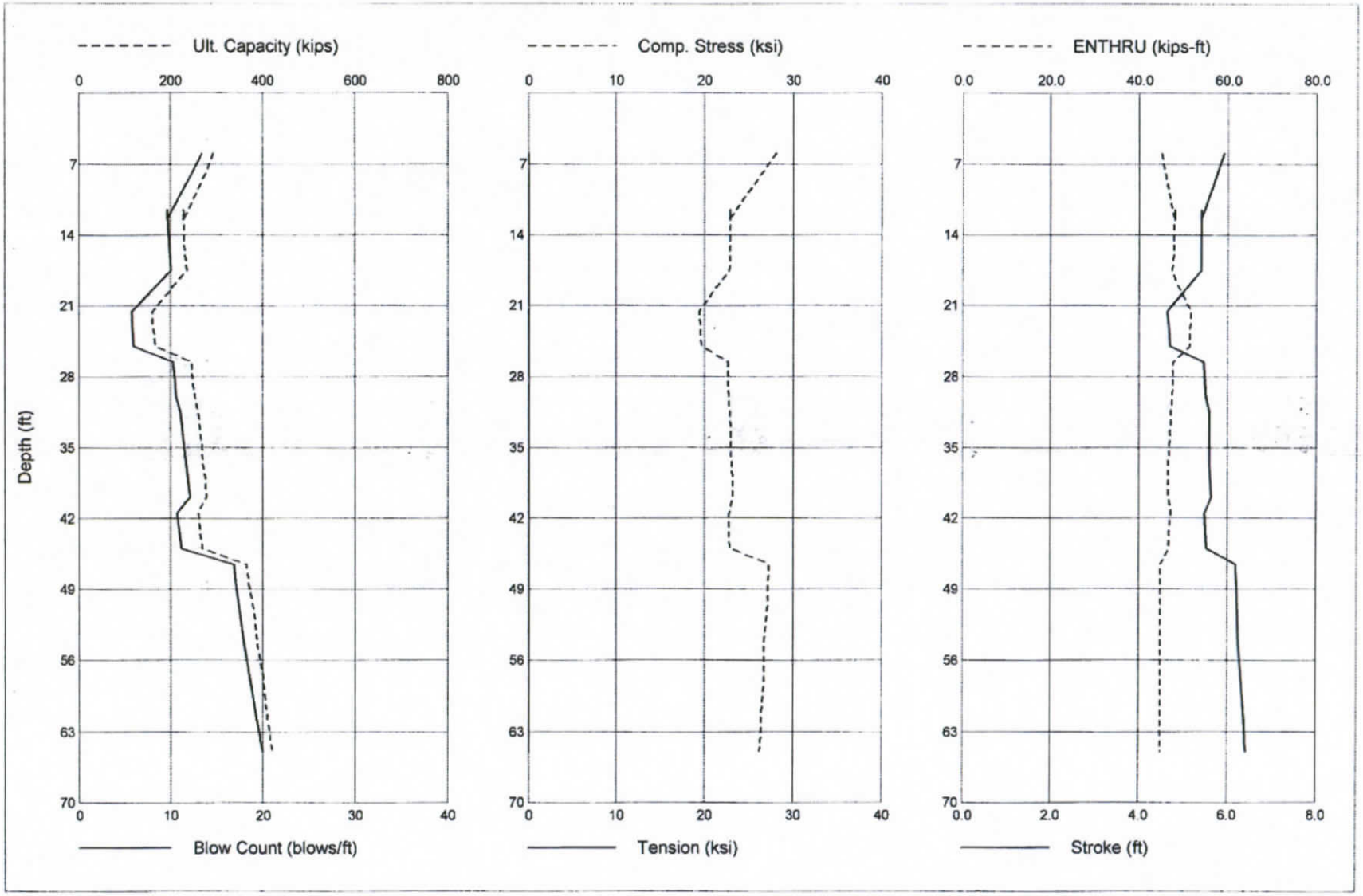
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	16.3	27.109	-0.223	6.22	37.5
12.5	229.3	7.6	221.6	12.5	22.111	-0.377	5.71	38.5
11.6	228.3	6.7	221.6	12.4	22.117	-0.343	5.70	38.5
13.4	230.3	8.7	221.6	12.5	22.118	-0.413	5.71	38.5
17.5	235.7	14.1	221.6	12.7	22.160	-0.588	5.80	38.9
21.6	160.6	20.7	140.0	7.6	18.817	0.000	5.01	40.4
23.4	163.9	23.9	140.0	7.7	18.907	0.000	5.03	40.3
25.0	166.7	26.8	140.0	7.8	18.998	0.000	5.05	40.2
26.6	245.4	29.6	215.8	13.1	21.605	-0.791	5.82	38.7
28.4	248.8	33.0	215.8	13.3	21.716	-0.708	5.84	38.6
30.0	251.8	36.0	215.8	13.4	21.722	-0.651	5.85	38.6
31.6	260.8	39.1	221.6	14.0	21.873	-0.550	5.90	38.5
33.4	264.6	42.9	221.6	14.2	21.952	-0.468	5.92	38.4
35.0	267.9	46.2	221.6	14.4	22.006	-0.394	5.93	38.3
36.6	271.3	49.7	221.6	14.6	22.080	-0.327	5.94	38.2
38.4	275.5	53.9	221.6	14.9	22.130	-0.238	5.96	38.1
40.0	279.2	57.5	221.6	15.1	22.195	-0.166	5.97	38.1
41.6	259.7	61.4	198.3	13.5	21.761	-0.323	5.84	38.3
43.4	264.3	66.0	198.3	13.8	21.907	-0.278	5.87	38.2
45.0	268.4	70.1	198.3	14.1	21.955	-0.223	5.88	38.1
46.6	365.7	74.1	291.6	20.6	26.004	-0.270	6.46	37.4
48.4	370.6	79.0	291.6	21.2	25.761	-0.204	6.42	37.0
54.4	387.4	95.8	291.6	22.3	25.603	0.000	6.52	37.2
60.4	405.9	114.3	291.6	23.7	25.315	0.000	6.63	37.4
61.6	409.7	118.1	291.6	24.0	25.255	0.000	6.65	37.4
63.4	416.0	124.4	291.6	24.5	25.146	0.000	6.68	37.4
63.8	417.1	125.5	291.6	24.6	25.097	0.000	6.68	37.5
64.1	418.2	126.6	291.6	24.8	25.104	0.000	6.69	37.4
65.0	421.4	129.8	291.6	25.0	25.017	0.000	6.70	37.5

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 991

California D.O.T.
Mojave River Br D62-02 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br D62-02 (Abut 1) North

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

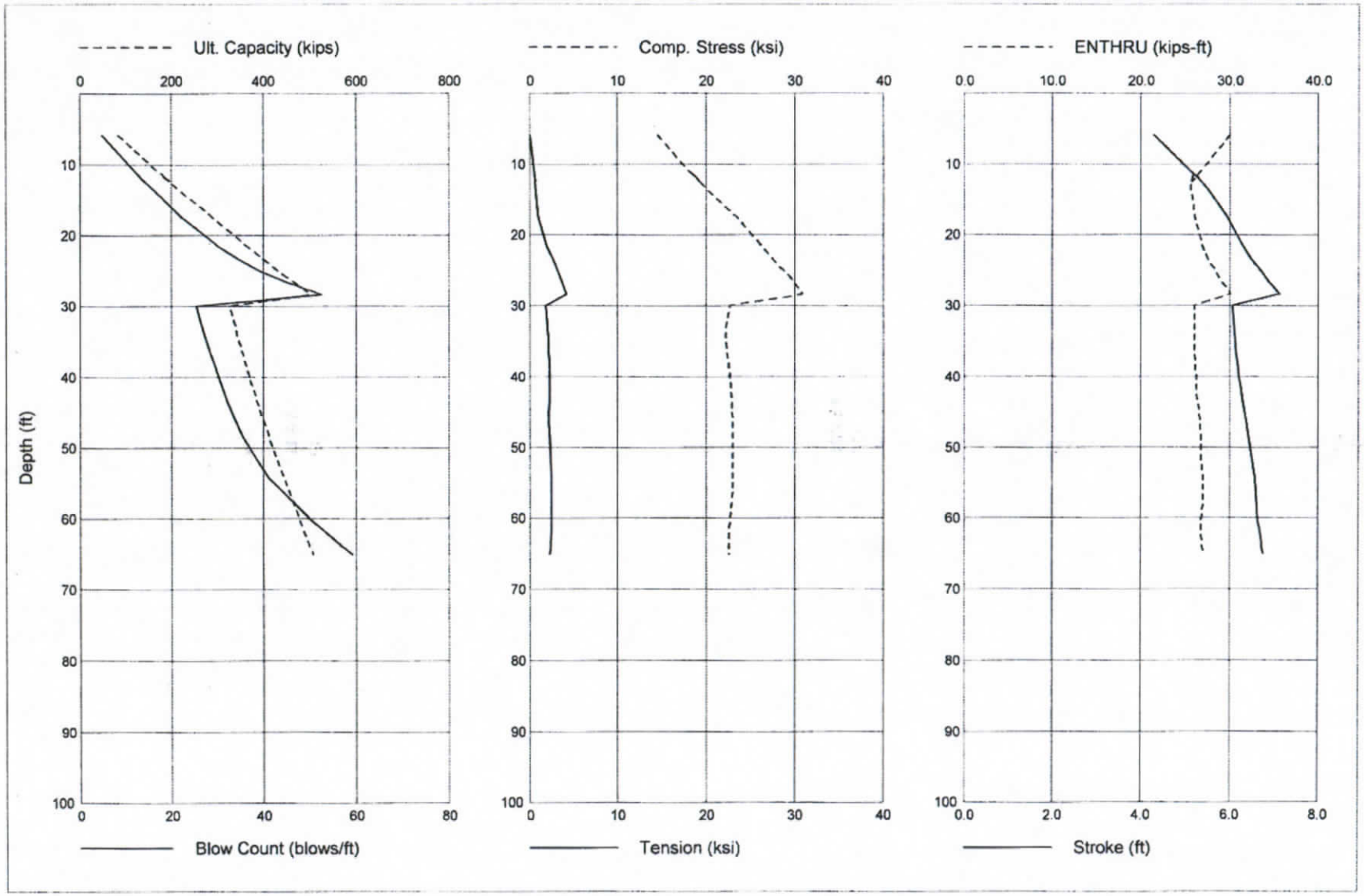
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	293.5	1.9	291.6	13.4	28.143	0.000	5.93	45.2
12.5	229.3	7.6	221.6	9.7	22.884	0.000	5.41	48.0
11.6	228.3	6.7	221.6	9.7	22.916	0.000	5.41	48.1
13.4	230.3	8.7	221.6	9.8	22.838	0.000	5.41	47.9
17.5	235.7	14.1	221.6	10.1	22.761	0.000	5.41	47.5
21.6	160.6	20.7	140.0	5.8	19.497	0.000	4.65	51.7
23.4	163.9	23.9	140.0	5.9	19.614	0.000	4.68	51.6
25.0	166.7	26.8	140.0	6.0	19.695	0.000	4.70	51.5
26.6	245.4	29.6	215.8	10.3	22.628	0.000	5.48	47.7
28.4	248.8	33.0	215.8	10.5	22.686	0.000	5.50	47.6
30.0	251.8	36.0	215.8	10.6	22.725	0.000	5.52	47.5
31.6	260.8	39.1	221.6	11.1	22.933	0.000	5.59	47.3
33.4	264.6	42.9	221.6	11.3	22.991	0.000	5.60	47.1
35.0	267.9	46.2	221.6	11.5	23.035	0.000	5.61	46.9
36.6	271.3	49.7	221.6	11.7	23.064	0.000	5.61	46.7
38.4	275.5	53.9	221.6	11.9	23.150	0.000	5.63	46.6
40.0	279.2	57.5	221.6	12.1	23.235	0.000	5.65	46.6
41.6	259.7	61.4	198.3	10.7	22.730	0.000	5.50	47.2
43.4	264.3	66.0	198.3	11.0	22.809	0.000	5.51	46.9
45.0	268.4	70.1	198.3	11.2	22.877	0.000	5.53	46.8
46.6	365.7	74.1	291.6	16.9	27.229	0.000	6.20	44.9
48.4	370.6	79.0	291.6	17.1	27.141	0.000	6.21	44.8
54.4	387.4	95.8	291.6	18.0	26.772	0.000	6.27	44.8
60.4	405.9	114.3	291.6	19.1	26.511	0.000	6.36	44.9
61.6	409.7	118.1	291.6	19.3	26.444	0.000	6.38	44.9
63.4	416.0	124.4	291.6	19.7	26.356	0.000	6.41	44.9
63.8	417.1	125.5	291.6	19.7	26.322	0.000	6.41	45.0
64.1	418.2	126.6	291.6	19.8	26.319	0.000	6.41	45.0
65.0	421.4	129.8	291.6	20.0	26.239	0.000	6.43	45.0

Total Continuous Driving Time 17.00 minutes; Total Number of Blows 794

California D.O.T.
Mojave River Br (D36-23) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D36-23) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

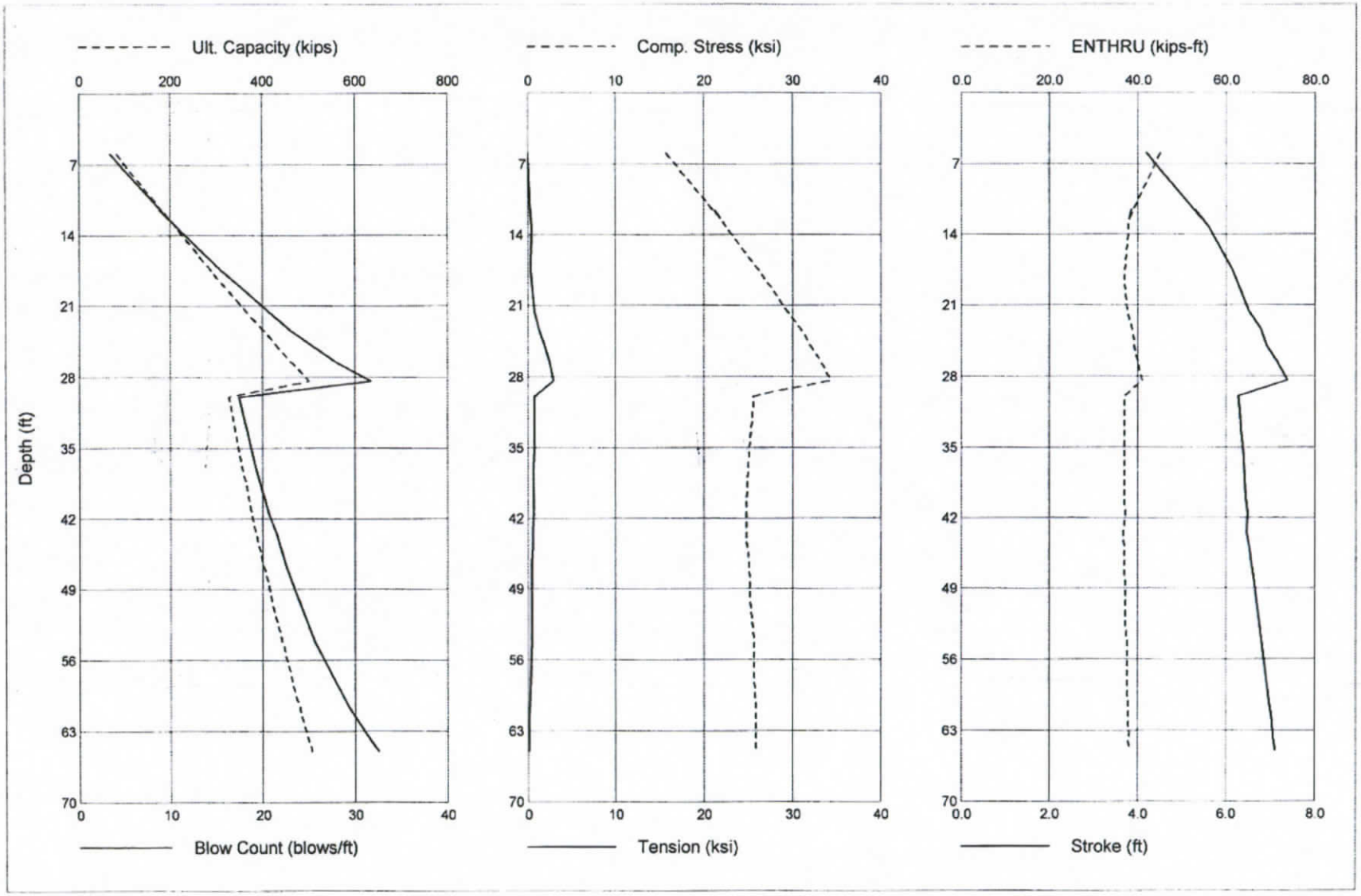
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	4.9	14.544	0.000	4.30	30.0
12.5	197.0	10.7	186.4	14.3	19.228	-0.710	5.37	25.8
11.6	180.5	9.0	171.6	12.8	18.655	-0.550	5.23	25.9
13.4	213.7	12.5	201.2	15.8	19.917	-0.746	5.49	25.7
17.5	288.3	22.2	266.1	22.1	23.406	-1.000	5.94	26.1
21.6	365.6	34.7	330.9	30.3	26.297	-2.002	6.31	26.9
23.4	401.8	41.3	360.5	35.0	27.613	-2.734	6.49	27.6
25.0	432.8	47.2	385.6	39.3	28.808	-3.236	6.71	28.4
26.6	464.2	53.6	410.6	44.7	29.832	-3.690	6.89	29.1
28.4	502.0	61.7	440.2	52.5	30.905	-4.208	7.13	30.1
30.0	327.3	67.5	259.8	25.4	22.661	-1.866	6.06	26.1
31.6	333.6	73.2	260.4	26.1	22.488	-1.985	6.08	26.1
33.4	341.3	80.2	261.2	26.9	22.261	-2.109	6.11	26.1
35.0	348.0	86.2	261.8	27.6	22.281	-2.190	6.14	26.1
36.6	354.9	92.4	262.5	28.4	22.396	-2.219	6.16	26.1
38.4	363.2	100.0	263.2	29.4	22.548	-2.240	6.19	26.2
40.0	370.4	106.6	263.9	30.2	22.665	-2.248	6.22	26.3
41.6	377.8	113.3	264.5	31.1	22.759	-2.263	6.26	26.3
43.4	386.8	121.5	265.3	32.2	22.837	-2.263	6.30	26.4
45.0	394.5	128.6	265.9	33.2	22.908	-2.235	6.35	26.6
46.6	402.4	135.8	266.5	34.2	22.964	-2.208	6.39	26.7
48.4	411.9	144.6	267.3	35.5	22.998	-2.275	6.44	26.8
54.4	444.2	174.5	269.7	41.2	22.952	-2.503	6.58	27.0
60.4	478.9	206.7	272.2	50.6	22.634	-2.522	6.65	26.8
61.6	485.8	213.1	272.6	52.7	22.607	-2.487	6.68	26.8
63.4	497.1	223.7	273.4	56.2	22.584	-2.407	6.73	26.9
63.8	499.1	225.6	273.5	56.9	22.579	-2.387	6.74	26.9
64.1	501.1	227.4	273.7	57.4	22.562	-2.367	6.74	26.9
65.0	506.9	232.9	274.0	59.3	22.544	-2.287	6.77	27.0

Total Continuous Driving Time 41.00 minutes; Total Number of Blows 1919

California D.O.T.
Mojave River Br (D46-32) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D46-32) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

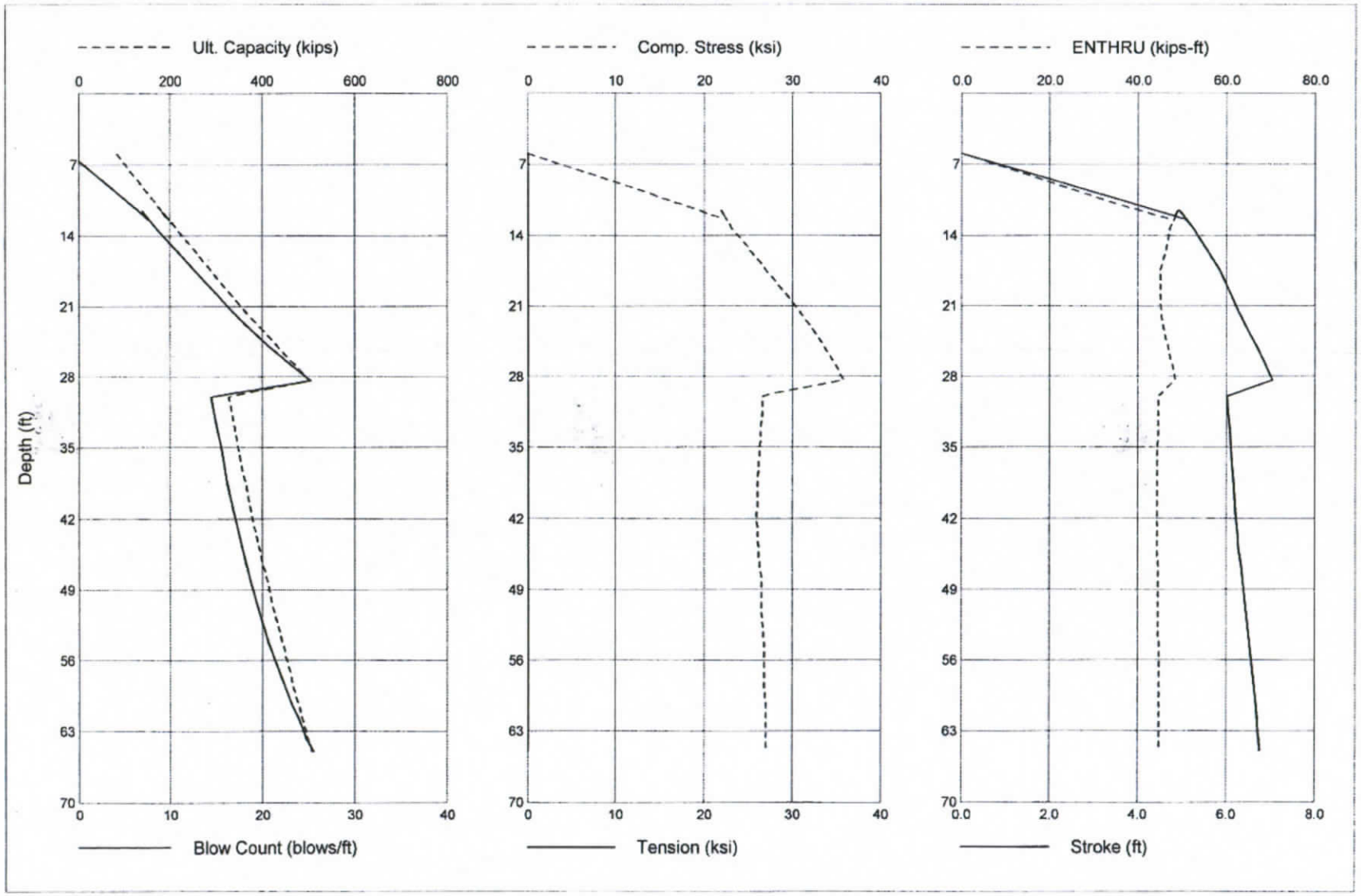
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	3.5	15.782	0.000	4.20	45.2
12.5	197.0	10.7	186.4	9.9	21.768	-0.413	5.46	38.1
11.6	180.5	9.0	171.6	8.9	21.162	-0.372	5.30	38.6
13.4	213.7	12.5	201.2	10.9	22.513	-0.431	5.62	37.8
17.5	288.3	22.2	266.1	15.6	26.176	-0.393	6.15	37.1
21.6	365.6	34.7	330.9	20.7	29.427	-0.823	6.51	37.6
23.4	401.8	41.3	360.5	23.0	31.003	-1.342	6.79	38.7
25.0	432.8	47.2	385.6	25.6	32.075	-1.972	6.93	39.2
26.6	464.2	53.6	410.6	28.1	33.242	-2.506	7.15	40.1
28.4	502.0	61.7	440.2	31.7	34.444	-2.924	7.39	41.1
30.0	327.3	67.5	259.8	17.5	25.581	-0.808	6.29	37.0
31.6	333.6	73.2	260.4	17.9	25.432	-0.821	6.32	37.0
33.4	341.3	80.2	261.2	18.4	25.290	-0.782	6.35	37.0
35.0	348.0	86.2	261.8	18.8	25.141	-0.780	6.38	37.0
36.6	354.9	92.4	262.5	19.2	25.062	-0.745	6.40	37.0
38.4	363.2	100.0	263.2	19.7	24.932	-0.735	6.44	37.1
40.0	370.4	106.6	263.9	20.2	24.837	-0.698	6.46	37.1
41.6	377.8	113.3	264.5	20.7	24.756	-0.666	6.50	37.2
43.4	386.8	121.5	265.3	21.5	24.782	-0.623	6.48	36.8
45.0	394.5	128.6	265.9	22.0	24.945	-0.568	6.54	37.0
46.6	402.4	135.8	266.5	22.5	25.092	-0.513	6.59	37.1
48.4	411.9	144.6	267.3	23.2	25.278	-0.493	6.64	37.2
54.4	444.2	174.5	269.7	25.8	25.684	-0.475	6.82	37.6
60.4	478.9	206.7	272.2	29.2	25.826	-0.280	6.99	37.8
61.6	485.8	213.1	272.6	30.0	25.873	-0.196	7.02	37.9
63.4	497.1	223.7	273.4	31.3	25.826	-0.160	7.08	38.0
63.8	499.1	225.6	273.5	31.6	25.835	-0.161	7.08	38.0
64.1	501.1	227.4	273.7	31.8	25.844	-0.161	7.09	37.9
65.0	506.9	232.9	274.0	32.6	25.815	-0.162	7.11	38.0

Total Continuous Driving Time 27.00 minutes; Total Number of Blows 1232

California D.O.T.
Mojave River Br (D62-02) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Br (D62-02) Pier2

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

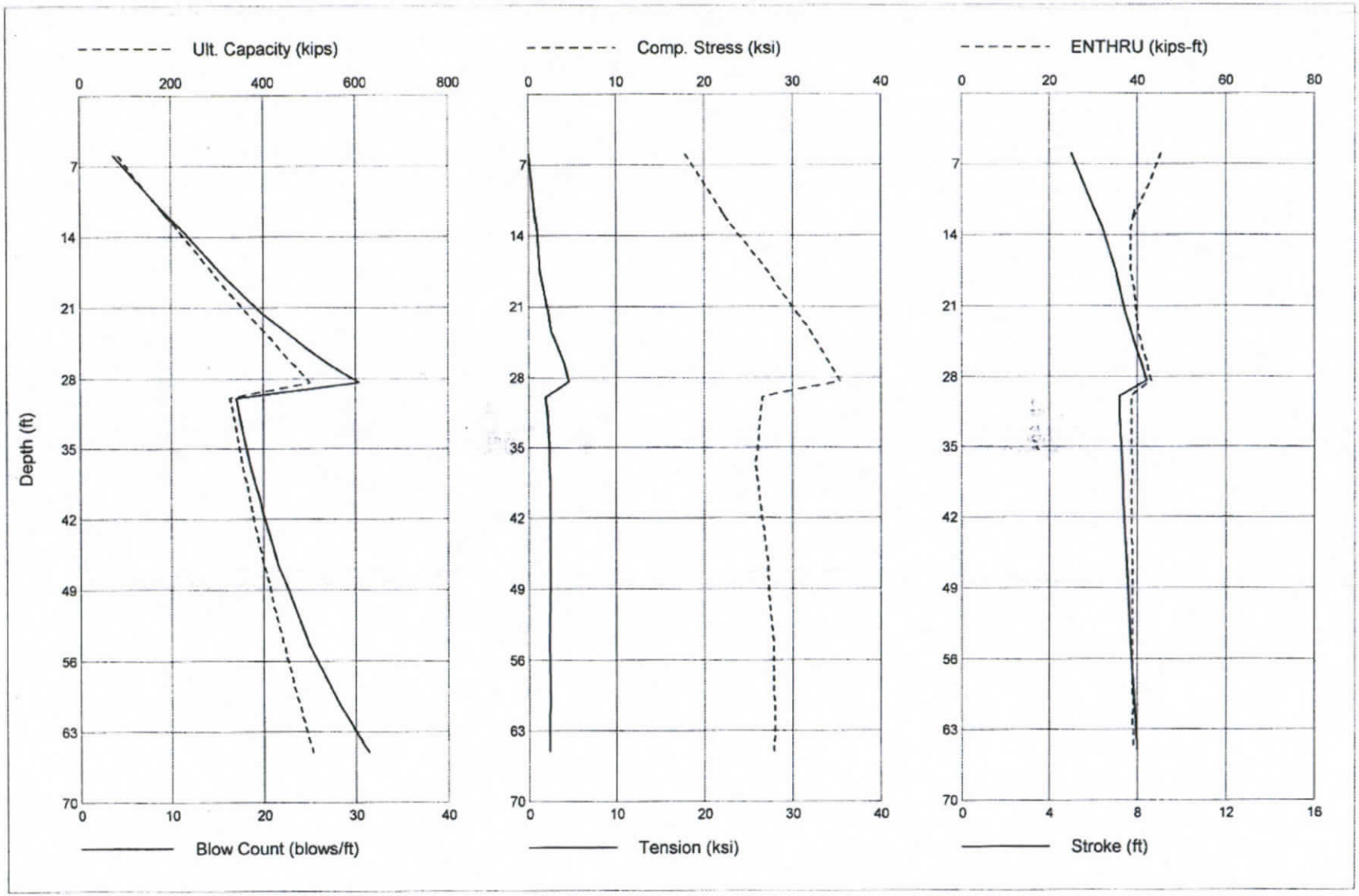
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	-1.0	0.000	0.000	0.00	0.0
12.5	197.0	10.7	186.4	7.7	22.487	0.000	5.11	48.2
11.6	180.5	9.0	171.6	6.9	21.928	0.000	4.94	49.1
13.4	213.7	12.5	201.2	8.6	23.116	0.000	5.25	47.2
17.5	288.3	22.2	266.1	12.7	27.027	0.000	5.85	45.1
21.6	365.6	34.7	330.9	16.9	30.837	0.000	6.29	45.3
23.4	401.8	41.3	360.5	18.9	32.363	0.000	6.49	46.0
25.0	432.8	47.2	385.6	20.7	33.574	0.000	6.68	46.8
26.6	464.2	53.6	410.6	22.7	34.702	0.000	6.85	47.6
28.4	502.0	61.7	440.2	25.3	35.933	0.000	7.06	48.5
30.0	327.3	67.5	259.8	14.4	26.640	0.000	6.02	44.7
31.6	333.6	73.2	260.4	14.7	26.578	0.000	6.05	44.7
33.4	341.3	80.2	261.2	15.1	26.427	0.000	6.08	44.6
35.0	348.0	86.2	261.8	15.5	26.289	0.000	6.11	44.5
36.6	354.9	92.4	262.5	15.8	26.183	0.000	6.14	44.5
38.4	363.2	100.0	263.2	16.2	26.118	0.000	6.17	44.5
40.0	370.4	106.6	263.9	16.6	26.055	0.000	6.20	44.5
41.6	377.8	113.3	264.5	17.0	25.938	0.000	6.22	44.5
43.4	386.8	121.5	265.3	17.5	26.043	0.000	6.26	44.4
45.0	394.5	128.6	265.9	17.9	26.170	0.000	6.29	44.5
46.6	402.4	135.8	266.5	18.3	26.325	0.000	6.34	44.6
48.4	411.9	144.6	267.3	18.8	26.472	0.000	6.39	44.7
54.4	444.2	174.5	269.7	20.7	26.851	0.000	6.54	45.0
60.4	478.9	206.7	272.2	23.2	27.022	0.000	6.68	45.0
61.6	485.8	213.1	272.6	23.8	27.015	0.000	6.70	45.0
63.4	497.1	223.7	273.4	24.7	27.034	0.000	6.74	45.0
63.8	499.1	225.6	273.5	24.8	27.031	0.000	6.75	45.0
64.1	501.1	227.4	273.7	25.0	27.029	0.000	6.75	45.0
65.0	506.9	232.9	274.0	25.6	27.024	0.000	6.78	45.0

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 970

California D.O.T.
Mojave River Bridge D36-23 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

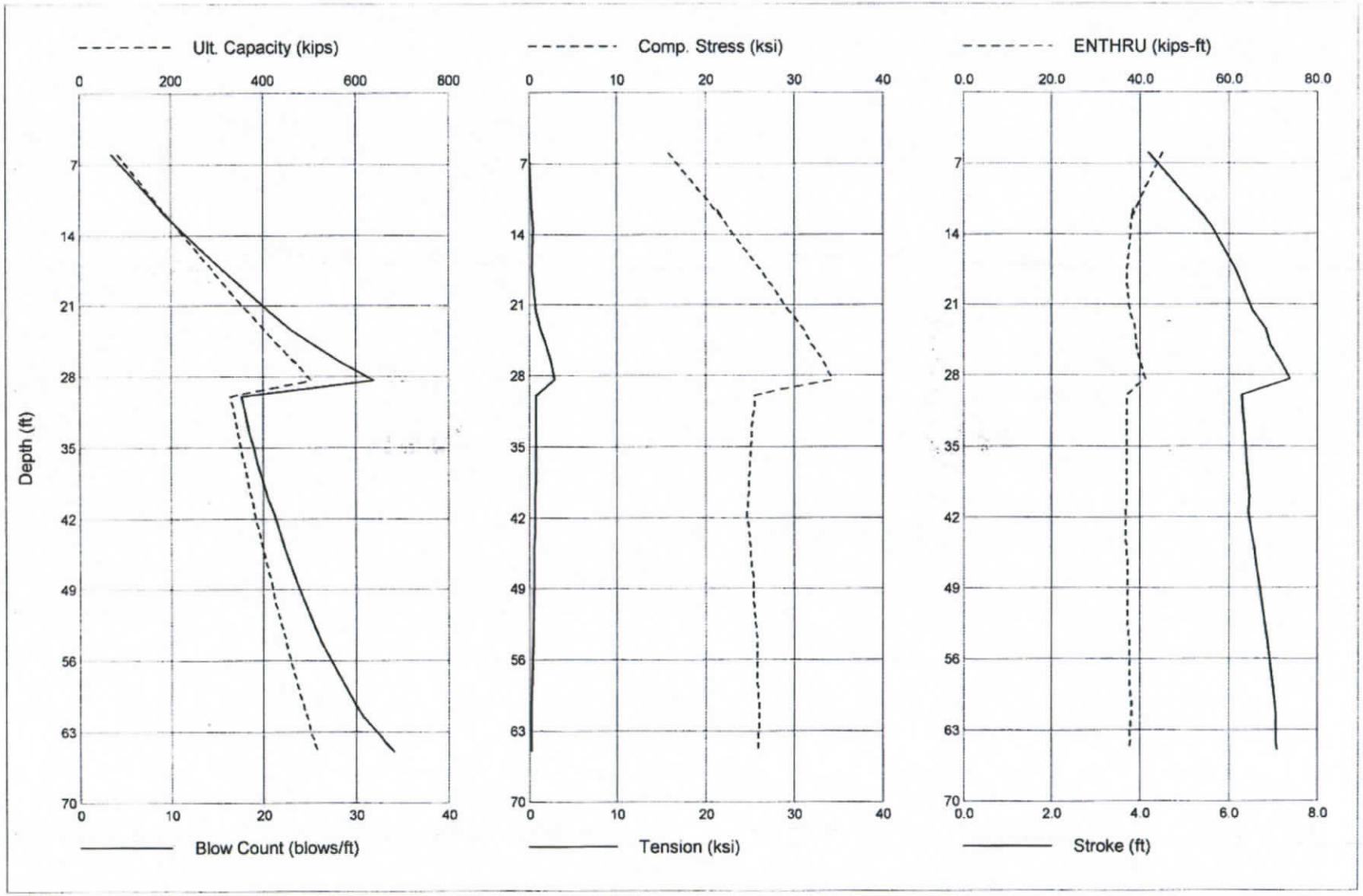
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	3.7	17.917	0.000	5.03	45.4
12.5	197.0	10.7	186.4	10.2	22.594	-0.848	6.24	38.9
11.6	180.5	9.0	171.6	9.2	21.948	-0.674	6.08	39.3
13.4	213.7	12.5	201.2	11.2	23.434	-1.022	6.40	38.6
17.5	288.3	22.2	266.1	15.3	27.240	-1.357	7.00	38.6
21.6	365.6	34.7	330.9	19.9	30.467	-2.288	7.46	39.7
23.4	401.8	41.3	360.5	22.4	31.919	-2.652	7.69	40.3
25.0	432.8	47.2	385.6	24.7	33.090	-3.359	7.91	41.0
26.6	464.2	53.6	410.6	27.1	34.134	-4.096	8.15	42.1
28.4	502.0	61.7	440.2	30.4	35.504	-4.649	8.42	43.1
30.0	327.3	67.5	259.8	17.1	26.592	-2.025	7.17	38.7
31.6	333.6	73.2	260.4	17.4	26.446	-2.154	7.20	38.7
33.4	341.3	80.2	261.2	17.8	26.232	-2.296	7.24	38.7
35.0	348.0	86.2	261.8	18.2	26.054	-2.399	7.27	38.8
36.6	354.9	92.4	262.5	18.6	25.916	-2.453	7.30	38.9
38.4	363.2	100.0	263.2	19.1	26.080	-2.486	7.34	38.8
40.0	370.4	106.6	263.9	19.6	26.277	-2.498	7.38	38.8
41.6	377.8	113.3	264.5	20.0	26.523	-2.524	7.41	38.8
43.4	386.8	121.5	265.3	20.6	26.776	-2.529	7.46	38.8
45.0	394.5	128.6	265.9	21.1	27.029	-2.519	7.49	38.9
46.6	402.4	135.8	266.5	21.6	27.245	-2.530	7.53	39.0
48.4	411.9	144.6	267.3	22.4	27.401	-2.501	7.57	38.9
54.4	444.2	174.5	269.7	25.0	27.870	-2.448	7.71	38.9
60.4	478.9	206.7	272.2	28.3	28.021	-2.475	7.88	39.1
61.6	485.8	213.1	272.6	29.1	28.006	-2.440	7.90	39.0
63.4	497.1	223.7	273.4	30.3	27.970	-2.408	7.96	39.1
63.8	499.1	225.6	273.5	30.6	27.965	-2.390	7.97	39.1
64.1	501.1	227.4	273.7	30.7	27.946	-2.397	7.98	39.2
65.0	506.9	232.9	274.0	31.4	27.890	-2.356	8.00	39.2

Total Continuous Driving Time 28.00 minutes; Total Number of Blows 1197

California D.O.T.
Mojave River Bridge D46-32 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000



California D.O.T.
Mojave River Bridge D46-32 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.833 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.6	1.8	82.8	3.5	15.793	0.000	4.20	45.2
12.5	197.5	11.1	186.4	9.9	21.760	-0.416	5.47	38.1
11.6	180.9	9.3	171.6	8.9	21.231	-0.375	5.31	38.5
13.4	214.2	13.0	201.2	10.9	22.524	-0.434	5.62	37.8
17.5	289.2	23.2	266.1	15.6	26.191	-0.400	6.16	37.1
21.6	367.0	36.1	330.9	20.7	29.413	-0.849	6.53	37.7
23.4	403.5	43.0	360.5	23.0	31.085	-1.379	6.83	39.0
25.0	434.8	49.2	385.6	25.7	32.071	-2.021	6.94	39.2
26.6	466.4	55.9	410.6	28.3	33.244	-2.551	7.16	40.1
28.4	504.5	64.3	440.2	31.9	34.397	-2.971	7.40	41.2
30.0	330.0	70.3	259.8	17.7	25.563	-0.831	6.31	37.1
31.6	336.6	76.2	260.4	18.1	25.447	-0.838	6.33	37.1
33.4	344.6	83.5	261.2	18.5	25.258	-0.808	6.36	37.1
35.0	351.6	89.8	261.8	19.0	25.098	-0.809	6.39	37.0
36.6	358.7	96.3	262.5	19.4	24.999	-0.779	6.42	37.1
38.4	367.4	104.1	263.2	20.0	24.905	-0.766	6.45	37.1
40.0	374.8	111.0	263.9	20.5	24.792	-0.729	6.48	37.1
41.6	382.5	118.0	264.5	21.2	24.716	-0.719	6.46	36.7
43.4	391.8	126.5	265.3	21.8	24.925	-0.645	6.52	36.9
45.0	399.8	133.9	265.9	22.3	25.103	-0.588	6.58	37.1
46.6	408.0	141.4	266.5	22.9	25.252	-0.554	6.63	37.2
48.4	417.9	150.6	267.3	23.6	25.448	-0.562	6.69	37.3
54.4	451.4	181.7	269.7	26.4	25.862	-0.528	6.87	37.7
60.4	487.4	215.3	272.2	30.0	26.039	-0.315	7.05	38.1
61.6	494.5	221.9	272.6	30.8	26.054	-0.239	7.08	38.1
63.4	506.3	233.0	273.4	32.7	25.982	-0.249	7.07	37.7
63.8	508.4	234.9	273.5	33.0	25.975	-0.252	7.07	37.7
64.1	510.5	236.8	273.7	33.2	25.957	-0.271	7.08	37.8
65.0	516.5	242.5	274.0	34.1	25.927	-0.263	7.10	37.7

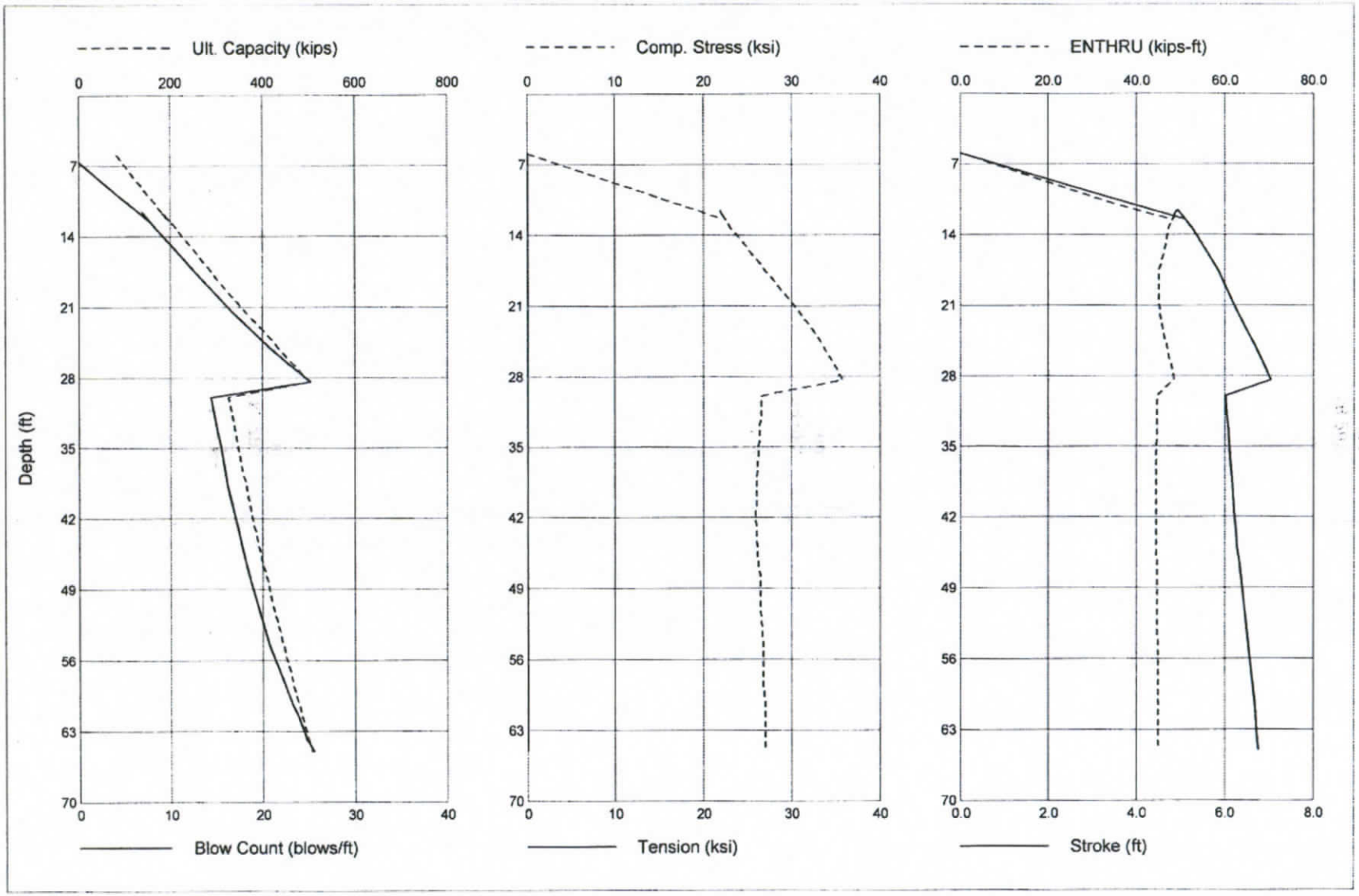
Total Continuous Driving Time 27.00 minutes; Total Number of Blows 1250

25.957

California D.O.T.
Mojave River Bridge D62-02 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 Pier3/4

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

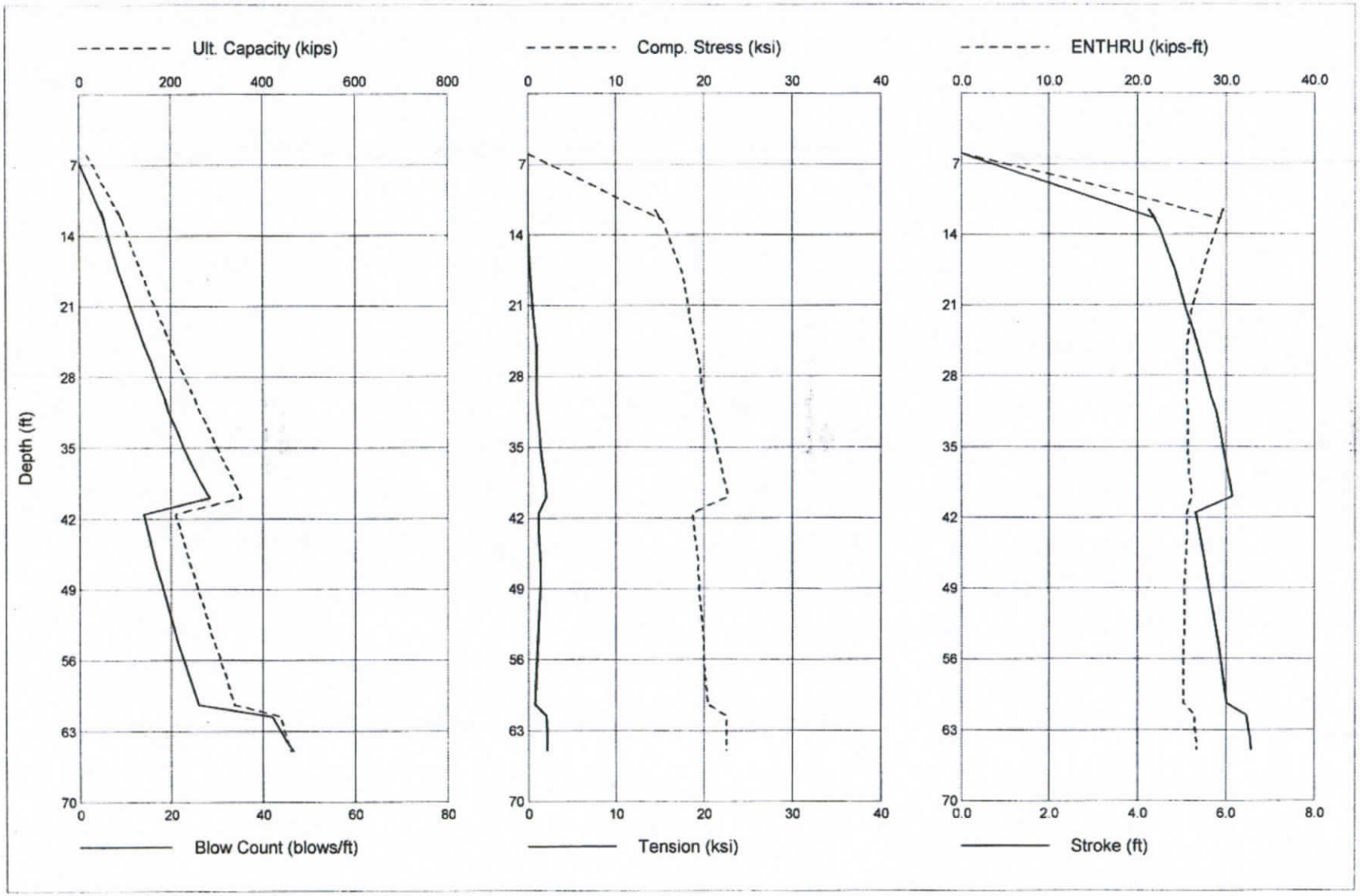
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	84.5	1.7	82.8	-1.0	0.000	0.000	0.00	0.0
12.5	197.0	10.7	186.4	7.7	22.487	0.000	5.11	48.2
11.6	180.5	9.0	171.6	6.9	21.928	0.000	4.94	49.1
13.4	213.7	12.5	201.2	8.6	23.116	0.000	5.25	47.2
17.5	288.3	22.2	266.1	12.7	27.027	0.000	5.85	45.1
21.6	365.6	34.7	330.9	16.9	30.837	0.000	6.29	45.3
23.4	401.8	41.3	360.5	18.9	32.363	0.000	6.49	46.0
25.0	432.8	47.2	385.6	20.7	33.574	0.000	6.68	46.8
26.6	464.2	53.6	410.6	22.7	34.702	0.000	6.85	47.6
28.4	502.0	61.7	440.2	25.3	35.933	0.000	7.06	48.5
30.0	327.3	67.5	259.8	14.4	26.640	0.000	6.02	44.7
31.6	333.6	73.2	260.4	14.7	26.578	0.000	6.05	44.7
33.4	341.3	80.2	261.2	15.1	26.427	0.000	6.08	44.6
35.0	348.0	86.2	261.8	15.5	26.289	0.000	6.11	44.5
36.6	354.9	92.4	262.5	15.8	26.183	0.000	6.14	44.5
38.4	363.2	100.0	263.2	16.2	26.118	0.000	6.17	44.5
40.0	370.4	106.6	263.9	16.6	26.055	0.000	6.20	44.5
41.6	377.8	113.3	264.5	17.0	25.938	0.000	6.22	44.5
43.4	386.8	121.5	265.3	17.5	26.043	0.000	6.26	44.4
45.0	394.5	128.6	265.9	17.9	26.170	0.000	6.29	44.5
46.6	402.4	135.8	266.5	18.3	26.325	0.000	6.34	44.6
48.4	411.9	144.6	267.3	18.8	26.472	0.000	6.39	44.7
54.4	444.2	174.5	269.7	20.7	26.851	0.000	6.54	45.0
60.4	478.9	206.7	272.2	23.2	27.022	0.000	6.68	45.0
61.6	485.8	213.1	272.6	23.8	27.015	0.000	6.70	45.0
63.4	497.1	223.7	273.4	24.7	27.034	0.000	6.74	45.0
63.8	499.1	225.6	273.5	24.8	27.031	0.000	6.75	45.0
64.1	501.1	227.4	273.7	25.0	27.029	0.000	6.75	45.0
65.0	506.9	232.9	274.0	25.6	27.024	0.000	6.78	45.0

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 970

California D.O.T.
Mojave River Bridge D36-23 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

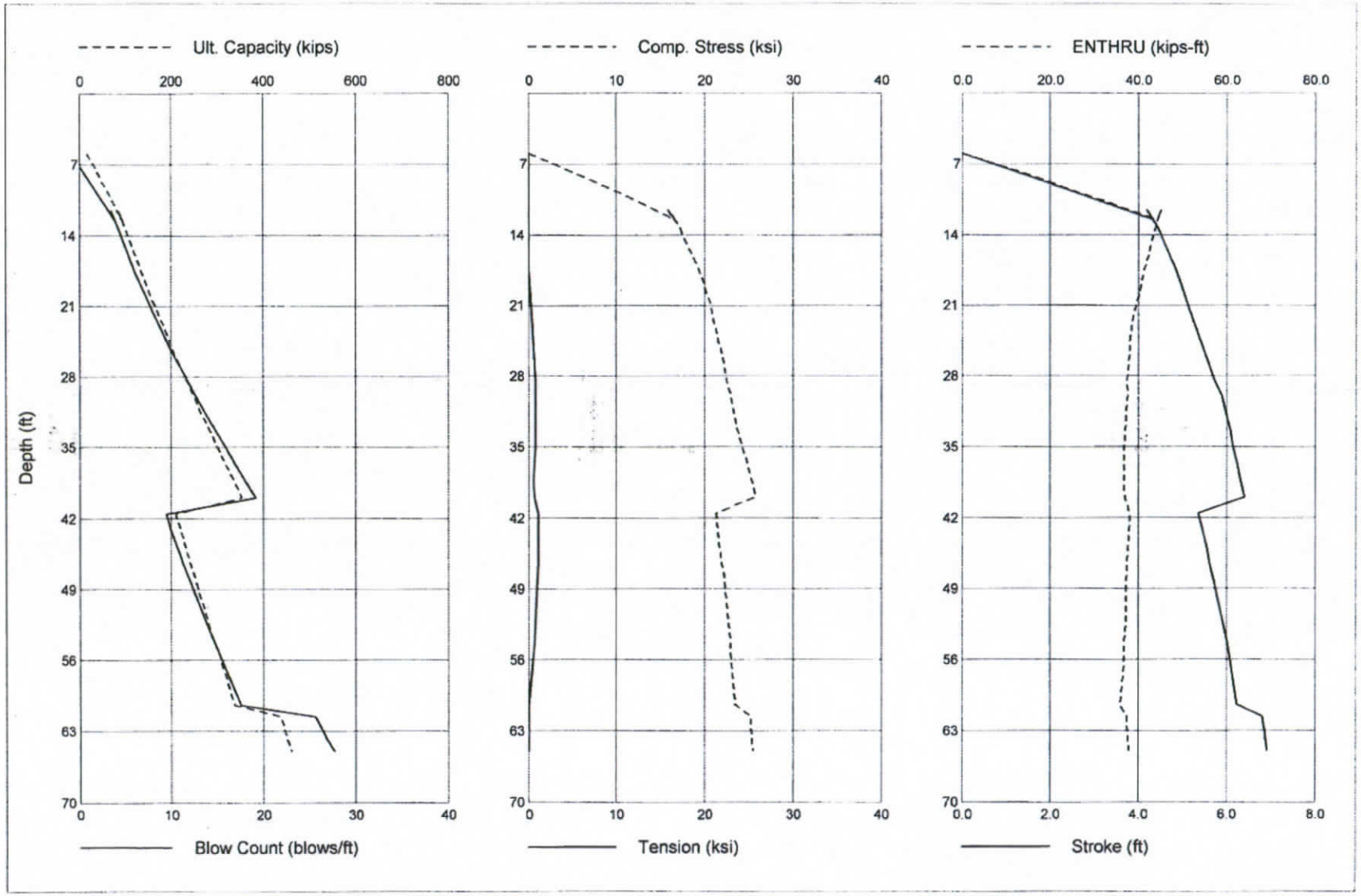
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	5.5	15.033	0.000	4.40	29.4
11.6	85.8	5.9	79.9	5.0	14.461	0.000	4.26	29.7
13.4	100.7	8.2	92.5	6.0	15.582	0.000	4.49	29.0
17.5	134.6	14.6	120.0	8.7	17.407	-0.230	4.86	27.4
21.6	170.2	22.7	147.5	11.6	18.297	-0.548	5.10	26.1
23.4	187.1	27.0	160.1	13.0	18.771	-0.853	5.25	25.9
25.0	201.6	30.9	170.7	14.3	19.074	-0.975	5.36	25.7
26.6	216.4	35.0	181.4	15.6	19.419	-0.973	5.47	25.7
28.4	234.2	40.3	193.9	17.1	19.696	-0.969	5.58	25.6
30.0	249.6	45.0	204.6	18.5	19.934	-1.053	5.66	25.5
31.6	265.2	50.0	215.2	19.6	20.519	-1.160	5.79	25.8
33.4	284.0	56.2	227.8	21.3	21.082	-1.307	5.87	25.8
35.0	300.2	61.8	238.4	22.8	21.511	-1.485	5.94	25.8
36.6	316.6	67.6	249.0	24.4	21.909	-1.687	6.01	25.9
38.4	336.4	74.8	261.6	26.5	22.338	-1.921	6.09	26.0
40.0	353.4	81.2	272.2	28.5	22.748	-2.109	6.16	26.2
41.6	210.4	87.0	123.5	14.0	18.760	-1.208	5.32	25.7
43.4	221.8	92.3	129.5	15.0	18.979	-1.255	5.41	25.7
45.0	231.5	97.0	134.5	15.9	19.131	-1.364	5.48	25.5
46.6	241.4	101.9	139.6	16.8	19.317	-1.392	5.54	25.4
48.4	253.4	107.9	145.6	18.0	19.439	-1.394	5.60	25.3
54.4	293.9	128.9	165.0	21.6	20.015	-1.130	5.84	25.2
60.4	336.9	152.6	184.3	26.0	20.408	-0.789	6.02	25.2
61.6	438.9	159.7	279.2	42.0	22.530	-2.126	6.48	26.5
63.4	451.0	171.8	279.2	44.4	22.567	-2.172	6.54	26.6
63.8	453.1	173.9	279.2	44.9	22.572	-2.174	6.55	26.6
64.1	455.2	176.0	279.2	45.3	22.585	-2.178	6.56	26.7
65.0	461.3	182.1	279.2	46.7	22.579	-2.183	6.59	26.7

Total Continuous Driving Time 21.00 minutes; Total Number of Blows 1037

California D.O.T.
Mojave River Bridge D46-32 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D46-32 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

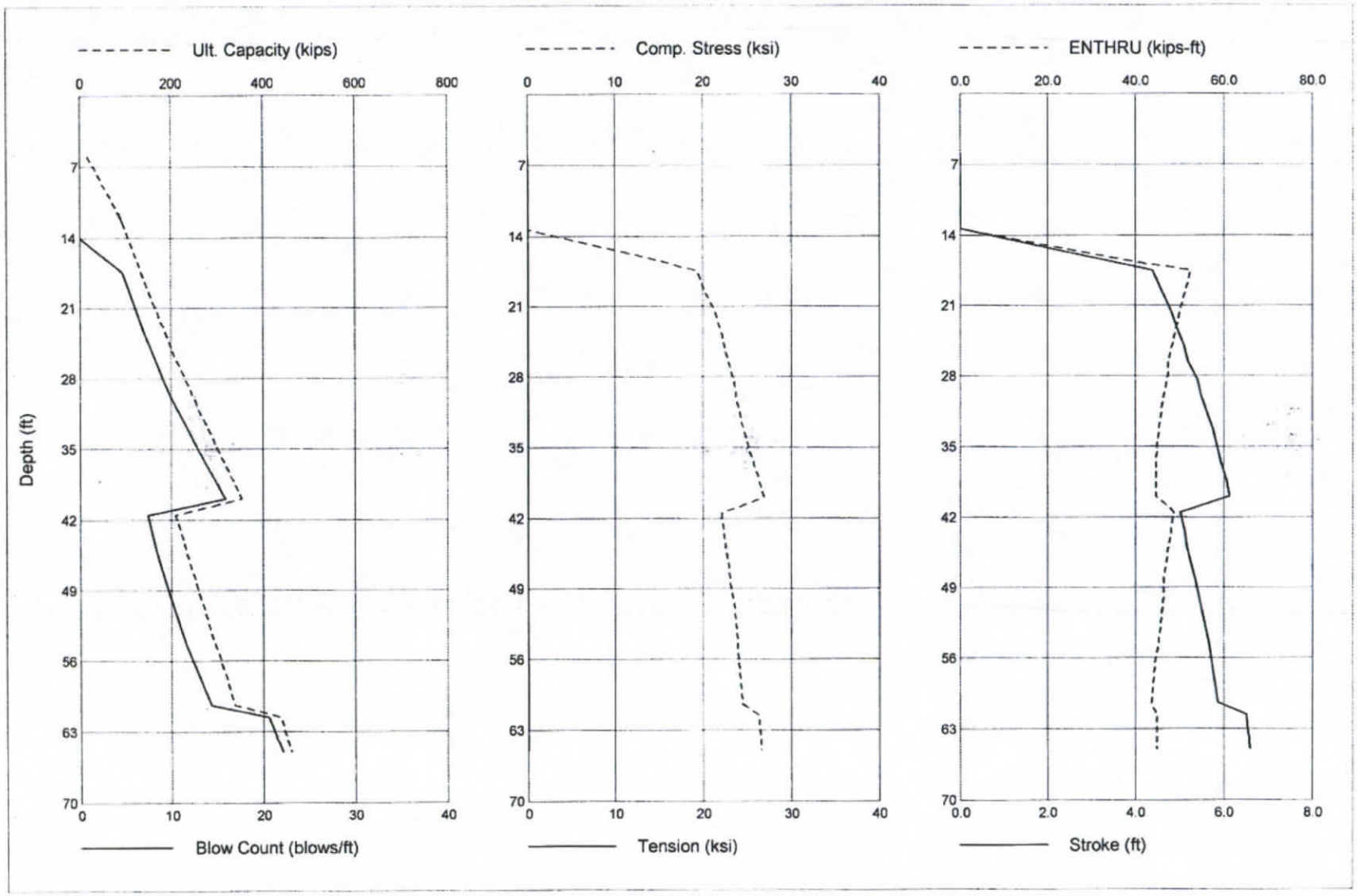
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	3.9	16.551	0.000	4.31	44.3
11.6	85.8	5.9	79.9	3.5	15.795	0.000	4.20	45.2
13.4	100.7	8.2	92.5	4.3	17.228	0.000	4.45	43.9
17.5	134.6	14.6	120.0	6.0	19.349	0.000	4.86	41.2
21.6	170.2	22.7	147.5	8.1	20.814	-0.403	5.17	39.1
23.4	187.1	27.0	160.1	9.0	21.318	-0.521	5.32	38.5
25.0	201.6	30.9	170.7	9.8	21.660	-0.605	5.45	38.1
26.6	216.4	35.0	181.4	10.7	22.091	-0.664	5.58	37.8
28.4	234.2	40.3	193.9	11.8	22.500	-0.764	5.72	37.5
30.0	249.6	45.0	204.6	12.7	22.942	-0.816	5.90	37.7
31.6	265.2	50.0	215.2	13.7	23.261	-0.823	5.98	37.3
33.4	284.0	56.2	227.8	14.8	23.703	-0.809	6.08	37.1
35.0	300.2	61.8	238.4	15.9	24.261	-0.771	6.15	36.9
36.6	316.6	67.6	249.0	16.9	24.779	-0.660	6.23	36.8
38.4	336.4	74.8	261.6	18.1	25.380	-0.605	6.33	36.9
40.0	353.4	81.2	272.2	19.2	25.783	-0.650	6.41	37.1
41.6	210.4	87.0	123.5	9.5	21.276	-1.072	5.37	38.1
43.4	221.8	92.3	129.5	10.1	21.494	-1.091	5.47	37.9
45.0	231.5	97.0	134.5	10.7	21.730	-1.107	5.55	37.7
46.6	241.4	101.9	139.6	11.3	21.934	-1.082	5.63	37.5
48.4	253.4	107.9	145.6	12.1	22.215	-1.026	5.72	37.2
54.4	293.9	128.9	165.0	14.7	22.921	-0.736	6.03	36.7
60.4	336.9	152.6	184.3	17.6	23.371	0.000	6.23	36.0
61.6	438.9	159.7	279.2	25.7	25.212	-0.071	6.82	37.5
63.4	451.0	171.8	279.2	26.7	25.325	-0.043	6.88	37.7
63.8	453.1	173.9	279.2	26.9	25.339	-0.037	6.89	37.7
64.1	455.2	176.0	279.2	27.1	25.384	-0.009	6.90	37.7
65.0	461.3	182.1	279.2	27.7	25.401	0.000	6.93	37.8

Total Continuous Driving Time 15.00 minutes; Total Number of Blows 698

California D.O.T.
Mojave River Bridge D62-02 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 (Pier 5)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

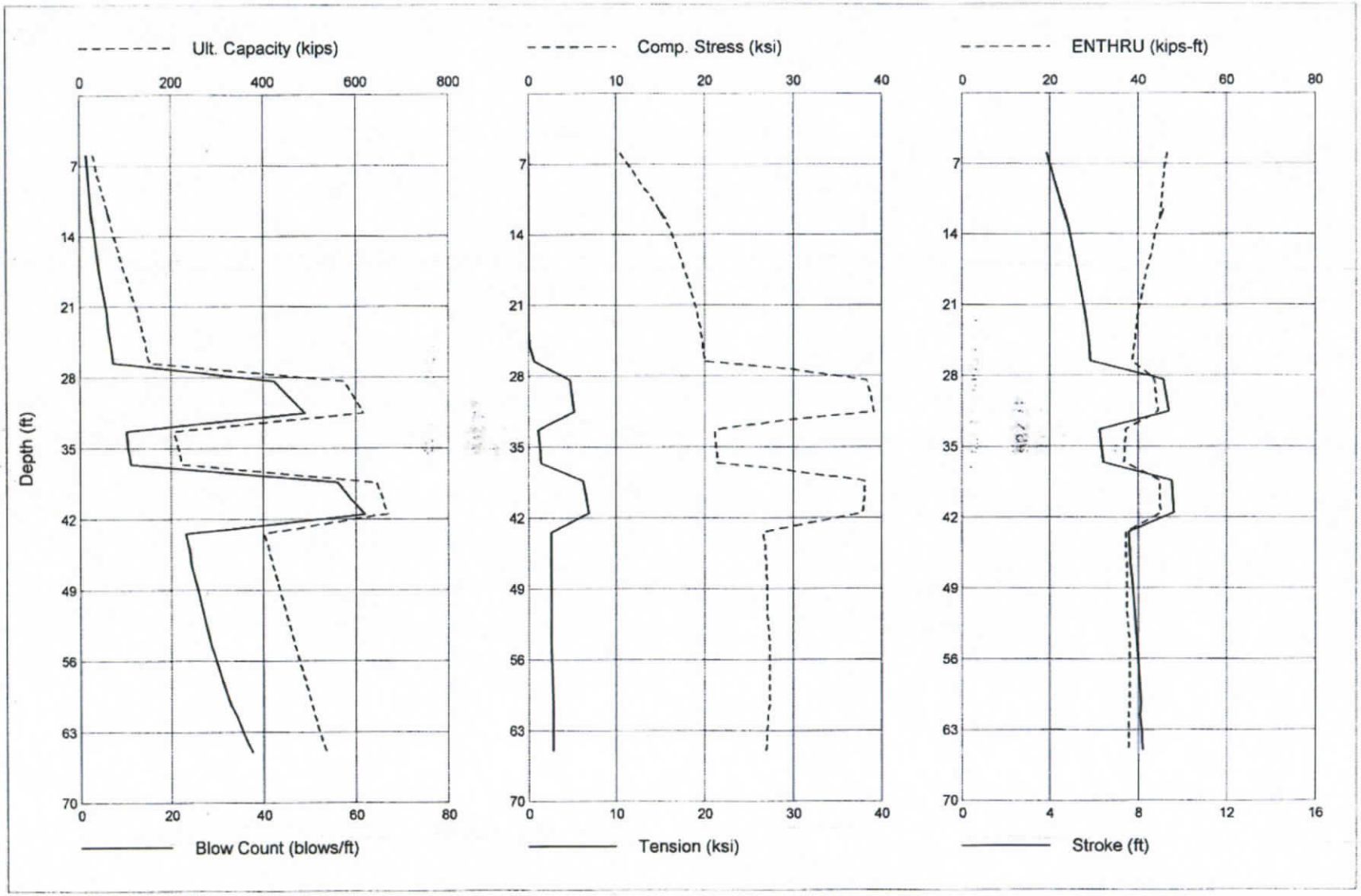
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	17.4	1.1	16.3	-1.0	0.000	0.000	0.00	0.0
12.5	93.2	7.0	86.2	-1.0	0.000	0.000	0.00	0.0
11.6	85.8	5.9	79.9	-1.0	0.000	0.000	0.00	0.0
13.4	100.7	8.2	92.5	-1.0	0.000	0.000	0.00	0.0
17.5	134.6	14.6	120.0	4.7	19.364	0.000	4.39	52.5
21.6	170.2	22.7	147.5	6.3	21.424	0.000	4.80	50.1
23.4	187.1	27.0	160.1	7.0	22.033	0.000	4.96	49.1
25.0	201.6	30.9	170.7	7.7	22.499	0.000	5.10	48.3
26.6	216.4	35.0	181.4	8.5	22.862	0.000	5.20	47.4
28.4	234.2	40.3	193.9	9.3	23.499	0.000	5.41	47.2
30.0	249.6	45.0	204.6	10.1	23.762	0.000	5.49	46.3
31.6	265.2	50.0	215.2	11.0	24.123	0.000	5.63	45.9
33.4	284.0	56.2	227.8	12.0	24.735	0.000	5.76	45.3
35.0	300.2	61.8	238.4	12.9	25.234	0.000	5.85	44.9
36.6	316.6	67.6	249.0	13.8	25.756	0.000	5.95	44.7
38.4	336.4	74.8	261.6	14.9	26.449	0.000	6.06	44.6
40.0	353.4	81.2	272.2	15.8	26.974	0.000	6.14	44.6
41.6	210.4	87.0	123.5	7.4	22.063	0.000	5.02	48.7
43.4	221.8	92.3	129.5	7.9	22.398	0.000	5.13	48.2
45.0	231.5	97.0	134.5	8.4	22.539	0.000	5.17	47.4
46.6	241.4	101.9	139.6	8.9	22.829	0.000	5.26	47.1
48.4	253.4	107.9	145.6	9.5	23.085	0.000	5.36	46.5
54.4	293.9	128.9	165.0	11.6	23.975	0.000	5.67	45.4
60.4	336.9	152.6	184.3	14.3	24.488	0.000	5.87	43.6
61.6	438.9	159.7	279.2	20.6	26.428	0.000	6.52	44.9
63.4	451.0	171.8	279.2	21.4	26.539	0.000	6.57	45.0
63.8	453.1	173.9	279.2	21.5	26.533	0.000	6.58	44.9
64.1	455.2	176.0	279.2	21.7	26.566	0.000	6.59	45.0
65.0	461.3	182.1	279.2	22.1	26.593	0.000	6.61	45.0

Total Continuous Driving Time 11.00 minutes; Total Number of Blows 538

California D.O.T.
Mojave River Bridge D36-23 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D36-23 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

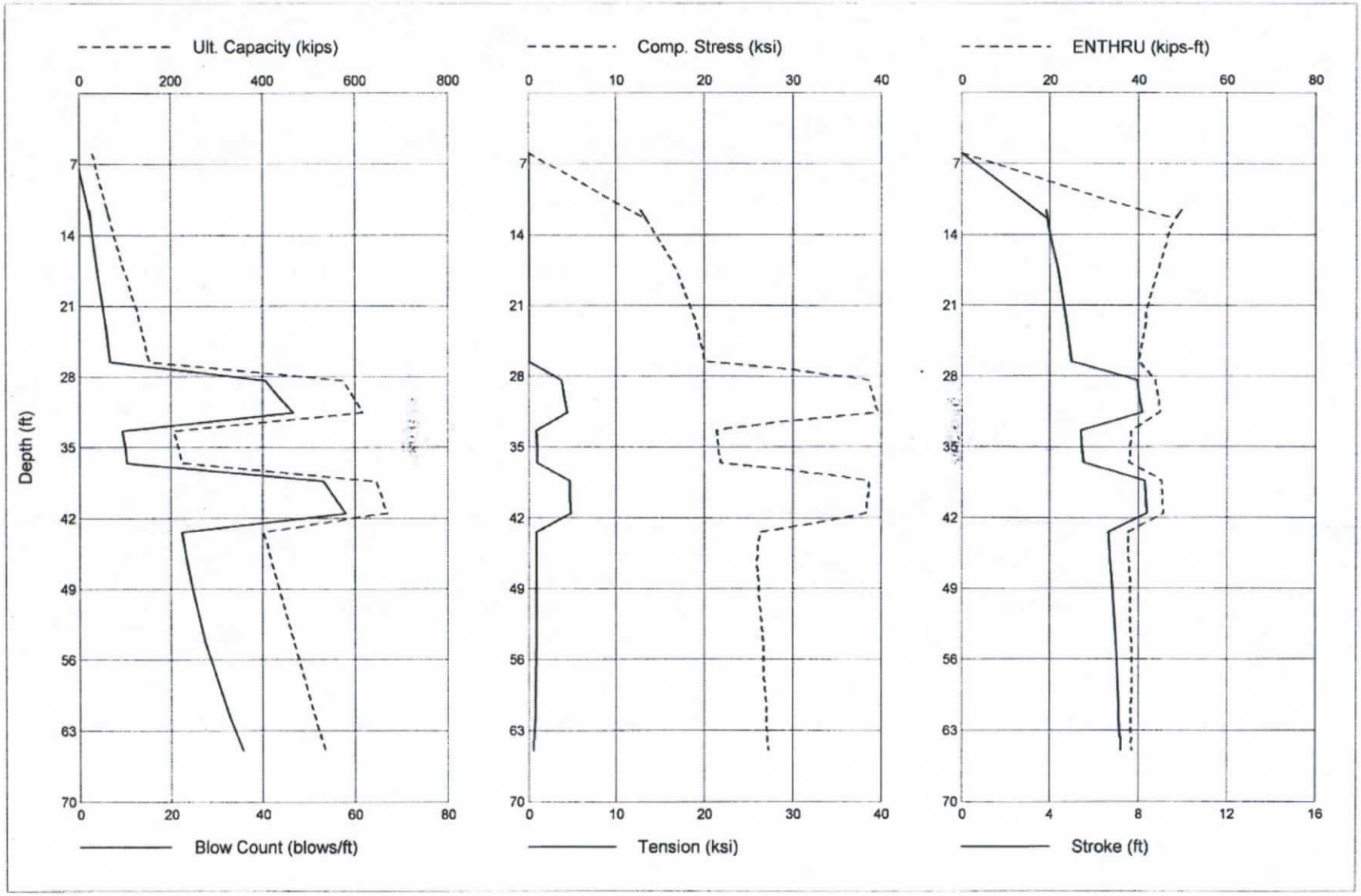
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	1.5	10.523	-0.018	3.87	46.7
12.5	66.9	8.3	58.6	2.8	15.616	0.000	4.73	45.0
11.6	61.3	7.1	54.2	2.5	14.930	0.000	4.62	45.8
13.4	72.5	9.6	62.9	3.1	16.081	0.000	4.84	44.3
17.5	98.2	16.2	82.0	4.4	17.801	0.000	5.24	41.9
21.6	125.7	24.7	101.1	5.9	19.199	0.000	5.57	40.0
23.4	136.0	29.0	107.0	6.4	19.549	0.000	5.68	39.5
25.0	144.2	32.9	111.2	6.9	19.805	-0.184	5.76	39.1
26.6	152.5	36.9	115.5	7.3	19.974	-0.728	5.84	38.8
28.4	574.9	43.1	531.8	42.4	38.354	-4.701	9.14	43.6
30.0	595.5	51.9	543.6	45.6	38.833	-4.923	9.26	44.0
31.6	616.4	61.1	555.3	49.2	39.233	-5.169	9.40	44.5
33.4	205.8	68.1	137.7	10.2	21.128	-1.150	6.27	37.2
35.0	215.0	73.1	141.9	10.7	21.255	-1.302	6.35	37.0
36.6	224.4	78.2	146.2	11.3	21.473	-1.402	6.43	36.9
38.4	647.8	89.3	558.5	56.3	38.150	-6.282	9.53	44.8
40.0	658.9	100.4	558.5	58.9	38.091	-6.561	9.58	45.0
41.6	670.3	111.8	558.5	62.0	37.934	-6.880	9.63	45.1
43.4	402.6	123.3	279.2	23.2	26.634	-2.591	7.58	37.2
45.0	411.7	132.5	279.2	23.9	26.777	-2.601	7.62	37.3
46.6	421.0	141.7	279.2	24.5	26.912	-2.604	7.67	37.5
48.4	432.0	152.8	279.2	25.4	27.040	-2.576	7.74	37.5
54.4	468.4	189.2	279.2	28.6	27.380	-2.655	7.95	38.0
60.4	505.9	226.7	279.2	32.9	27.380	-2.825	8.13	38.1
61.6	513.2	233.9	279.2	34.3	27.191	-2.842	8.09	37.8
63.4	525.1	245.8	279.2	36.0	27.077	-2.828	8.15	37.8
63.8	527.2	247.9	279.2	36.3	27.041	-2.825	8.16	37.8
64.1	529.2	250.0	279.2	36.6	27.047	-2.819	8.17	37.8
65.0	535.2	256.0	279.2	37.6	26.973	-2.798	8.20	37.9

Total Continuous Driving Time 32.00 minutes; Total Number of Blows 1322

California D.O.T.
Mojave River Bridge D46-32 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D46-32 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

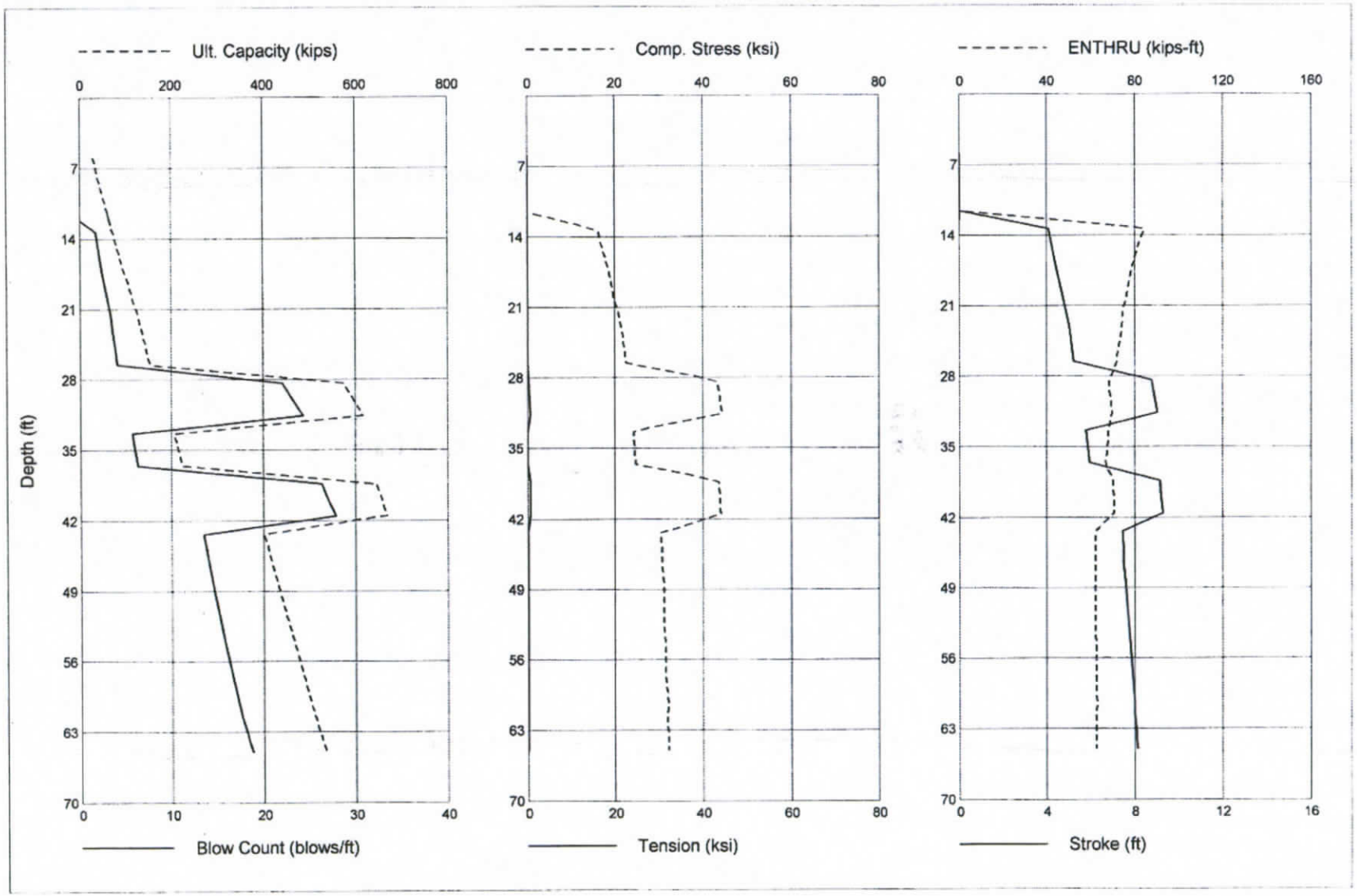
Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	-1.0	0.000	0.000	0.00	0.0
12.5	66.9	8.3	58.6	2.5	13.438	0.000	3.90	48.6
11.6	61.3	7.1	54.2	2.3	12.753	-0.070	3.81	49.8
13.4	72.5	9.6	62.9	2.8	14.027	0.000	3.96	47.3
17.5	98.2	16.2	82.0	4.0	16.950	0.000	4.39	44.5
21.6	125.7	24.7	101.1	5.4	18.566	0.000	4.68	41.7
23.4	136.0	29.0	107.0	5.9	19.243	0.000	4.82	41.4
25.0	144.2	32.9	111.2	6.3	19.682	0.000	4.87	40.6
26.6	152.5	36.9	115.5	6.8	19.985	0.000	4.95	40.2
28.4	574.9	43.1	531.8	40.6	38.624	-3.740	7.94	43.8
30.0	595.5	51.9	543.6	43.5	39.176	-4.081	8.06	44.4
31.6	616.4	61.1	555.3	46.7	39.588	-4.447	8.18	45.0
33.4	205.8	68.1	137.7	9.5	21.399	-0.914	5.38	38.2
35.0	215.0	73.1	141.9	10.0	21.553	-0.979	5.46	38.0
36.6	224.4	78.2	146.2	10.5	21.762	-1.043	5.54	37.8
38.4	647.8	89.3	558.5	53.1	38.655	-4.713	8.31	45.4
40.0	658.9	100.4	558.5	55.5	38.596	-4.797	8.35	45.6
41.6	670.3	111.8	558.5	58.1	38.366	-4.839	8.40	45.8
43.4	402.6	123.3	279.2	22.4	26.304	-0.880	6.62	37.6
45.0	411.7	132.5	279.2	23.0	26.061	-0.866	6.68	37.7
46.6	421.0	141.7	279.2	23.6	25.957	-0.879	6.74	37.9
48.4	432.0	152.8	279.2	24.4	26.175	-0.880	6.80	38.0
54.4	468.4	189.2	279.2	27.4	26.726	-0.952	6.99	38.5
60.4	505.9	226.7	279.2	31.9	27.026	-0.827	7.09	38.3
61.6	513.2	233.9	279.2	32.8	27.078	-0.771	7.12	38.3
63.4	525.1	245.8	279.2	34.4	27.140	-0.689	7.16	38.3
63.8	527.2	247.9	279.2	34.7	27.158	-0.668	7.17	38.4
64.1	529.2	250.0	279.2	35.0	27.173	-0.636	7.17	38.3
65.0	535.2	256.0	279.2	35.8	27.206	-0.574	7.20	38.4

Total Continuous Driving Time 29.00 minutes; Total Number of Blows 1248

California D.O.T.
Mojave River Bridge D62-02 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000



California D.O.T.
Mojave River Bridge D62-02 (Abut 6)

Jul 01 2013
GRLWEAP Version 2010

Gain/Loss 1 at Shaft and Toe 0.800 / 1.000

Depth ft	Ultimate Capacity kips	Friction kips	End Bearing kips	Blow Count blows/ft	Comp. Stress ksi	Tension Stress ksi	Stroke ft	ENTHRU kips-ft
6.0	30.0	1.9	28.1	-1.0	0.000	0.000	0.00	0.0
12.5	66.9	8.3	58.6	-1.0	0.000	0.000	0.00	0.0
11.6	61.3	7.1	54.2	-1.0	0.000	0.000	0.00	0.0
13.4	72.5	9.6	62.9	1.8	16.001	-0.203	4.08	84.1
17.5	98.2	16.2	82.0	2.5	18.682	0.000	4.47	78.3
21.6	125.7	24.7	101.1	3.4	20.795	0.000	4.88	74.5
23.4	136.0	29.0	107.0	3.6	21.585	0.000	5.05	73.9
25.0	144.2	32.9	111.2	3.9	22.090	0.000	5.14	72.9
26.6	152.5	36.9	115.5	4.1	22.503	0.000	5.23	72.0
28.4	574.9	43.1	531.8	22.1	43.209	-0.405	8.78	68.4
30.0	595.5	51.9	543.6	23.2	43.738	-0.611	8.90	69.1
31.6	616.4	61.1	555.3	24.4	44.249	-0.800	9.03	69.7
33.4	205.8	68.1	137.7	5.7	24.213	0.000	5.77	68.0
35.0	215.0	73.1	141.9	6.0	24.462	0.000	5.87	67.5
36.6	224.4	78.2	146.2	6.3	24.703	0.000	5.96	66.9
38.4	647.8	89.3	558.5	26.4	43.720	-0.777	9.16	70.3
40.0	658.9	100.4	558.5	27.1	43.835	-0.770	9.21	70.6
41.6	670.3	111.8	558.5	27.9	43.957	-0.812	9.26	70.8
43.4	402.6	123.3	279.2	13.5	30.326	0.000	7.43	62.0
45.0	411.7	132.5	279.2	13.8	30.531	0.000	7.47	62.1
46.6	421.0	141.7	279.2	14.1	30.687	0.000	7.50	62.0
48.4	432.0	152.8	279.2	14.5	30.957	0.000	7.58	62.2
54.4	468.4	189.2	279.2	15.8	31.552	0.000	7.79	62.6
60.4	505.9	226.7	279.2	17.4	32.015	0.000	7.98	62.8
61.6	513.2	233.9	279.2	17.7	31.962	0.000	8.01	62.7
63.4	525.1	245.8	279.2	18.3	32.055	0.000	8.07	62.7
63.8	527.2	247.9	279.2	18.4	32.085	0.000	8.08	62.7
64.1	529.2	250.0	279.2	18.5	32.077	0.000	8.09	62.7
65.0	535.2	256.0	279.2	18.8	32.046	0.000	8.12	62.7

Total Continuous Driving Time 16.00 minutes; Total Number of Blows 679

Memorandum

To: MR. DAN ADAMS, CHIEF
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES MS#9-48I
OFFICE OF BRIDGE DESIGN CENTRAL
STRUCTURES DESIGN BRANCH - 10

Date: November 04, 2013

File: 08-SBd-15-PM 43.5
EA 08-355561
E-FIS 0800000621

Attention: Mr. Ryan Stiltz

Victorville Separation
and Overhead (Widen)
Bridge No. 54-0484

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: Revised Foundation Report

Introduction

This report supersedes the Foundation Report dated August 15, 2013 and presents the foundation and seismic design recommendations for the proposed widening of the Victorville Separation and Overhead Bridge (54-0484). The revision is due to a pile type change from 24 inch CIDH to driven 16" steel pipe pile (Class 200, Alt W). The foundation and seismic recommendations contained in this report are based on our review of the General Plan, Foundation Plans, Structures Loads (dated May 2, 2013), Subsurface explorations (1950's and 2009), As-Built records (1950's-1970's), and your request letter dated April 21, 2008. Elevations referenced in this report are based on the NGVD29 vertical datum, unless otherwise indicated.

Project/Site Description

The existing bridge (54-0484) is located on Interstate 15, at Post Mile 43.5 in San Bernardino County, in the city of Victorville. The original Victorville Separation and Overhead bridges were constructed in 1950's and consisted of two separate bridges, a right bridge and a left bridge. In 1970s', the bridges were widened 11 feet on each side and 22 feet in the center to form a single structure.

The existing Victorville Separation and Overhead (54-0484) is a continuous six-span, with composite welded steel girder with Reinforced Concrete (RC) deck on RC seven columns five bents with seated abutments, supported on 45 and 70 tons driven concrete piles. The total length and width of the existing bridge is approximately 380 feet and 92 feet, respectively.

Proposed Improvements

The existing Victorville Separation and Overhead (54-0484) will be widened in both northbound and southbound to accommodate additional lanes in each direction. The width of both proposed widening of northbound and southbound is about 25 feet, and varies along the existing bridge alignment. The widening portion of the bridge will be built identical to the existing bridge structure.

Geology of the Proposed Site

The bridge site is located within the Mojave Desert Geomorphic Province of California. The Mojave desert is situated between the Transverse Ranges across the San Andreas fault on the southwest, the Sierra Nevada Mountains and Basin and Range provinces on the north across the Garlock fault, and the Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region.

The local geology at the Victorville Separation and Overhead consists of modern alluvial soils, and older alluvial fan fill deposits, with granitic bedrock at depth.

Geotechnical Investigation

The 1950's "As-Built" Log of Test Borings (LOTB) sheet shows that five 2.5-inch diameter rotary borings and two 2-1/4 inches cone penetrometer borings were performed prior to the construction of the original bridges. The borings were drilled to depths approximately ranging from 33 feet to 63 feet (elevation 2666 feet to 2635 feet) and the cone penetrometer borings were advanced to depths approximately ranging from 45 feet to 48 feet (elevation 2654 feet to 2652 feet) below the existing natural grades. There were no records found of subsurface investigation for the widening in 1970s'

In addition to the prior (1950's) geotechnical subsurface investigation, the Office of Geotechnical Design South-2 performed subsurface geotechnical investigations in June and July 2009. The subsurface geotechnical exploration included drilling a total of eight 4.5-inch diameter rotary wash borings to a maximum depth of about 101.5 feet (elevation 2608 feet) below the existing ground surface. The summary of

field investigation; including stations, top of borehole elevations, depths, and groundwater level measurements at the time of drilling, are presented in Table 1.

TABLE 1. SUMMARY OF 2009 FIELD INVESTIGATION

Boring Number	Station (feet)	Top of Borehole Elevation (feet)	Exploration Depth (feet)	Groundwater Surface Elevation (feet)
R-09-001	164+40.00	2,736.3	101.5	Not measured
R-09-002	166+20.00	2,701.1	101.5	2,692.5
R-09-003	167+36.00	2,700.4	101.5	2,692.0
R-09-004	168+36.00	2,698.8	101.0	2,692.0
R-09-005	169+10.00	2,699.3	100.3	2,691.0
R-09-006	168+40.00	2,736.4	101.0	Not measured
R-09-007	166+70.00	2,701.5	101.0	Not measured
R-09-008	168+45.00	2,698.6	101.5	2687.6

Subsurface Conditions

The subsurface characterization of the site is based on borings drilled in 1950's and 2009. The soil materials at the site consist of recent wash deposits from the local Mojave River (late Holocene, Qw). The recent wash deposits are underlain by layers of older alluvium of variable thickness consisting of loose to very dense interbedded soil layers of clay / lean clay, silts, sands and combinations of silty sands with fine gravel with a trace of caliche to full depth of all eight borings. Deep layers of very stiff lean clay were encountered in most of the borings.

The thickness of loose to medium dense soil is approximately 20 to 30 feet deep (elevation 2680 to 2670 feet) from the ground surface. Refer to Log of Test Borings for more details, and boring locations.

Based on the above subsurface geotechnical data, the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30} = 270 m/s (886 ft/s). using the shear wave velocity correlation with Standard Penetration Test (SPT) by Sykora (1987) after Sykora and Stokoe (1983). However, Vs30 of 200 m/s (656 ft/s) was used when developing the design earthquake ground motion, because of the liquefiable soil layers.

Groundwater

During the 2009 subsurface geotechnical investigation, the highest groundwater was measured at elevation 2692.5 feet (8.6 feet below existing ground surface) in Boring R-09-002. Groundwater surface elevations are shown on the LOTB sheet. The groundwater elevation may fluctuate due to seasonal variations, and surface flow in the local Mojave River.

Liquefaction Potential Evaluation

The soil profile at each boring location was analyzed for liquefaction potential in accordance with the procedure suggested by Seed et al (1985) and modified by Youd et al (2001). The results of our analysis indicate that the loose to medium dense sandy soil layers are prone to liquefaction. The approximate elevation, thickness, and estimated seismically induced ground surface settlement of potentially liquefying soils are summarized in Table 2.

The seismically induced ground surface settlements were calculated based on the procedure suggested by Tokimatsu and Seed (1987). The shear strength of the liquefiable soils was neglected in the evaluation of pile capacity under earthquake loading conditions.

The estimated seismically induced ground settlement ranges from 2 to 3 inches. The piles are expected to settle about 1 to 2 inches or less. It is not necessary to use downdrag loads under the extreme limit state because the kinematic load from 1 to 2 inches of pile settlement, cannot compromise the structure integrity under the "no collapse criteria". Also, the structural capacity of the steel piles will not be compromised by this transient load. However, the structural designer should consider this additional settlement of the piles (1 to 2 inches) when they perform the lateral (push over) analysis of the structure.

TABLE 2. RESULTS OF LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSIS

Support Locations		Approx. Elevation of Liquefiable Soils (feet)	Approx. Thickness of Liquefying Soils (feet)	Total Estimated Seismically-Induced Ground Surface Settlement (inch)
Right (Northbound) Bridge (54-0484 R)	Abut. 01	2,692 to 2,670	22	3
	Bent 02	2,692 to 2,680	12	2
	Bent 03	2,692 to 2,670	22	3
	Bent 04	2,691 to 2,670	21	3
	Bent 05	2,692 to 2,675	17	2
	Bent 06 and Abut. 07	2,692 to 2,680	12	2
Left (Southbound) Bridge (54-0484 L)	Abut. 01	2,692 to 2,667	25	3
	Bent 02	2,692 to 2,670	22	2
	Bent 03	2,692 to 2,670	22	2
	Bent 04	2,692 to 2,665	27	3
	Bents 05, 06 and Abut. 07	2,692 to 2,665	27	3

Note: Although, our liquefaction studies indicate that there may be some deep and local liquefaction potential in some of the borings, the adverse liquefaction effect(s) to the structure is negligible. Those deep, potentially liquefiable soils layers are located at different depths (not as a continuous uniform layer) along the bridge alignment.

Lateral Spread

It is anticipated that the lateral spread may occur at the project site due to earthquakes. The additional lateral force generated by the lateral spread should be considered in design.

Kinematic approach is used to estimate the lateral spreading forces in this report. Kinematic approach is a displacement-controlled method. It accounts directly for the interaction between the moving soil and the pile displacement and includes the available mobilized soil resistance since it accounts for the residual strength of liquefied soils. Computer programs LPILE v5 and GSTABLE were used during analyses.

The results of these analyses show that to consider the effects of soil movements during earthquake, a lateral spreading force of 50 kips should be applied a the top of each pile at abutments 1, 7 and bents 2, 6.

Scour Evaluation

The proposed site is located within an area that is generally flat and there is no river, creek or hydraulic channels that cross through the project site; therefore, scour should not be considered a design issue in foundation analysis.

Seismic Data Evaluation

Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v2.0.5, USGS 2008 Interactive Deaggregations (Beta) and 2009 borings.

Seismicity

Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 10.2 miles (16.4 km) from the Helendale-So Lockhart fault. This fault (Fault ID 241, MMax = 7.4, strike-slip, dip = 90 degrees, vertical, Bottom and Top of Rupture Plane approximately 10.2 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure. A map showing the location of the bridge and the nearby faults is attached in (Figure 1).

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a minimum deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km).

The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectrum calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to 975 year return period).

For this site, the design response spectrum is controlled by probabilistic response spectrum. The corresponding peak horizontal ground acceleration at proposed site is 0.49g. The recommended acceleration response spectrum is attached in Figure 2.

Laboratory Testing

Selected soil samples of layers of alluvium deposits (Qw) were tested to evaluate the corrosion potential evaluation, mechanical analysis and moisture content.

All tests were performed in accordance with American Society for Testing and Material (ASTM) standards or California Testing Methods (CTMs), and the results of the tests are tests are included in Appendices A and B.

Corrosion Evaluation

Representative soil samples collected from the field investigation in 2009 were tested to determine the corrosion potential of the in-situ soils. Caltrans considers a site to be corrosive for structural elements, if one or more of the following conditions exist for the representative soil and /or water samples taken at the site: Chloride concentration is 500 ppm or greater, or sulfate concentration is 2000 ppm, or minimum resistivity of less than 1000 ohm-centimeters, or the pH is 5.5 or less.

The laboratory test results indicate that the layers of alluvium deposits (Qw) underlying the site will be non-corrosive. The tests results are included in Appendix-B.

Settlement

Subsurface soils are composed of predominantly granular material. Therefore, long-term consolidation settlement is not anticipated. A fill delay period of 15 days is recommended to overcome effects of any immediate settlement.

Foundation Recommendations

The following recommendations are for the proposed right and left widening of the existing Victorville Separation and Overhead (54-0484). At all support locations, the proposed bridge will be supported on Caltrans Standard Class 200 Alternative "W" piles. Piles should be constructed in accordance with Section 49-1 and 49-2 of the Caltrans' Standard Specifications (Caltrans' 2010).

The specified pile tip elevations are listed below in Tables 3 through 8. The calculated geotechnical capacities of all Caltrans Standard Class 200 Alternative "W" piles are based on both skin friction and end-bearing. The API method was used to estimate both, the skin friction and the end bearing. Pile friction resistance within the liquefiable layers (table 2) was ignored in our analyses for the extreme event limit state loading.

The three controlling LRFD limit states loads provided by Structure Design (Service-I Limit State, Strength Limit State, and Extreme Event Limit State) are shown in the Table 10.

As per section 49-2.01C (4) of standard specifications, driven piles should be installed through predrilled holes drilled to elevation 2700 ft at abutments 1 and 7.

TABLE 3. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Victorville Separation and Overhead (Widen), *Right*, Bridge No. 54-0484 Abutment Foundation Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt "W"	2,724.6	750	500	160	320	2,673 (a) 2,665 (d)	2,665	560
Abut. 7	Class 200 Alt "W"	2,716.0	750	500	160	320	2,675 (a) 2,665 (d)	2,665	560

Notes:
1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for lateral.

TABLE 4. FOUNDATION RECOMMENDATIONS FOR BENTS

Victorville Separation and Overhead (Widen), *Right*, Bridge No. 54-0484 Bent Foundation Recommendations											
Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2	Class 200 Alt "W"	2,694	1,200	1	200	0	320	120	2,655 (a-I) 2,650 (a-II) 2,648 (b-II) 2,654 (d)	2,648	400
Bent 3	Class 200 Alt "W"	2,695	1,200	1	200	0	320	120	2,656 (a-I) 2,650 (a-II) 2,649 (b-II) 2,655 (d)	2,649	390
Bent 4	Class 200 Alt "W"	2,693	1,600	1	260	0	360	120	2,641 (a-I) 2,637 (a-II) 2,639 (b-II) 2,650 (d)	2,637	450
Bent 5	Class 200 Alt "W"	2,692	1,600	1	260	0	360	120	2,645 (a-I) 2,645 (a-II) 2,649 (b-II) 2,652 (d)	2,645	370
Bent 6	Class 200 Alt "W"	2,694	1,100	1	200	0	320	120	2,653 (a-I) 2,649 (a-II) 2,646 (b-II) 2,649 (d)	2,646	360

Notes: 1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral

2) The specified tip elevation shall not be raised above the design tip elevations for tension or lateral.

TABLE 5. PILE DATA TABLE

Victorville Separation and Overhead (Widen), *Right*, Bridge No. 54-0484						
Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "W"	320	0	2,673 (a) 2,665 (d)	2,665	560
Bent 2	Class 200 Alt "W"	320	120	2,650 (a) 2,648 (b) 2,654 (d)	2,648	400
Bent 3	Class 200 Alt "W"	320	120	2,650 (a) 2,649 (b) 2,655 (d)	2,649	390
Bent 4	Class 200 Alt "W"	370	120	2,637 (a) 2,639 (b) 2,650 (d)	2,637	450
Bent 5	Class 200 Alt "W"	370	120	2,645 (a) 2,649 (b) 2,652 (d)	2,645	370
Bent 6	Class 200 Alt "W"	320	120	2,649 (a) 2,646 (b) 2,649 (d)	2,646	360
Abut 7	Class 200 Alt "W"	320	0	2,675 (a) 2,665 (d)	2,665	560

Notes: 1) Design tip elevations for **Abutments** are controlled by: (a) Compression , (d) Lateral

2) Design tip elevations for **Bents** are controlled by: (a) Compression , (b) Tension, (d) Lateral

TABLE 6. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Victorville Separation and Overhead (Widen), *Left*, Bridge No. 54-0484 Abutment Foundation Recommendations									
Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt "W"	2,724.6	750	500	160	320	2,674 (a) 2,665 (d)	2,665	600
Abut. 7	Class 200 Alt "W"	2,716.0	750	500	160	320	2,666 (a) 2,655 (d)	2,655	550

Notes:
1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for lateral.

TABLE 7. FOUNDATION RECOMMENDATIONS FOR BENTS

Victorville Separation and Overhead (Widen), *Left*, Bridge No. 54-0484 Bent Foundation Recommendations											
Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kins)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2	Class 200 Alt "W"	2,694	1,200	1	200	0	320	120	2,655 (a-I) 2,650 (a-II) 2,649 (b-II) 2654 (d)	2,649	380
Bent 3	Class 200 Alt "W"	2,695	1,200	1	200	0	320	120	2,656 (a-I) 2,651 (a-II) 2,650 (b-II) 2655 (d)	2,650	390
Bent 4	Class 200 Alt "W"	2,693	1,600	1	260	0	360	120	2,649 (a-I) 2,648 (a-II) 2,648 (b-II) 2653 (d)	2,648	370
Bent 5	Class 200 Alt "W"	2,692	1,600	1	260	0	360	120	2,649 (a-I) 2,648 (a-II) 2,646 (b-II) 2652 (d)	2,646	410
Bent 6	Class 200 Alt "W"	2,694	1,100	1	200	0	320	120	2,655 (a-I) 2,650 (a-II) 2,648 (b-II) 2650 (d)	2,648	380

Notes: 1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral

2) The specified tip elevation shall not be raised above the design tip elevations for tension or lateral.

TABLE 8. PILE DATA TABLE

Victorville Separation and Overhead (Widen), *Left*, Bridge No. 54-0484						
Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "W"	320	0	2,674 (a) 2,665 (d)	2,665	600
Bent 2	Class 200 Alt "W"	320	120	2,650 (a) 2,649 (b) 2,654 (d)	2,649	380
Bent 3	Class 200 Alt "W"	320	120	2,651 (a) 2,650 (b) 2,655 (d)	2,650	390
Bent 4	Class 200 Alt "W"	370	120	2,648 (a) 2,648 (b) 2,653 (d)	2,648	370
Bent 5	Class 200 Alt "W"	370	120	2,648 (a) 2,646 (b) 2,652 (d)	2,646	410
Bent 6	Class 200 Alt "W"	320	120	2,650 (a) 2,648 (b) 2,650 (d)	2,648	380
Abut 7	Class 200 Alt "W"	320	0	2,666 (a) 2,655 (d)	2,655	550

Notes: 1) Design tip elevations for **Abutments** are controlled by: (a) Compression , (d) Lateral

2) Design tip elevations for **Bents** are controlled by: (a) Compression , (b) Tension, (d) Lateral

TABLE 9. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Victorville Separation and Overhead (Widen), *Left* and *Right* Bridges No. 54-0484 L/R Foundation Design Data Sheet								
Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)*	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt "W"	2,723	2,724.6	8.0	34	1	6
Bent 2	LRFD	Class 200 Alt "W"	2,700	2,694.0	10.0	36	1	12
Bent 3	LRFD	Class 200 Alt "W"	2,700	2,695.0	10.0	36	1	12
Bent 4	LRFD	Class 200 Alt "W"	2,700	2,693.0	10.0	36	1	12
Bent 5	LRFD	Class 200 Alt "W"	2,700	2,692.0	10.0	36	1	12
Bent 6	LRFD	Class 200 Alt "W"	2,700	2,694.0	10.0	36	1	12
Abut 7	WSD	Class 200 Alt "W"	2,719	2,716.0	8.0	34	1	6

TABLE 10. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Victorville Separation and Overhead (Widen), *Left* and *Right*, Bridges No. 54-0484 Foundation Design Loads											
Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	750	160	500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	1,200	N/A	900	2,000	200	0	0	1,200	320	0	120
Bent 3	1,200	N/A	900	2,200	200	0	0	1,200	320	0	120
Bent 4	1,600	N/A	1,300	2,800	260	0	0	1,600	360	0	120
Bent 5	1,600	N/A	1,300	2,800	260	0	0	1,600	360	0	120
Bent 6	1,100	N/A	900	2,000	200	0	0	1,200	320	0	120
Abut 9	750	160	500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:
1. Support loads shown are per column.
2. Service I loads are reported as net loads
3. Strength and Extreme loads are reported as gross loads.

General Notes:

1. The structural engineer shall show the pile data table (Table 5) with the specified pile tip elevations on the foundation plan.

2. Support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

Construction Considerations

1. If necessary to attain the specified tip elevation, drilling through the center of the recommended pile (center relief drilling) may be used. Center relief drilling shall not extend lower than 10 feet above the pile tip during installation of the piles. To avoid quick conditions, water elevation inside the pile shall be maintained higher than the ground water surface to ensure a positive head.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South, Branch 10. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to attention of Segaran Logeswaran (916) 227-4516 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 11/04/13

Segaran Logeswaran, PE
Transportation Engineer

REGISTERED PROFESSIONAL ENGINEER
SEGARAN LOGESWARAN
No. C70280
Exp. 09/14
CIVIL
STATE OF CALIFORNIA

cc: District 08 Structure Construction R.E. – Pending File
District 08 Project Manager – Melecio Chalco (Electronic File)
Specs & Estimates – Ofelia Alcantara (Electronic File)
District 08 Materials Engineer – Farzad Tasbihgoo (Electronic File)
HQ GS Corporate – Project Coordination Engineer – Colyn L. Peterson (Electronic File)
HQ Geotechnical Design South-2 – Abbas Abghari – OGDS-2 (Electronic File)
HQ Geotechnical Design South-2 – Angel Perez-Cobo (Electronic File) APC
HQ Geotechnical Archive

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FIGURES

Figure 1. Nearby Major Faults with Reference to the Project Site
Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

SOIL SAMPLE LABORATORY RESULT

APPENDIX B

CORROSION EVALUATION

Figures

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.2.06)

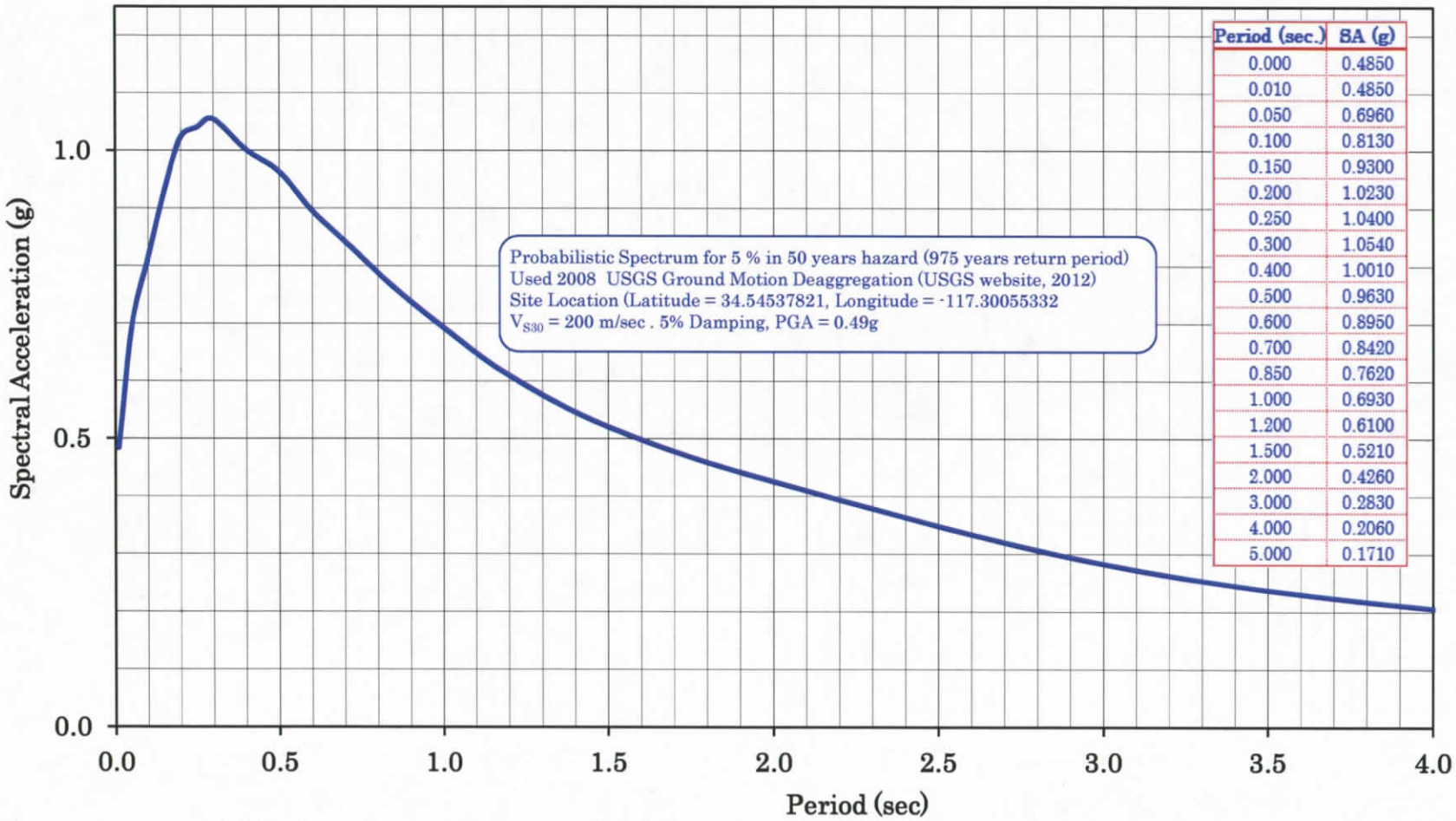
This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION

Latitude: 34.54548425 **Longitude:** -117.30055332 ***Vs30:*** 200 m/s Calculate

Figure 1. Project site and the nearby faults is attached .

Recommended Acceleration Response Spectrum for the Victorville Sep. and OH (Widen) (Bridges # 54-0484)



Period (sec.)	SA (g)
0.000	0.4850
0.010	0.4850
0.050	0.6960
0.100	0.8130
0.150	0.9300
0.200	1.0230
0.250	1.0400
0.300	1.0540
0.400	1.0010
0.500	0.9630
0.600	0.8950
0.700	0.8420
0.850	0.7620
1.000	0.6930
1.200	0.6100
1.500	0.5210
2.000	0.4260
3.000	0.2830
4.000	0.2060
5.000	0.1710

Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 3/11/2010

To: Asef Wardak / GDS-2

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 08-355561
GL 09-065

Final test results.

Note: All remaining test specimens will be disposed of in 30 calendar days from the release date of the final test results.

AASHTO R18

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 09-065
Dist - EA: 08-355561
Report Date: March 11, 2010

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R09-001_07								100	99	97	89	78	65	50	35	16	8				17.1	
R09-001_08											100	99	91	66	43	9	5				26.9	
R09-001_09										100	99	97	89	46	17	6	3				30.5	
R09-001_10								100	98	82	55	32	18	10	6	2	1				18.1	
R09-001_11								100	96	90	79	70	62	39	17	4	1				27.3	
R09-001_12								100	92	79	56	36	20	11	7	3	1				17.6	
R09-002_02								100	97	94	75	44	23	10	5	3	1				12.6	
R09-002_03									100	98	91	78	50	18	9	3	1				29.3	
R09-002_04						100	86	82	75	66	52	35	18	9	6	5	4				15.9	
R09-002_05					100	92	92	91	86	82	67	38	19	10	6	5	4				18.1	
R09-002_06								100	99	97	92	74	49	19	9	3	1				22.1	
R09-002_15								100	99	96	92	88	80	57	39	16	7				21.8	
R09-003_01										100	99	97	88	56	35	12	6				32.0	
R09-003_02									100	94	76	55	32	21	17	7	4				24.1	
R09-003_03									100	94	83	55	15	6	3	3	0				22.6	
R09-003_04									100	98	90	79	58	30	9	3	0				23.2	
R09-003_05									100	95	73	34	15	7	4	3	0				18.1	
R09-003_06				100	91	81	71	66	55	45	31	19	10	6	4	1	0				9.2	
R09-003_07								100	86	75	64	50	27	16	8	2	0				16.5	
R09-003_10										100	99	97	88	59	38	19	10				22.3	
R09-004_02										100	94	79	54	36	21	3	1				32.6	
R09-004_04								100	89	70	42	24	13	7	5	2	1				17.0	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 09-065
Dist - EA: 08-355561
Report Date: March 11, 2010

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R09-005_04				100	80	80	80	80	79	76	72	66	41	17	14	4	4				18.8	
R09-005_05								100	93	87	65	47	31	19	11	5	4				17.4	
R09-006_07					100	93	93	92	90	86	76	62	50	40	31	15	10				16.3	
R09-006_09				100	87	87	87	87	87	87	86	86	84	58	29	9	7				30.6	
R09-006_11									100	87	65	38	22	13	8	3	1				19.3	
R09-006_12								100	99	94	77	54	28	12	7	3	1				19.2	
R09-006_13				100	93	93	93	92	86	69	46	28	19	12	8	4	3				13.8	
R09-006_17										100	99	99	96	84	60	22	13				25.5	
R09-007_02								100	99	97	83	72	65	50	28	11	7				14.5	
R09-007_05								100	96	82	51	26	14	7	4	4	4				15.4	
R09-007_07				100	89	89	84	82	78	67	48	31	21	15	11	3	1				15.7	
R09-007_09				100	91	88	81	79	60	38	22	12	8	5	3	1	1				13.0	
R09-008_02									100	89	63	47	23	15	8	5	3				1.1	
R09-008_04						100	99	99	92	74	47	27	13	7	4	2	1				22.3	
R09-008_05								100	98	88	63	31	15	10	9	6	4				17.9	
R09-008_06								100	99	94	75	37	16	8	5	4	3				18.1	
R09-008_07				100	86	86	80	78	73	62	38	21	13	8	5	1	0				12.8	

APPENDIX B

SUMMARY OF CORROSION TESTS

Boring No.	Top of Borehole Elevation (feet)	Sample at Elevation (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
R-09-001	2736.3	2731	Sands	1392	7.19	N/A	N/A
		2700	Sands	1215	6.94	N/A	N/A
		2650	Lean Clay	2380	7.89	N/A	N/A
R-09-002	2701.1	2695	Sands	12154	8.26	N/A	N/A
		2685	Sands	8392	N/A	N/A	N/A
		2665	Sands	12678	N/A	N/A	N/A
		2625	Sand/Caliche	1398	7.98	N/A	N/A
		2605	Sands	4674	7.49	N/A	N/A
R-09-003	2700.4	2689	Sands	1759	6.53	N/A	N/A
		2674	Sands	16800	7.29	N/A	N/A
		2659	Lean Clay	1150	5.98	N/A	N/A
		2639	Sands	1383	6.62	N/A	N/A
R-09-004	2698.8	2688	Sands	8094	6.78	N/A	N/A
		2663	Sands	N/A	7.29	N/A	N/A
		2643	Sands	N/A	7.99	N/A	N/A
		2623	Silts	3379	8.54	N/A	N/A
R-09-005	2699.3	2693	Sands	1350	6.27	N/A	N/A
		2678	Silts	9105	6.93	N/A	N/A
		2658	Sands	9295	7.20	N/A	N/A
		2653	Silts	2214	6.92	N/A	N/A
		2628	Sands	8413	8.34	N/A	N/A
		2598	Sands	1040	7.86	N/A	N/A
R-09-006	2736.4	2725	Sands	853	6.48	313	41
		2660	Silty Clay	2644	7.94	N/A	N/A
R-09-007	2701.5	2695	Sands	4485	8.16	N/A	N/A
		2665	Sands	N/A	8.36	N/A	N/A
		2640	Sands	N/A	8.94	N/A	N/A
		2620	Sands	7424	8.89	N/A	N/A
B12-01	2698.6	2687	Sands	12595	6.29	N/A	N/A
		2642	Sands	6219	7.92	N/A	N/A
		2617	Sands	6541	8.27	N/A	N/A

State of California

Business, Transportation and Housing Agency

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Be energy efficient!

Memorandum

To: MR. DAN ADAMS, CHIEF
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES MS#9-48I
OFFICE OF BRIDGE DESIGN CENTRAL
STRUCTURES DESIGN BRANCH - 10

Date: November 04, 2013

File: 08-SBd-15-PM 43.5
EA 08-355561
E-FIS 0800000621

Attention: Mr. Ryan Stiltz

Victorville Separation
and Overhead (New)
Bridge No. 54-0484G

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2

Subject: Revised Foundation Report

Introduction

This report supersedes the Foundation Report dated August 15, 2013 and presents the foundation and seismic design recommendations for the proposed new Victorville Separation and Overhead Collector Bridge (54-0484G). The revision is due to a pile type change from 24 inch CIDH to driven 16" steel pipe pile (Class 200, Alt W). The foundation and seismic recommendations contained in this report are based on our review of the General Plan, Foundation Plans, Structures Loads (dated May 2, 2013), Subsurface explorations (1950's and 2009), As-Built records (1950's-1970's), and your request letter dated April 21, 2008. Elevations referenced in this report are based on the NGVD29 vertical datum, unless otherwise indicated.

Project/Site Description

The existing bridge (54-0484) is located on Interstate 15, at Post Mile 43.5 in San Bernardino County, in the city of Victorville. The original Victorville Separation and Overhead bridges were constructed in 1950's and consisted of two separate bridges, a right bridge and a left bridge. In 1970s', the bridges were widened 11 feet on each side and 22 feet in the center to form a single structure.

"Caltrans improves mobility across California"

The existing Victorville Separation and Overhead (54-0484) is a continuous six-span, with composite welded steel girder with Reinforced Concrete (RC) deck on RC seven columns five bents with seated abutments, supported on 45 and 70 tons driven concrete piles. The total length and width of the existing bridge is approximately 380 feet and 92 feet, respectively.

Proposed Improvements

The proposed new collector structure (Bridge No. 54-0484G) will be built parallel; about 120 feet southeast of the centerline of the existing bridge (54-0484). The new structure will accommodate two new managed traffic lanes. The total length and width of the new collector bridge are approximately 380 feet and 42 feet, respectively

Geology of the Proposed Site

The bridge site is located within the Mojave Desert Geomorphic Province of California. The Mojave desert is situated between the Transverse Ranges across the San Andreas fault on the southwest, the Sierra Nevada Mountains and Basin and Range provinces on the north across the Garlock fault, and the Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region.

The local geology at the Victorville Separation and Overhead consists of modern alluvial soils, and older alluvial fan fill deposits, with granitic bedrock at depth.

Geotechnical Investigation

The 1950's "As-Built" Log of Test Borings (LOTB) sheet shows that five 2.5-inch diameter rotary borings and two 2-1/4 inches cone penetrometer borings were performed prior to the construction of the original bridges. The borings were drilled to depths approximately ranging from 33 feet to 63 feet (elevation 2666 feet to 2635 feet) and the cone penetrometer borings were advanced to depths approximately ranging from 45 feet to 48 feet (elevation 2654 feet to 2652 feet) below the existing natural grades. There were no records found of subsurface investigation for the widening in 1970s'

In addition to the prior (1950's) geotechnical subsurface investigation, the Office of Geotechnical Design South-2 performed subsurface geotechnical investigations in June and July 2009. The subsurface geotechnical exploration included drilling a total of eight 4.5-inch diameter rotary wash borings to a maximum depth of about 101.5 feet (elevation 2608 feet) below the existing ground surface. The summary of

field investigation; including stations, top of borehole elevations, depths, and groundwater level measurements at the time of drilling, are presented in Table 1.

TABLE 1. SUMMARY OF 2009 FIELD INVESTIGATION

Boring Number	Station (feet)	Top of Borehole Elevation (feet)	Exploration Depth (feet)	Groundwater Surface Elevation (feet)
R-09-001	164+40.00	2,736.3	101.5	Not measured
R-09-002	166+20.00	2,701.1	101.5	2,692.5
R-09-003	167+36.00	2,700.4	101.5	2,692.0
R-09-004	168+36.00	2,698.8	101.0	2,692.0
R-09-005	169+10.00	2,699.3	100.3	2,691.0
R-09-006	168+40.00	2,736.4	101.0	Not measured
R-09-007	166+70.00	2,701.5	101.0	Not measured
R-09-008	168+45.00	2,698.6	101.5	2687.6

Subsurface Conditions

The subsurface characterization of the site is based on borings drilled in 1950's and 2009. The soil materials at the site consist of recent wash deposits from the local Mojave River (late Holocene, Qw). The recent wash deposits are underlain by layers of older alluvium of variable thickness consisting of loose to very dense interbedded soil layers of clay / lean clay, silts, sands and combinations of silty sands with fine gravel with a trace of caliche to full depth of all eight borings. Deep layers of very stiff lean clay were encountered in most of the borings.

The thickness of loose to medium dense soil is approximately 20 to 30 feet deep (elevation 2680 to 2670 feet) from the ground surface. Refer to Log of Test Borings for more details, and boring locations.

Based on the above subsurface geotechnical data, the average shear wave velocity for the upper 100 feet of subsurface materials is estimated as V_{S30} = 270 m/s (886 ft/s). using the shear wave velocity correlation with Standard Penetration Test (SPT) by Sykora (1987) after Sykora and Stokoe (1983). However, Vs30 of 200 m/s (656 ft/s) was used when developing the design earthquake ground motion, because of the liquefiable soil layers.

Groundwater

During the 2009 subsurface geotechnical investigation, the highest groundwater was measured at elevation 2692.5 feet (8.6 feet below existing ground surface) in Boring R-09-002. Groundwater surface elevations are shown on the LOTB sheet. The groundwater elevation may fluctuate due to seasonal variations, and surface flow in the local Mojave River.

Liquefaction Potential Evaluation

The soil profile at each boring location was analyzed for liquefaction potential in accordance with the procedure suggested by Seed et al (1985) and modified by Youd et al (2001). The results of our analysis indicate that the loose to medium dense sandy soil layers are prone to liquefaction. The approximate elevation, thickness, and estimated seismically induced ground surface settlement of potentially liquefying soils are summarized in Table 2.

The seismically induced ground surface settlements were calculated based on the procedure suggested by Tokimatsu and Seed (1987). The shear strength of the liquefiable soils was neglected in the evaluation of pile capacity under earthquake loading conditions.

The estimated seismically induced ground settlement ranges from 2 to 3 inches. The piles are expected to settle about 1 to 2 inches or less. It is not necessary to use downdrag loads under the extreme limit state because the kinematic load from 1 to 2 inches of pile settlement, cannot compromise the structure integrity under the "no collapse criteria". Also, the structural capacity of the steel piles will not be compromised by this transient load. However, the structural designer should consider this additional settlement of the piles (1 to 2 inches) when they perform the lateral (push over) analysis of the structure.

TABLE 2. RESULTS OF LIQUEFACTION AND SEISMIC SETTLEMENT ANALYSIS

Support Locations	Approx. Elevation of Liquefiable Soils (feet)	Approx. Thickness of Liquefying Soils (feet)	Total Estimated Seismically-Induced Ground Surface Settlement (inch)
Abut. 01	2,692 to 2,670	22	3
Bent 02	2,692 to 2,680	12	2
Bent 03	2,692 to 2,670	22	3
Bent 04	2,691 to 2,670	21	3
Bent 05	2,692 to 2,675	17	2
Bent 06 and Abut. 07	2,692 to 2,680	12	2

Note: Although, our liquefaction studies indicate that there may be some deep and local liquefaction potential in some of the borings, the adverse liquefaction effect(s) to the structure is negligible. Those deep, potentially liquefiable soils layers are located at different depths (not as a continuous uniform layer) along the bridge alignment.

Lateral Spread

It is anticipated that the lateral spread may occur at the project site due to earthquakes. The additional lateral force generated by the lateral spread should be considered in design.

Kinematic approach is used to estimate the lateral spreading forces in this report. Kinematic approach is a displacement-controlled method. It accounts directly for the interaction between the moving soil and the pile displacement and includes the available mobilized soil resistance since it accounts for the residual strength of liquefied soils. Computer programs LPILE v5 and GSTABLE were used during analyses.

The results of these analyses show that to consider the effects of soil movements during earthquake, a lateral spreading force of 50 kips should be applied a the top of each pile at abutments 1, 7 and bents 2, 6.

Scour Evaluation

The proposed site is located within an area that is generally flat and there is no river, creek or hydraulic channels that cross through the project site; therefore, scour should not be considered a design issue in foundation analysis.

Seismic Data Evaluation

Ground motion recommendations are based on the Caltrans 2009 Seismic Design Procedure (SDP) as described in the Seismic Design Criteria Version 1.6 (SDC) Appendix B, the Acceleration Response Spectrum (ARS) Online Tool v2.0.5, USGS 2008 Interactive Deaggregations (Beta) and 2009 borings.

Seismicity

Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 10.2 miles (16.4 km) from the Helendale-So Lockhart fault. This fault (Fault ID 241, MMax = 7.4, strike-slip, dip = 90 degrees, vertical, Bottom and Top of Rupture Plane approximately 10.2 and 0 miles, respectively) is the controlling fault for the deterministic seismic design procedure. A map showing the location of the bridge and the nearby faults is attached in (Figure 1).

Design Response Spectrum

Based on the 2009 SDP, the design response spectrum is the upper envelope of the deterministic and probabilistic response, but is not less than a minimum deterministic response spectrum resulting from a Mmax = 6.5 earthquake on a vertical strike-slip fault at a distance of 7.5 miles (12 km).

The deterministic response spectrum is obtained by taking the arithmetic average of the median response spectrum calculated using the 2008 Campbell-Bozorgnia and 2008 Chiou-Youngs ground motion prediction equations. The probabilistic response spectrum is obtained for 5 percent probability of exceedance in 50 years (corresponding to 975 year return period).

For this site, the design response spectrum is controlled by probabilistic response spectrum. The corresponding peak horizontal ground acceleration at proposed site is 0.49g. The recommended acceleration response spectrum is attached in Figure 2.

Laboratory Testing

Selected soil samples of layers of alluvium deposits (Qw) were tested to evaluate the corrosion potential evaluation, mechanical analysis and moisture content.

All tests were performed in accordance with American Society for Testing and Material (ASTM) standards or California Testing Methods (CTMs), and the results of the tests are tests are included in Appendices A and B.

Corrosion Evaluation

Representative soil samples collected from the field investigation in 2009 were tested to determine the corrosion potential of the in-situ soils. Caltrans considers a site to be corrosive for structural elements, if one or more of the following conditions exist for the representative soil and /or water samples taken at the site: Chloride concentration is 500 ppm or greater, or sulfate concentration is 2000 ppm, or minimum resistivity of less than 1000 ohm-centimeters, or the pH is 5.5 or less.

The laboratory test results indicate that the layers of alluvium deposits (Qw) underlying the site will be non-corrosive. The tests results are included in Appendix B.

Settlement

Subsurface soils are composed of predominantly granular material. Therefore, long-term consolidation settlement is not anticipated. A fill delay period of 15 days is recommended to overcome effects of any immediate settlement.

Foundation Recommendations

The following recommendations are for the new collector bridge (54-0484G). At all support locations, the proposed bridge will be supported on Caltrans Standard Class 200 Alternative "W" piles. Piles should be constructed in accordance with Section 49-1 and 49-2 of the Caltrans' Standard Specifications (Caltrans' 2010).

The specified pile tip elevations are listed below in Tables 3 and 4. The calculated geotechnical capacities of all Caltrans Standard Class 200 Alternative "W" piles are based on both skin friction and end-bearing. The API method was used to estimate both, the skin friction and the end bearing. Pile friction resistance within the liquefiable layers (table 2) was ignored in our analyses for the extreme event limit state loading.

The three controlling LRFD limit states loads provided by Structure Design (Service-I Limit State, Strength Limit State, and Extreme Event Limit State) are shown in the Table 7.

As per section 49-2.01C (4) of standard specifications, driven piles should be installed through predrilled holes drilled to elevation 2700 ft at abutments 1 and 7.

TABLE 3. FOUNDATION RECOMMENDATIONS FOR ABUTMENTS

Support	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Required Nominal Resistance Per Pile (kips)	Design Pile Tip Elevations (ft)	Specified Pile Tip Elevation (ft)	Nominal Pile Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt "W"	2,725.0	850	650	140	280	2,673 (a) 2,665 (d)	2,665	560
Abut. 7	Class 200 Alt "W"	2,720.0	850	650	140	280	2,675 (a) 2,665 (d)	2,665	560

Notes:
1) Design tip elevations are controlled by: (a) Compression, (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for lateral.

TABLE 4. FOUNDATION RECOMMENDATIONS FOR BENTS

Support Location	Pile Type	Cut-off - Elevation (ft)	Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
					Strength Limit		Extreme Event				
					Comp. (φ=0.7)	Tension (φ=0.7)	Comp. (φ=1)	Tension (φ=1)			
Bent 2	Class 200 Alt "W"	2,694	1,250	1	270	0	360	170	2,649 (a-I) 2,647 (a-II) 2,644 (b-II) 2,654 (d)	2,644	440
Bent 3	Class 200 Alt "W"	2,695	1,430	1	270	0	360	170	2,649 (a-I) 2,647 (a-II) 2,644 (b-II) 2,655 (d)	2,644	440
Bent 4	Class 200 Alt "W"	2,693	2,000	1	270	0	320	100	2,640 (a-I) 2,639 (a-II) 2,646 (b-II) 2,650 (d)	2,639	400
Bent 5	Class 200 Alt "W"	2,692	2,000	1	270	0	320	100	2,646 (a-I) 2,648 (a-II) 2,654 (b-II) 2,652 (d)	2,646	385
Bent 6	Class 200 Alt "W"	2,694	1,250	1	250	0	360	170	2,646 (a-I) 2,646 (a-II) 2,639 (b-II) 2,649 (d)	2,639	450

Notes:

1) Design tip elevations are controlled by: (a-I) Compression (Strength Limit), (a-II) Compression (Extreme Event), (b-II) Tension (Extreme Event), (d) Lateral
2) The specified tip elevation shall not be raised above the design tip elevations for tension or lateral.

TABLE 5. PILE DATA TABLE

Support Location	Pile Type	Nominal Resistance (kips)		Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
		Compression	Tension			
Abut 1	Class 200 Alt "W"	280	0	2,673 (a) 2,665 (d)	2,665	560
Bent 2	Class 200 Alt "W"	385	170	2,647 (a) 2,644 (b) 2,654 (d)	2,644	440
Bent 3	Class 200 Alt "W"	385	170	2,647 (a) 2,644 (b) 2,655 (d)	2,644	440
Bent 4	Class 200 Alt "W"	385	100	2,639 (a) 2,646 (b) 2,650 (d)	2,639	400
Bent 5	Class 200 Alt "W"	385	100	2,646 (a) 2,654 (b) 2,652 (d)	2,646	385
Bent 6	Class 200 Alt "W"	360	170	2,646 (a) 2,639 (b) 2,649 (d)	2,639	450
Abut 7	Class 200 Alt "W"	280	0	2,675 (a) 2,665 (d)	2,665	560

Notes:

1) Design tip elevations for **Abutments** are controlled by: (a) Compression , (d) Lateral
2) Design tip elevations for **Bents** are controlled by: (a) Compression , (b) Tension, (d) Lateral

TABLE 6. GENERAL FOUNDATION INFORMATION PROVIDED BY "STRUCTURE DESIGN"

Support No.	Design Method	Pile Type	Finished Grade Elevation (ft)	Cut-off Elevation (ft)	Pile Cap Size (ft)		Permissible Settlement under Service Load (in)	Number of Piles per Support
					B	L		
Abut 1	WSD	Class 200 Alt "W"	2,735	2,725	8.0	44	1	8
Bent 2	LRFD	Class 200 Alt "W"	2,700	2,694	10.0	42	1	12
Bent 3	LRFD	Class 200 Alt "W"	2,700	2,695	10.0	42	1	12
Bent 4	LRFD	Class 200 Alt "W"	2,700	2,693	10.0	42	1	16
Bent 5	LRFD	Class 200 Alt "W"	2,700	2,692	10.0	42	1	16
Bent 6	LRFD	Class 200 Alt "W"	2,700	2,694	10.0	42	1	12
Abut 7	WSD	Class 200 Alt "W"	2,735	2,720	8.0	44	1	8

TABLE 7. DESIGN LOADS PROVIDED BY "STRUCTURE DESIGN"

Support No.	Service-I Limit State (kips)			Strength Limit State (Controlling Group, kips)				Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	850	140	650	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	1,250	N/A	1,000	2,250	270	0	0	1,200	360	0	170
Bent 3	1,430	N/A	1,100	2,400	270	0	0	1,200	360	0	170
Bent 4	2,000	N/A	1,500	3,200	270	0	0	1,800	320	0	100
Bent 5	2,000	N/A	1,600	3,200	270	0	0	1,800	320	0	100
Bent 6	1,250	N/A	1,000	2,200	250	0	0	1,200	360	0	170
Abut 7	850	140	650	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note:
1. Support loads shown are per column.
2. Service I loads are reported as net loads
3. Strength and Extreme loads are reported as gross loads.

General Notes:

1. The structural engineer shall show the pile data table (Table 5) with the specified pile tip elevations on the foundation plan.

2. Support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

Construction Considerations

1. If necessary to attain the specified tip elevation, drilling through the center of the recommended pile (center relief drilling) may be used. Center relief drilling shall not extend lower than 10 feet above the pile tip during installation of the piles. To avoid quick conditions, water elevation inside the pile shall be maintained higher than the ground water surface to ensure a positive head.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by Office of Bridge Design South, Branch 10. If any conceptual changes are made during final project design, the Office of Geotechnical Design South-2 should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to attention of Segaran Logeswaran (916) 227-4516 or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by: Date: 11/04/13

Segaran Logeswaran, PE
Transportation Engineer

REGISTERED PROFESSIONAL ENGINEER
SEGARAN LOGESWARAN
No. C70280
Exp. 09/14
CIVIL
STATE OF CALIFORNIA

cc: District 08 Structure Construction R.E. – Pending File
District 08 Project Manager – Melecio Chalco (Electronic File)
Specs & Estimates – Ofelia Alcantara (Electronic File)
District 08 Materials Engineer – Farzad Tasbihgoo (Electronic File)
HQ GS Corporate – Project Coordination Engineer – Colyn L. Peterson (Electronic File)
HQ Geotechnical Design South-2 – Abbas Abghari – OGDS-2 (Electronic File) APC
HQ Geotechnical Design South-2 – Angel Perez-Cobo (Electronic File)
HQ Geotechnical Archive

FIGURES

Figure 1. Nearby Major Faults with Reference to the Project Site
Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

SOIL SAMPLE LABORATORY RESULT

APPENDIX B

CORROSION EVALUATION

FIGURES

CALIFORNIA DEPARTMENT OF
TRANSPORTATION

Caltrans ARS Online (v2.2.06)

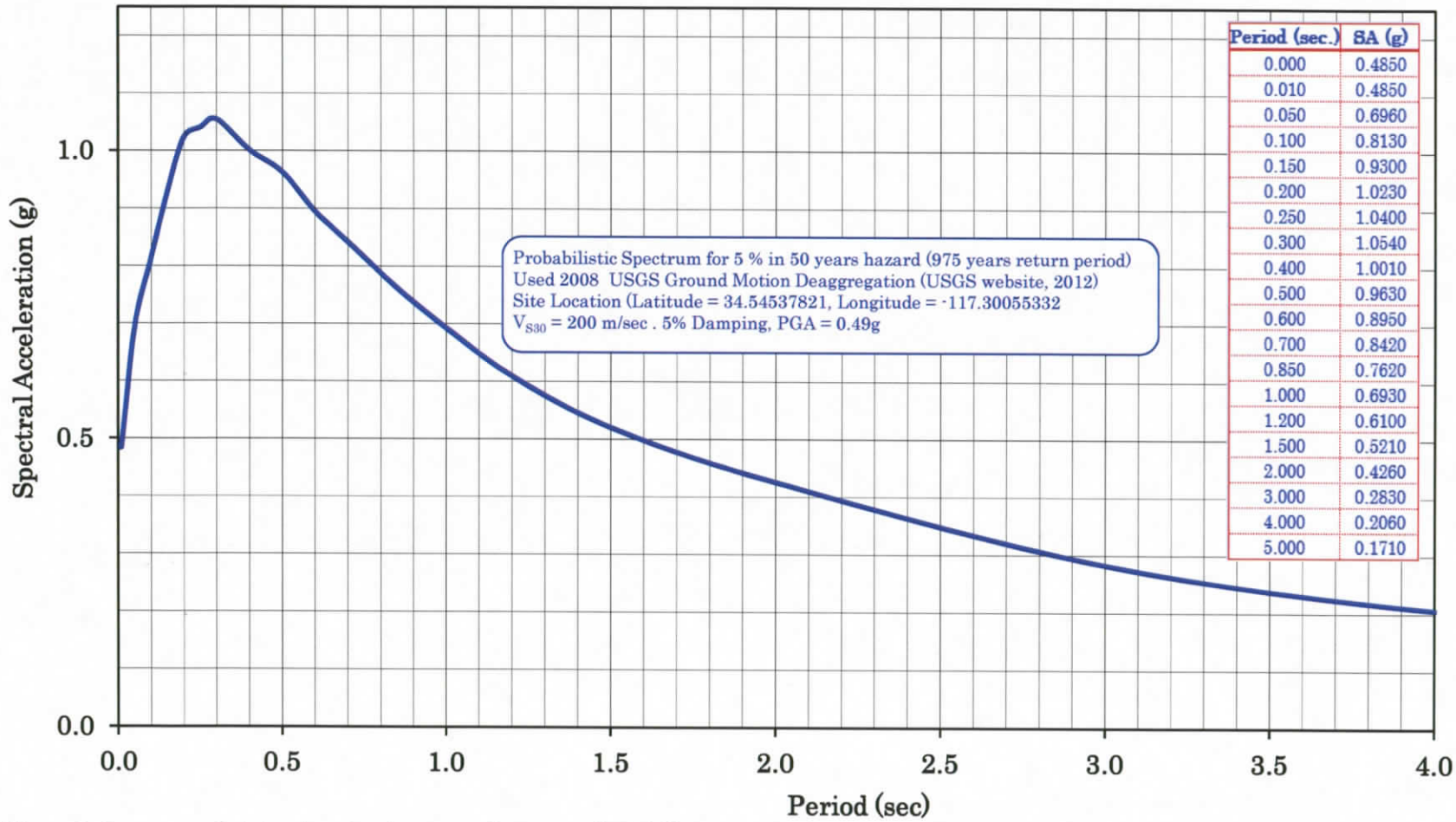
This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION

Latitude: 34.54548425 **Longitude:** -117.30055332 ***Vs30:*** 200 m/s Calculate

Figure 1. Project site and the nearby faults is attached .

Recommended Acceleration Response Spectrum for the Victorville Sep. and OH (New) (Bridges # 54-0484G)



Period (sec.)	SA (g)
0.000	0.4850
0.010	0.4850
0.050	0.6960
0.100	0.8130
0.150	0.9300
0.200	1.0230
0.250	1.0400
0.300	1.0540
0.400	1.0010
0.500	0.9630
0.600	0.8950
0.700	0.8420
0.850	0.7620
1.000	0.6930
1.200	0.6100
1.500	0.5210
2.000	0.4260
3.000	0.2830
4.000	0.2060
5.000	0.1710

Figure 2. Recommended Acceleration Response Spectrum (ARS) Curve

APPENDIX A

DIVISION OF
ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SUPPORT
GEOTECHNICAL LABORATORY
5900 Folsom Boulevard
Sacramento, CA 95819

Date: 3/11/2010

To: Asef Wardak / GDS-2

From: Lilibeth C. Purta / (916) 227-5239

RE: Laboratory Test Report -- EA: 08-355561
GL 09-065

Final test results.

Note: All remaining test specimens will be disposed of in 30 calendar days from the release date of the final test results.

AASHTO R18

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 09-065
Dist - EA: 08-355561
Report Date: March 11, 2010

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R09-001_07								100	99	97	89	78	65	50	35	16	8				17.1	
R09-001_08											100	99	91	66	43	9	5				26.9	
R09-001_09										100	99	97	89	46	17	6	3				30.5	
R09-001_10								100	98	82	55	32	18	10	6	2	1				18.1	
R09-001_11								100	96	90	79	70	62	39	17	4	1				27.3	
R09-001_12								100	92	79	56	36	20	11	7	3	1				17.6	
R09-002_02								100	97	94	75	44	23	10	5	3	1				12.6	
R09-002_03									100	98	91	78	50	18	9	3	1				29.3	
R09-002_04						100	86	82	75	66	52	35	18	9	6	5	4				15.9	
R09-002_05					100	92	92	91	86	82	67	38	19	10	6	5	4				18.1	
R09-002_06								100	99	97	92	74	49	19	9	3	1				22.1	
R09-002_15								100	99	96	92	88	80	57	39	16	7				21.8	
R09-003_01										100	99	97	88	56	35	12	6				32.0	
R09-003_02									100	94	76	55	32	21	17	7	4				24.1	
R09-003_03									100	94	83	55	15	6	3	3	0				22.6	
R09-003_04									100	98	90	79	58	30	9	3	0				23.2	
R09-003_05									100	95	73	34	15	7	4	3	0				18.1	
R09-003_06				100	91	81	71	66	55	45	31	19	10	6	4	1	0				9.2	
R09-003_07								100	86	75	64	50	27	16	8	2	0				16.5	
R09-003_10										100	99	97	88	59	38	19	10				22.3	
R09-004_02										100	94	79	54	36	21	3	1				32.6	
R09-004_04								100	89	70	42	24	13	7	5	2	1				17.0	

CALIFORNIA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL LABORATORY

GL TRACKING NO : 09-065
Dist - EA: 08-355561
Report Date: March 11, 2010

CLASSIFICATION TEST SUMMARY

SAMPLE ID	% FINER THAN																	ATTERBERG LIMITS		AS RECEIVED		Gs
	3"	2 1/2"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	5μ	1μ	LL	PI	γd (pcf)	%m	
R09-005_04				100	80	80	80	80	79	76	72	66	41	17	14	4	4				18.8	
R09-005_05								100	93	87	65	47	31	19	11	5	4				17.4	
R09-006_07					100	93	93	92	90	86	76	62	50	40	31	15	10				16.3	
R09-006_09				100	87	87	87	87	87	87	86	86	84	58	29	9	7				30.6	
R09-006_11									100	87	65	38	22	13	8	3	1				19.3	
R09-006_12								100	99	94	77	54	28	12	7	3	1				19.2	
R09-006_13				100	93	93	93	92	86	69	46	28	19	12	8	4	3				13.8	
R09-006_17										100	99	99	96	84	60	22	13				25.5	
R09-007_02								100	99	97	83	72	65	50	28	11	7				14.5	
R09-007_05								100	96	82	51	26	14	7	4	4	4				15.4	
R09-007_07				100	89	89	84	82	78	67	48	31	21	15	11	3	1				15.7	
R09-007_09				100	91	88	81	79	60	38	22	12	8	5	3	1	1				13.0	
R09-008_02									100	89	63	47	23	15	8	5	3				1.1	
R09-008_04						100	99	99	92	74	47	27	13	7	4	2	1				22.3	
R09-008_05								100	98	88	63	31	15	10	9	6	4				17.9	
R09-008_06								100	99	94	75	37	16	8	5	4	3				18.1	
R09-008_07				100	86	86	80	78	73	62	38	21	13	8	5	1	0				12.8	

APPENDIX B

SUMMARY OF CORROSION TESTS

Boring No.	Top of Borehole Elevation (feet)	Sample at Elevation (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
R-09-001	2736.3	2731	Sands	1392	7.19	N/A	N/A
		2700	Sands	1215	6.94	N/A	N/A
		2650	Lean Clay	2380	7.89	N/A	N/A
R-09-002	2701.1	2695	Sands	12154	8.26	N/A	N/A
		2685	Sands	8392	N/A	N/A	N/A
		2665	Sands	12678	N/A	N/A	N/A
		2625	Sand/Caliche	1398	7.98	N/A	N/A
		2605	Sands	4674	7.49	N/A	N/A
R-09-003	2700.4	2689	Sands	1759	6.53	N/A	N/A
		2674	Sands	16800	7.29	N/A	N/A
		2659	Lean Clay	1150	5.98	N/A	N/A
		2639	Sands	1383	6.62	N/A	N/A
R-09-004	2698.8	2688	Sands	8094	6.78	N/A	N/A
		2663	Sands	N/A	7.29	N/A	N/A
		2643	Sands	N/A	7.99	N/A	N/A
		2623	Silts	3379	8.54	N/A	N/A
R-09-005	2699.3	2693	Sands	1350	6.27	N/A	N/A
		2678	Silts	9105	6.93	N/A	N/A
		2658	Sands	9295	7.20	N/A	N/A
		2653	Silts	2214	6.92	N/A	N/A
		2628	Sands	8413	8.34	N/A	N/A
		2598	Sands	1040	7.86	N/A	N/A
R-09-006	2736.4	2725	Sands	853	6.48	313	41
		2660	Silty Clay	2644	7.94	N/A	N/A
R-09-007	2701.5	2695	Sands	4485	8.16	N/A	N/A
		2665	Sands	N/A	8.36	N/A	N/A
		2640	Sands	N/A	8.94	N/A	N/A
		2620	Sands	7424	8.89	N/A	N/A
B12-01	2698.6	2687	Sands	12595	6.29	N/A	N/A
		2642	Sands	6219	7.92	N/A	N/A
		2617	Sands	6541	8.27	N/A	N/A

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: DAN ADAMS
Design Branch 10

Attn: Ryan Stiltz

Date: November 1, 2013
File: 08-355560
0800000621
08- SBd-15- PM 42.2
Retaining Wall No.124

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services MS 5
Office of Geotechnical Design – South 2, Branch C

Subject: Revised Geotechnical Design Report

Introduction

As requested by your Office on October 3, 2013, our Office has prepared this Revision to the original Geotechnical Design Report (GDR) dated February 2000, (Ref. #1) and the previous Amended Geotechnical Design Reports (AGDR) (Ref. #2 and #3), for the freeway-widening project along interstate 15 east of Victorville in San Bernardino County. This Revised GDR provides geotechnical information and foundation recommendations for the proposed Retaining Wall No. 124 and supersedes all previous GDRs regarding Retaining Wall No. 124.

As originally requested by District in 1999, this Office analyzed both a Standard Type-1 retaining wall and a soil nail wall along the proposed LOL of Retaining Wall No. 124. Alternative #2 (Ref #2) was selected for Retaining Wall No. 124 which includes about 380 lineal feet of Standard Type-1 Wall and 1200 lineal feet of soil nail wall. The following geotechnical information is based on our site investigation, previous reports and a review of existing pertinent information related to this retaining wall.

The following recommendations are based on a review of References (Ref) listed below:

1. GDR For the Proposed Widening of I-15 from Mojave Drive in Victorville to Highway 58 in Barstow. Caltrans Office of Roadway Geotechnical Engineering – South. February 2000
2. Amended GDR. Caltrans Office of Roadway Geotechnical Engineering – South. May 2010
3. Amended GDR. Caltrans Office of Roadway Geotechnical Engineering – South. November 2012

Site Description

Currently at the site, the four lanes of NB I-15 are located at the base of an existing cut that slopes 2:1 (H:V) and varies in height from 15 feet at the south end of project area, to 120 feet above the roadway at the north end of the project. The projects slope is approximately 1 mile in length and is tallest at the north end of project along the D Street off ramp. Between stations 125+72 and 130+00 there is a level bench atop the slope that varies in width between 10 feet and 30 feet, Soundwall No. 40, and the adjacent Caltrans Right of Way (R/W) are located across the bench from the slope hinge point. Between Stations 130+00 and 141+60, the hinge point of the slope is adjacent to the R/W. Residential structures and vacant lots exist adjacent to the R/W.

Proposed Improvements
Based on our understanding, the ultimate design configuration for Retaining Wall No. 124 shall provide enough additional space to add 3 NB I-15 mainline lanes and to realign the D Street exit off ramp. At its ultimate design configuration Retaining, Wall No. 124 shall vary in height between 8 and 24 feet and be about 1600 feet long. This GDR covers the current phase of this project which is only to build the top half portion of the soil nail wall now and to construct the remaining bottom half at a later date.

Current plans for Retaining Wall No. 124 show a Caltrans Standard Type-1 retaining wall from Stations 125+72 to 129+39 and a soil nail wall from Stations 129+39 to 141+60. It is our understating the Type-1 Wall portion of Wall No. 124 has been designed and shall be constructed in it's ultimate built configuration.

Proposed wall heights for the Caltrans Standard Type-1 retaining wall portion range from 8 feet to 12 feet and the proposed finished slope above the wall shall be 2:1 (H:V) and the slope shall be a maximum of 15 feet in height. The Type-1 Wall footing shall be founded on over excavated and recompacted material and shall be founded such that the top of footing is below the ETW of the proposed paved shoulder.

The soil nail wall was designed using the ultimate design configuration, which includes longer nail tendons intended for a 24 foot tall wall. The Typical Section drawings show the leveling pad for the soil nail wall portion of Wall No. 124 to be located at midslope and the Finished Grade (FG) above and below the wall are shown to be 2:1 (H:V). The finished slope above the soil nail wall portion shall be 2:1 (H:V) and shall vary in height between 10 feet and 40 feet. The slope in front of the soil nail wall shall also be sloped down to the shoulder at 2:1 (H:V).

Site Geology
The retaining wall site is located within the Mojave Desert Geomorphic Province of California. The Mojave Desert is situated between the Transverse Ranges across the San Andreas fault on the southwest, the Sierra Nevada Mountains and Basin and Range Provinces on the North across the Garlock Fault, and Sonora Desert towards the south and east extending out of California. The Mojave Desert is an internally draining area, comprised of broad desert alluvial plains and lacustrine basins that are separated by mountainous bedrock blocks, controlled by the northwest-southeast trending strike slip fault pattern of the region.

Project Site Seismicity
Based on the 2012 Caltrans faults database and Caltrans ARS Online (v2.1.06) Tool, the site is located about 10.2 miles (16.4 km) from the Helendale-So Lockhart fault which is the controlling fault for this site. The Heledale Fault is a 56 mile long right-lateral fault that is capable of a Maximum Credible Earthquake (MCE) of 7.25. The peak horizontal bedrock acceleration at the site, based on Caltrans California Hazard Map, is estimated to be 0.4g

Geotechnical Investigation
Our office visited the project area and conducted several site investigations in order to explore the sub-surface soil conditions and to obtain soil samples for laboratory testing. The 1999 subsurface exploration utilized a B-47 trailer mounted drill rig, and a standard rubber tired back hoe. A CME 75 Drill Rig was used during the 2006 investigation. Please see Attachment #1 which includes the LOTBs that are relevant to Retaining Wall No. 124.

On September 8, 1999, a back hoe operated by District 8 Maintenance staff excavated six test pit trenches into the southern slopes to approximately 1 foot below grade of the existing paved shoulder. The trenches were excavated to allow visual identification of the subsurface soil conditions within the slope, to evaluate the caving potential of the site, and to collect samples for laboratory testing. The locations of the six trenches are shown on the Log of Test Borings (LOTB).

The drill rigs performed Standard Penetration Testing (SPT) every 5 feet or where needed. The drill rig advanced 6 deep holes from the top of the slope to investigate the subsurface conditions in the bonding area of the soil nail tendons and the piles for Soundwall No. 40. Blow counts from the SPT were recorded in the (LOTB)s. During our 1999 visit we advanced the auger borings to an elevation 2850 feet. Soil samples collected from the 2 inch-diameter SPT spoon sampler were packaged in zip-lock bags and bulk bag samples were collected from auger cuttings. Samples for testing were delivered to the District 7 Laboratory and to the Sacramento Laboratory. See attachment #1 and #2.

Three horizontal augured boreholes were advanced into the slope approximately 50 feet in order to evaluate the potential of bore holes caving during construction. After 36 hours the three holes remained clear and open and the cutting was typically dry silty Sands. The locations of the three horizontal borings are shown on the attached LOTB sheet.

Surface and Subsurface Soil Conditions
At the site the roadway cuts through an older alluvial fan deposit with existing slopes nearing 120 feet in height. The subsurface materials at the top of the slope are generally composed of a 2 to 10 foot layer of medium dense to dense, well graded SAND (SM). This layer is underlain by a dense to very dense silty SAND with granitic bedrock at deeper depth. Some loose sand layers were identified during the trenching investigation, the layers appeared to be 1 to 2 feet in thickness.

All natural and cut slopes in the project area appear to be performing well and no landslides or small slip outs were identified or reported by this office. The flat-lying bedding nature of the alluvial sands contributes to the stability of the slopes. Existing cut, fill and natural slopes were observed for degree of erosion as an indicator of the erosion performance of the geologic materials to be encountered and used on this project. The existing slopes at the project site are sparsely vegetated to non vegetated with surface soils consisting of moderately dense silty sands and thus are subject to erosion. No groundwater was encountered during our subsurface investigation.

Laboratory Testing
Laboratory tests performed on the collected samples included: Mechanical Analysis (California Test Method 202), Moisture Content (CTM 226), Plasticity Indexing (CTM 204) and Corrosion (CTM 643). Gradation plots and corrosion test results are presented as Attachment #2.

In-Situ Testing
In-situ testing for this report included Standard Penetration Tests (SPT) which were performed at all vertical boring locations. Percolation testing was conducted with in the area of the proposed detention basins.

Design Analysis and Recommendations
This section describes the methodology used for design of the proposed Retaining Wall, including the selection of soil strength parameters, the proposed slope and wall geometry, and analyzing the estimated soil parameters and wall dimensions for failure resulting from sliding, overturning and soil bearing capacity. The section closes with a presentation of calculated Factors of Safety (FOS) obtained from the slope stability, SNAILZ and the XSTABLE slope stability program and bearing capacity analysis.

Looking at the cross sections and General Plans dated 6-17-2013, this Office received, it appears the proposed Caltrans Standard Type 1 Retaining Wall will be embedded so as the finished top of footing elevation will be lower than the proposed Edge of Traveled Way (ETW) of the paved shoulder of I-15. The Finished Grade (FG) of the slope above the Type 1 Wall portion of Wall No. 124 shall be 2:1 (H:V) and ranges in height from 10 feet to 15 feet.

The SPT data from the subsurface investigation for Wall No. 124 averaged 41 blows per foot near the proposed soil nail area. In general, soil samples from the site were classified as medium dense silty SAND (SM) although one sample from boring B2-15 indicated loose sands on the top 5 feet below ground surface. From these in-situ visual observations from the exploratory trenches and Laboratory test results, we estimated the soil parameters to be: an angle of internal friction of 34 degrees, Cohesion of 100 psf and a moist unit weight of 130 lb/ft^3. These soil strength parameters are applicable to both Type-1 and soil nail wall designs.

<u>Type 1 Wall</u>
For the proposed Type 1 portion of Wall No. 124 the footing dimensions and bearing pressures are provided on the Caltrans Revised Standard Plan RSP B3-1B (April 2012e). In accordance with the Caltrans bridge design specifications, as resulted from our analyses, the expected soil resistances on-site are higher than required resistances in strength limit state and extreme limit state for the wall design. In addition, under the service limit state based on the permissible stress, the estimated settlement of the wall footing is expected to be less than 1 inch provided a minimum of 1 foot of over excavation is performed as described below. The Finished Grade (FG) of the slope above the Type 1 Wall shall be 2:1 (H:V) and range in height from 10 feet to 15 feet indicating a Case II Loading Condition.

We recommend the foundation material beneath the footing be over excavated to a vertical depth of one foot below the bottom of the footing. The over excavated area should include the entire footing footprint and extend a minimum of 1 foot horizontal beyond the face of the footing toe. The foundation material at the bottom of the over excavated area should be scarified, moisture conditioned and recompacted to at least 95% relative compaction. Then the on-site materials can be placed back to the area, moisture conditioned and compacted to 95% relative compaction.

Our slope stability analyses indicated that the minimum factors of safety met the required factors under the static and psudo-static conditions.

Soil Nail Wall

The above soil strength parameters, slope and wall geometry were inputted into the limit equilibrium computer program SNAILZ, created by Caltrans, to determine possible combinations of nail lengths, spacing and the associated Fact of Safety (FOS) for geotechnical recommendations. A nail inclination angle of 15 degrees and soil nail diameter of 1 inch were design inputs used. The Soil Nail Wall was designed as a vertical wall with no batter.

Table 1: Recommended Soil Nail Spacing

Start Stations	End Stations	Soil Nail Row	Horizontal Spacing (ft)	Vertical Spacing (ft)
129+39	135+40	1 & 2	4	4.5
135+40	141+13	1 & 2	5	4.5
136+90	141+13	3 & 4	5	4

Table 2: Recommended Soil Nail Length

Start Station	End Station	Height Range (ft)	Soil Nail Length (ft)
129+39	140+58	23 to 26	26
140+58	141+13	20 to 30	35

The soil nail design pullout resistance is recommended to be 3,300 lb/ft. Contractor will select drilled hole diameter and soil nail size to meet the design capacity. In the top 5 ft of the slope area, some loose soils may be encountered during wall construction, the first row of nails may require a short section of casing. The top row of nails should be placed a maximum of 3 feet below the finished grade. All construction operations should comply with the special specifications provisions, Section 10.1, based on the following recommended Wall Zones.

Soil Nail Wall No.124 will be separated into three zones for soil nail testing and temporary open cut duration purposes. Zone 1 will cover the top 5 feet, of the full face of the wall. Zone 2 through Zone 3 will cover the wall profile betweens stations as listed in the following Table 3.

Table 3: Soil Nail Wall Soil Zones

Wall Zones	Start Station	End Station	Elevation Range
1	129+39	141+13	Top 5 feet of wall
2	129+39	140+58	Below Zone 1
3	140+58	141+13	Below Zone 1

The Contractor will perform verification testing and proof testing as specified in the Construction Specifications. A minimum of eight percent (8%) of the total number of nails shall be proof tested.

Construction Considerations

For the first row of soil nails, there is a potential that some loose sands will be encountered during construction, Soil nail holes drilled in the first row may require casing near the surface. Compressed air should not be introduced into the borehole as the air will dry out the sands and cause them to slough and cave. All holes drilled for soil nails should be grouted the same day they are drilled; no holes shall be left open overnight. No groundwater was noted on the existing LOTB, and groundwater should not be encountered during soil nail installation.

Due to the fact the cross section do not include the right of way line or existing structures it is difficult to determine where the temporary back cut for footing excavation will daylight and the influence of any existing structures on the stability of the slope and proposed cuts.

Corrosion

The Materials Engineering and Testing Services, testing and technology Branch, has performed corrosion tests on soil samples from the field investigation. Test results indicate soils at the site are not considered corrosive.

If you require further information, please contact Brian Gutierrez at (916) 227-1222 or Shawn Wei at (916) 227-5252

Prepared by: Date: 11-1-13

REGISTERED PROFESSIONAL ENGINEER
BRIAN A. GUTIERREZ
No. 66258
Exp. 06/14
CIVIL
STATE OF CALIFORNIA

BRIAN GUTIERREZ, P.E.
Branch C
Office of Geotechnical Design- South 2

Attachment #1: 2 LOTBs for Retaining Wall No. 124.
Attachment #2: Soil Laboratory Test Data.

cc: AAbghari - GDS2
SWei – GDS2
GS Corporate

Attachment #1
Log of Test Borings (LOTB)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER XX DATE

PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

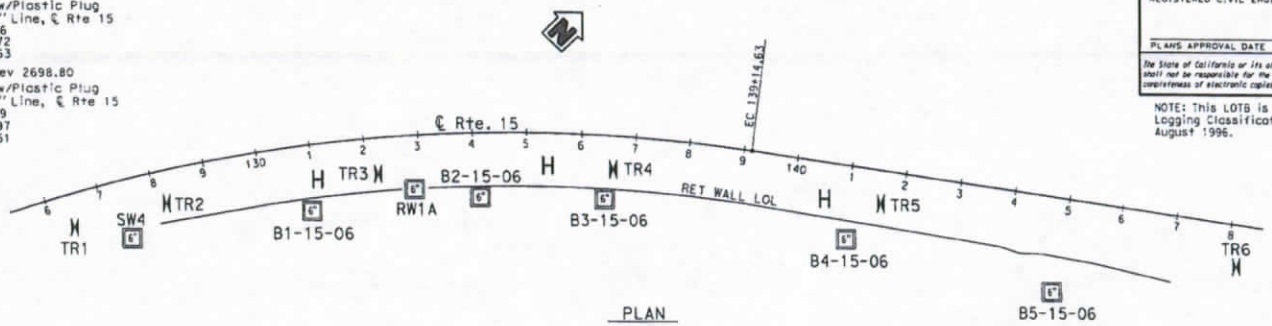
REGISTERED PROFESSIONAL ENGINEER Brian Gutierrez No. C66258 Exp. 5-6-14 CIVIL STATE OF CALIFORNIA

NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.

BENCH MARK

E 103 Elev 2699.26
Fnd 1" I.P. w/Plastic Plug
130.03 Rt "A" Line, ℄ Rte 15
Sta 168+15.36
N 2,021,558.72
E 6,772,441.63

SUHV 532 Elev 2698.80
Fnd 1" I.P. w/Plastic Plug
147.83 Lt "A" Line, ℄ Rte 15
Sta 168+86.49
N 2,021,823.97
E 6,772,332.51

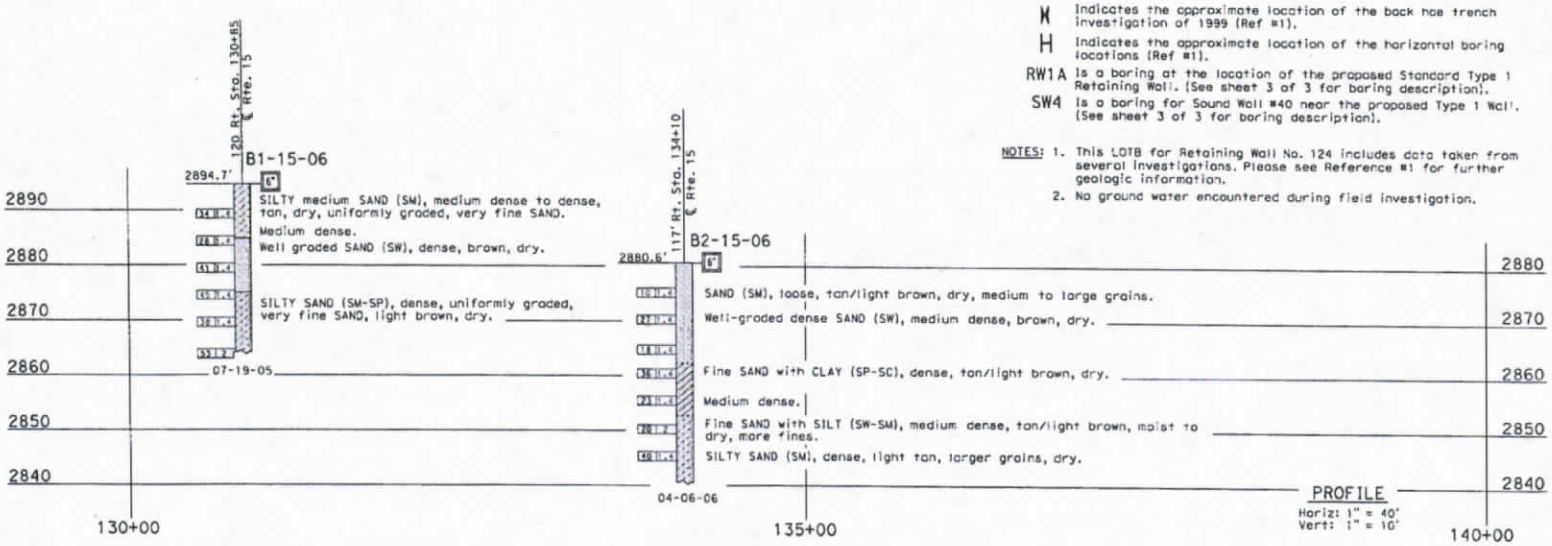


PLAN
1" = 100'

LEGEND

- ⋈ Indicates the approximate location of the back hoe trench investigation of 1999 (Ref #1).
- H Indicates the approximate location of the horizontal boring locations (Ref #1).
- RW1A Is a boring at the location of the proposed Standard Type 1 Retaining Wall. (See sheet 3 of 3 for boring description).
- SW4 Is a boring for Sound Wall #40 near the proposed Type 1 Wall. (See sheet 3 of 3 for boring description).

NOTES: 1. This LOTB for Retaining Wall No. 124 includes data taken from several investigations. Please see Reference #1 for further geologic information.
2. No ground water encountered during field investigation.



PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'

ENGINEERING SERVICES	MATERIALS & GEOTECHNICAL SVCS	FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. / POST MILE 130.0/146.0	RETAINING WALL 124 LOG OF TEST BORINGS 1 OF 3
DRAWN BY I.G-Remmen		B. Gutierrez				
CHECKED BY B. Gutierrez						

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

UNIT: 3643
PROJECT NUMBER & PHASE:
FILE => rw124-1of3.dgn

CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 8-14-13 10-21-13 10-25-13

SHEET X OF X

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

DGS LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 5/25/07)

TIME PLOTTED => 15:15
DATE PLOTTED => 29-OCT-2013

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER — DATE

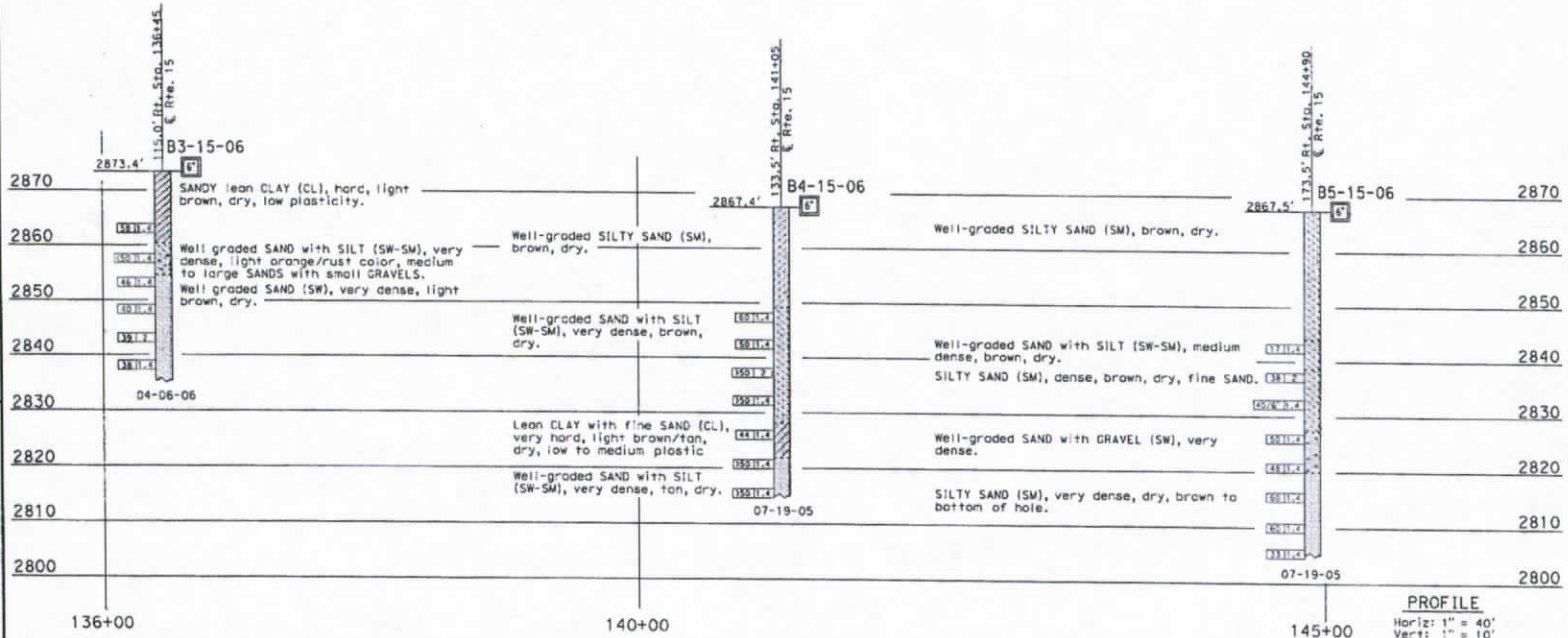
PLANS APPROVAL DATE

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER — Brian Gutierrez — No. C68254 — Exp. 6-5-14 — CIVIL — STATE OF CALIFORNIA

FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 3"

Note: No ground water encountered during field investigation.



PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'

ENGINEERING SERVICES	MATERIALS & GEOTECHNICAL SVCS
DRAWN BY	I.G-Remnen
CHECKED BY	B. Gutierrez

FIELD INVESTIGATION BY: B. Gutierrez

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH X

BRIDGE NO.
POST MILE 130.0/146.0

RETAINING WALL 124
LOG OF TEST BORINGS 2 OF 3

UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 01-17-14 02-27-14 10-21-14

SHEET X OF X

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

FILE =>rw124-2of3.dgn

DGS LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 5-05-07)

TIME PLOTTED => 15:18
DATE PLOTTED => 29-OCT-2013
USERNAME => s116982

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER XX DATE

PLANS APPROVAL DATE

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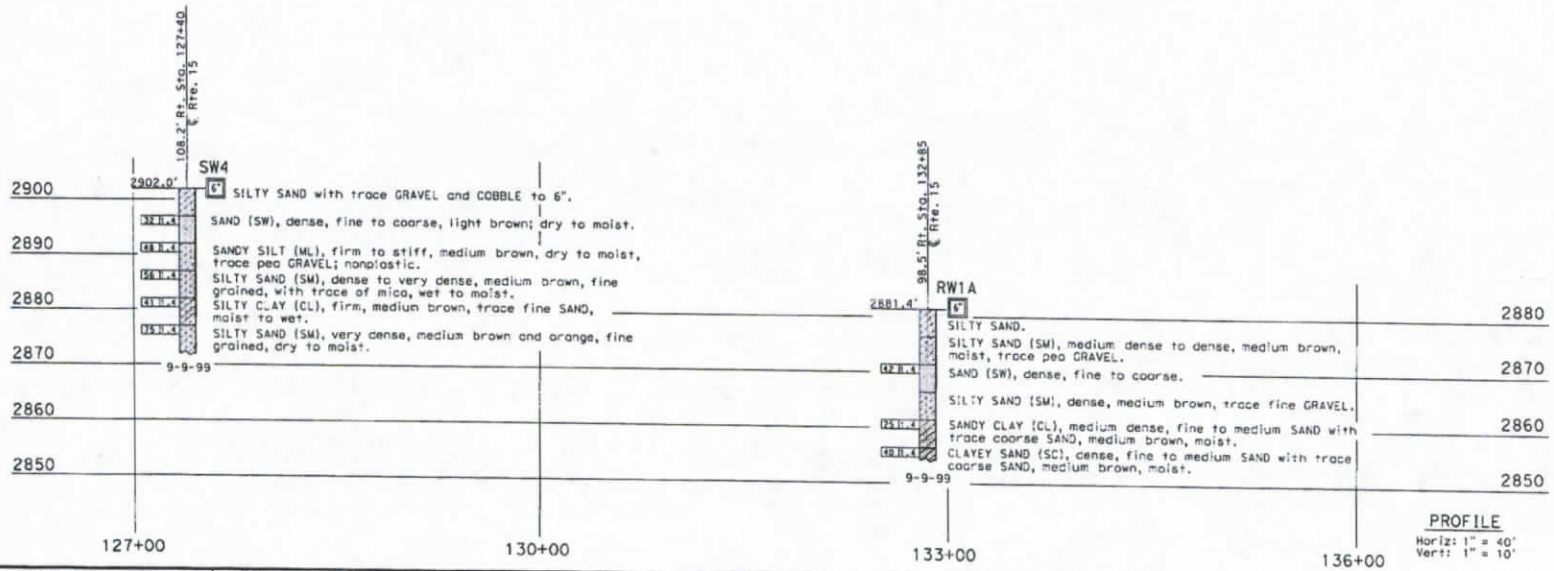
REGISTERED PROFESSIONAL ENGINEER Brian Gutierrez C66258 Exp. 6-6-14 CIVIL STATE OF CALIFORNIA

NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.

FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 3"



PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'

ENGINEERING SERVICES	MATERIALS & GEOTECHNICAL SVCS	FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH X	BRIDGE NO. / POST MILE 130.0/146.0	RETAINING WALL 124 LOG OF TEST BORINGS 3 OF 3
DRAWN BY I.G-Remmen						
CHECKED BY B. Gutierrez		B. Gutierrez				

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS

UNIT: 3643
PROJECT NUMBER & PHASE:
FILE => rw124-3of3.dgn

CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 10-29-13

SHEET X OF X

USERNAME => s116992 DATE PLOTTED => 29-OCT-2013 TIME PLOTTED => 15:19

LEGEND OF BORING OPERATIONS

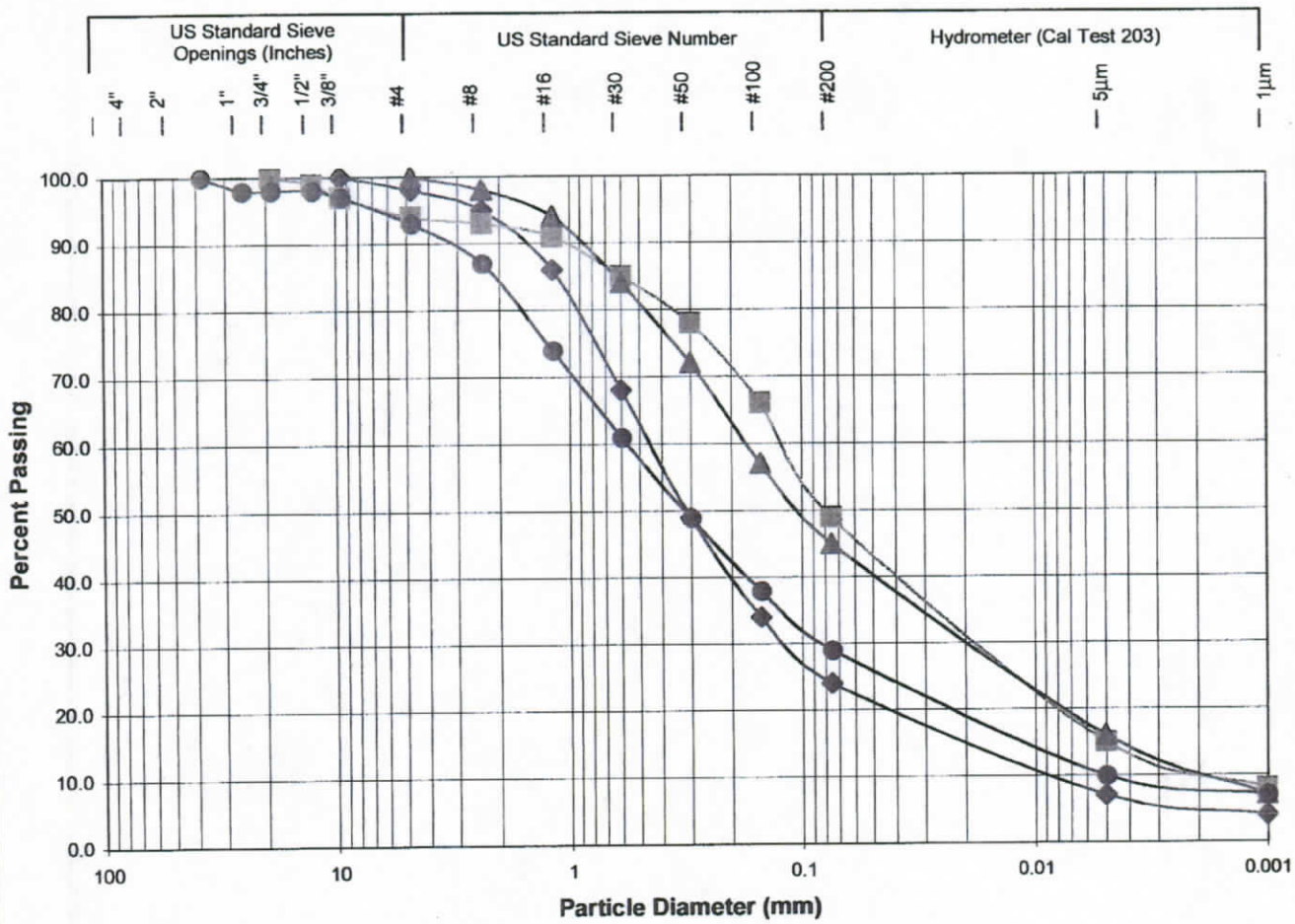
LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS

DES LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 3/25/01)

Attachment #2
Laboratory Test Results

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

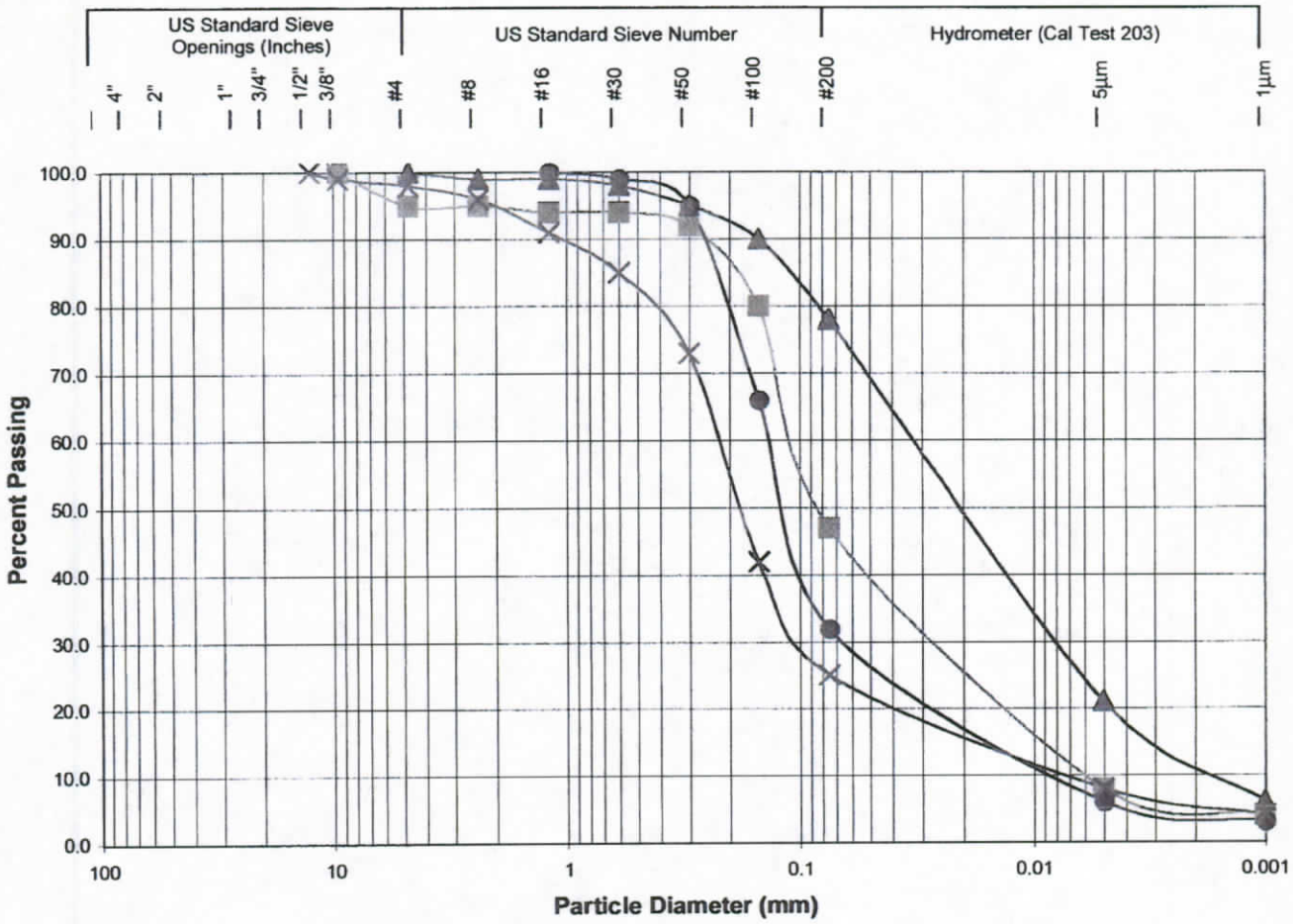
Sample ID: RW1A,5-7 ◆ RW1A,S4 ■ RW1A,S5 ▲ RW1A,15-17 ● ✕

Caltrans

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

Gradation Analysis Test Results

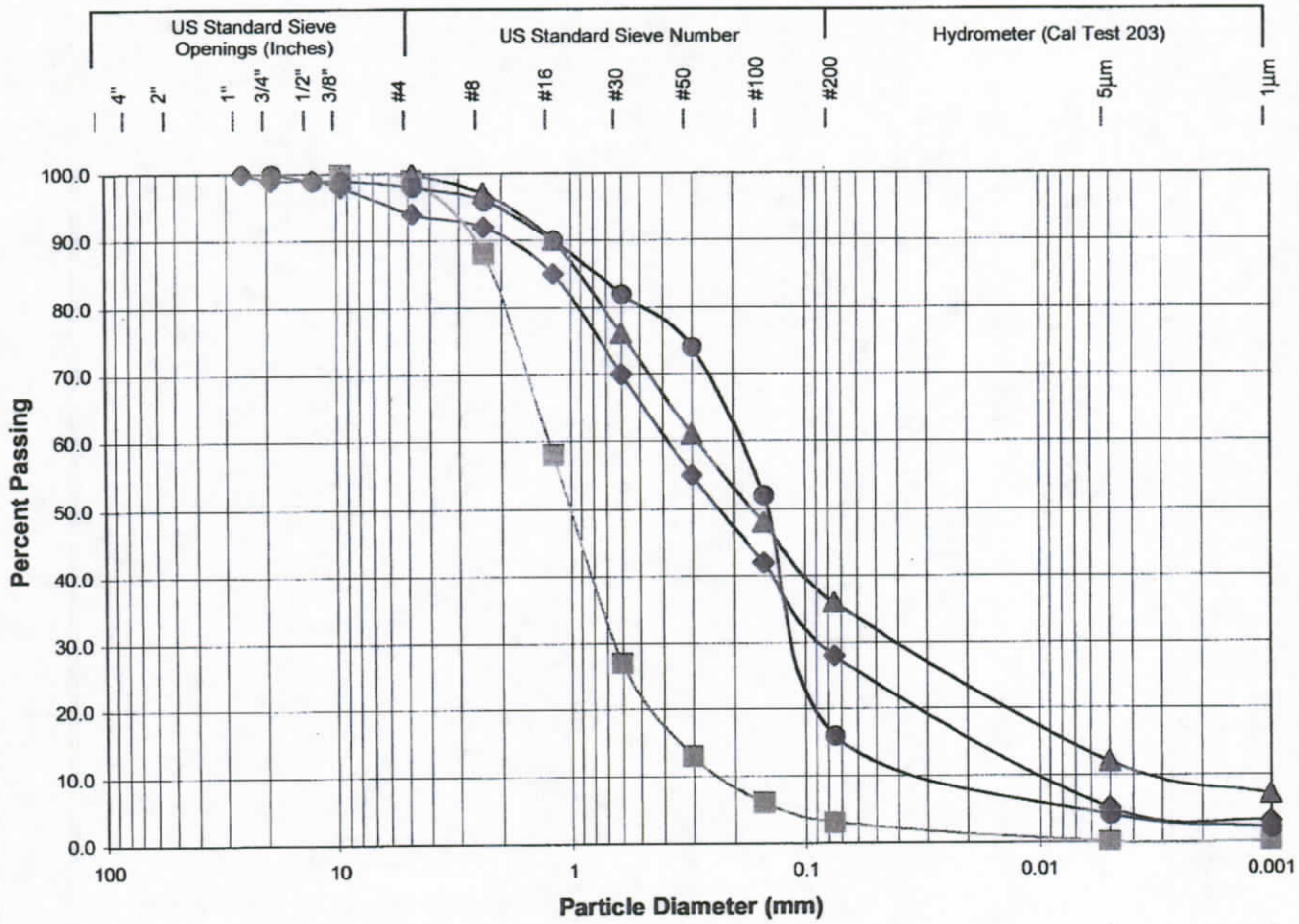


Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

Gradation Analysis Test Results



GRAVELS		SANDS			SILT	CLAY
Coarse	Fine	Coarse	Medium	Fine		

Sample ID: TR1 TR2 TR3 TR6

Engineering Service Center
Office of Structural Foundations
Roadway Geotechnical
Engineering - South

Caltrans

Project:	Rt 15 Widening, Vic-Bar
EA:	08-355500
D.-Co.-Rt.-:	08-SBd-15-67.6/113.6
Test Date:	Sep. 9, 1999

THE DIVISION OF MATERIALS AND FOUNDATIONS
TEST SUMMARY

REPORT BY: Angela Giordano
Corrosion Technology Section

MATERIAL SOURCE: 8 - Sol - 15 - 42/69
SAMPLE OF: Silty Sand & Gravel
EA : 08-355500

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	pH	MINIMUM RESISTIVITY (Ohm-Cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C435909	99-0651	Boring S3	Sta 38+50	8.3	3600	N/A	N/A	42
C435910	99-0635	Boring R5	N/A	7.7	5800	N/A	N/A	51
C435911	99-0636	Boring R6	N/A	8.5	4650	N/A	N/A	47
C435912	99-0637	Boring R10	N/A	8.3	4550	N/A	N/A	46
C537079	99-1185	RW 4	6' - 11'	8.4	3400	N/A	N/A	41
C537080	99-1186	RW 7B	12' - 15'	8.4	1800	N/A	N/A	32
C536551	99-1053	RW1A 15-17'	Sound Wall	9.2	3750	N/A	N/A	43
C536552	99-1054	RW1A 5-7'	Sound Wall	8.6	2800	N/A	N/A	38

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
TEST SUMMARY REPORT

REPORT BY: Corrosion Technology Section

MATERIAL SOURCE: 8 - SB - 15 - 41.9/70.3
SAMPLE OF: Silt, Sand & Gravel
EA : 08-355520

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	SAMPLE DEPTH	DISTRICT pH	DISTRICT MINIMUM RESISTIVITY (ohm-cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C100042	00-0043	B #RW7B	Sta 31 + 90	13' - 15'	7.7	950	430	70	24

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

THE DIVISION OF MATERIALS ENGINEERING AND TESTING SERVICES
TEST SUMMARY REPORT

REPORT BY: Corrosion Technology

MATERIAL SOURCE: 8 - SBd - 15 - 40.43
SAMPLE OF: Soil
EA : 08-355500

SIC No	CORROSION NUMBER	SAMPLE FROM	LOCATION	SAMPLE DEPTH	pH	MINIMUM RESISTIVITY (Ohm-Cm)	SULFATE CONTENT (PPM)	CHLORIDE CONTENT (PPM)	YEARS TO PERFORATION 18 ga. GALV. STEEL CULVERT
C4693286	99-1050	TR-6-99	Retaining Wall	N/A	8.0	2500	N/A	N/A	36
C4693287	99-1051	TR-3-99	Retaining Wall	N/A	8.5	660	870	210	21
C4693288	99-1052	TR-1-99	Retaining Wall	N/A	7.8	16000	N/A	N/A	78
C4693285	99-1049	TR-2-99	Retaining Wall	N/A	8.4	11000	N/A	N/A	67

Note: Caltrans currently defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of 5.5 or less.

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Grading Factor for Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing a Grading Factor for the purpose of calculating material quantities on the Interstate 15 (I-15) Widening Project in Victorville, California.

Grading Factors relate the in place volume of material to be excavated to the in place volume of material after placement as fill. The factors are defined as in place volume of compacted fill (V_{fill}) divided by in place volume of material to be excavated (V_{exc}).

$$G_f = V_{fill}/V_{exc}$$

Grading Factors may be determined by dividing the in place density of material to be excavated (γ_{exc}) divided by the in place density of compacted fill (γ_{fill}).

$$G_f = \gamma_{exc}/\gamma_{fill}$$

The freeway widening project will generate borrow material primarily from cuts in native alluvial soil west of D Street. The borrow material will be placed as embankment fill at nearby locations.

On January 29, 2014, OGDS2 staff and the Caltrans District 8 Materials Testing Laboratory in Victorville conducted nuclear density tests to determine a grading factor for the project. Numerous tests were performed within in-situ alluvium at locations west of D Street to determine the in place density of material to be excavated (γ_{exc}). Several more tests were performed within embankment fill near D Street to determine the in place density of compacted fill (γ_{fill}). The relative position and composition of the embankment fill near D Street suggests that it was derived from the alluvium west of D Street. The approximate locations of the nuclear density test conducted are depicted on Attachment 1. Nuclear density test results from the in-situ alluvium and embankment fill are included in Table 1 and Table 2, respectively.

The average dry density of the in-situ alluvium was compared to the average dry density of the embankment fill. In this manner, a Grading Factor of 0.93 was determined for the bulk of the borrow material that will be generated on the project.

Table 1: Nuclear Density Test Results from Alluvium

Location	γ_{dry} (g/cm^3)	γ_{wet} (g/cm^3)
1	1.68	1.85
2	1.76	1.81
3	1.59	1.66
4	1.61	1.73
5	1.81	1.91
6	1.85	1.91
7	1.61	1.64
8	1.72	1.82
Average	1.70	1.79

Table 2: Nuclear Density Test Results from Embankment Fill

Location	γ_{dry} (g/cm^3)	γ_{wet} (g/cm^3)
9	1.79	1.86
10	1.84	1.89
11	1.88	1.94
12	1.81	1.87
Average	1.83	1.89

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

ATTACHMENTS:
Attachment 1: Project Layout Plans (L-3, L-5, and L-8)

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

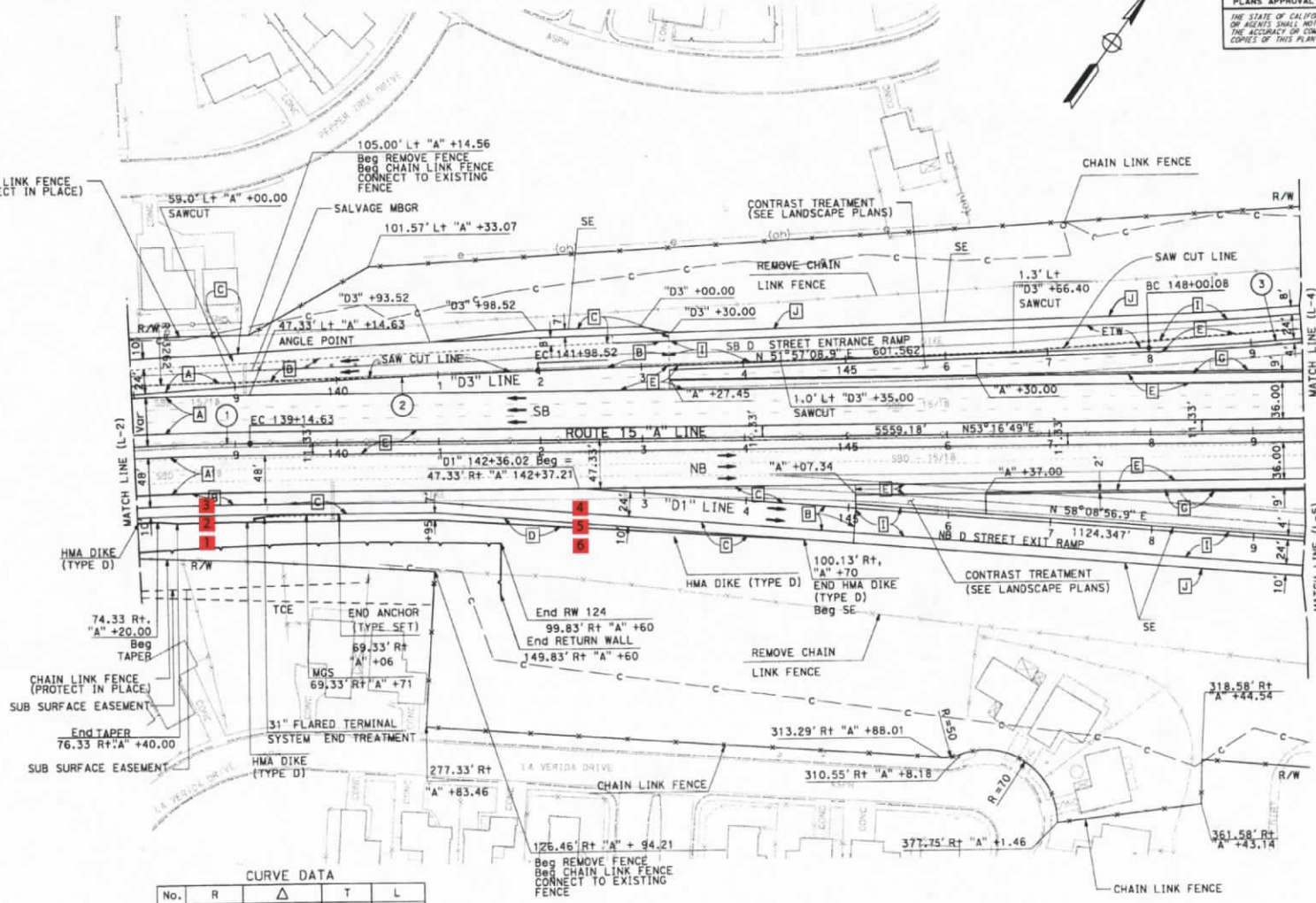
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

No.	R	Δ	T	L
1	3000.00'	30°24'51"	815.39'	1592.31'
2	8202.87'	4°02'19"	289.22'	578.20'
3	3000.00'	3°11'46"	83.70'	167.35'

= Nuclear Density Test Location

LAYOUT
SCALE: 1"=50'
L-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086ea003.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:46

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

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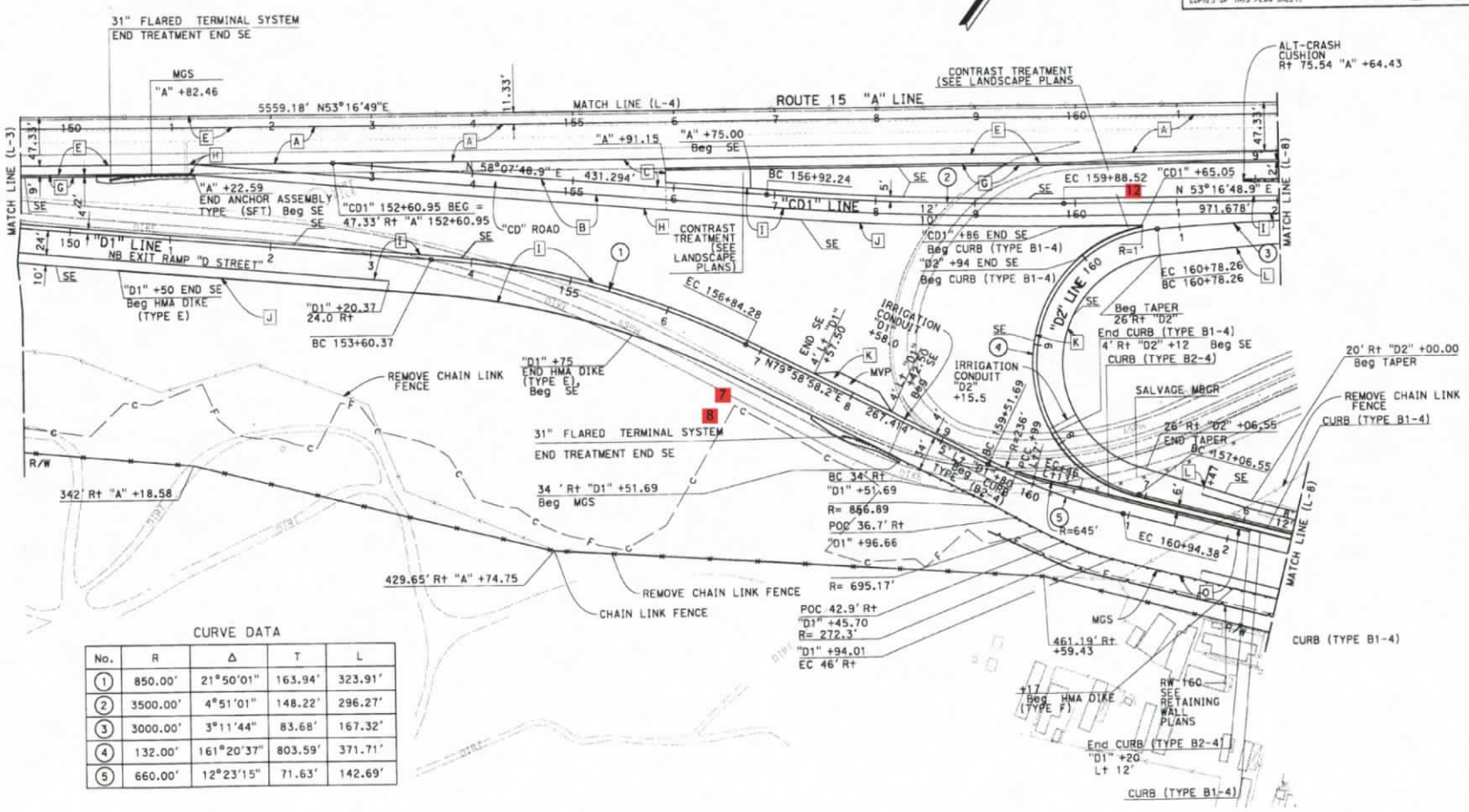
NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

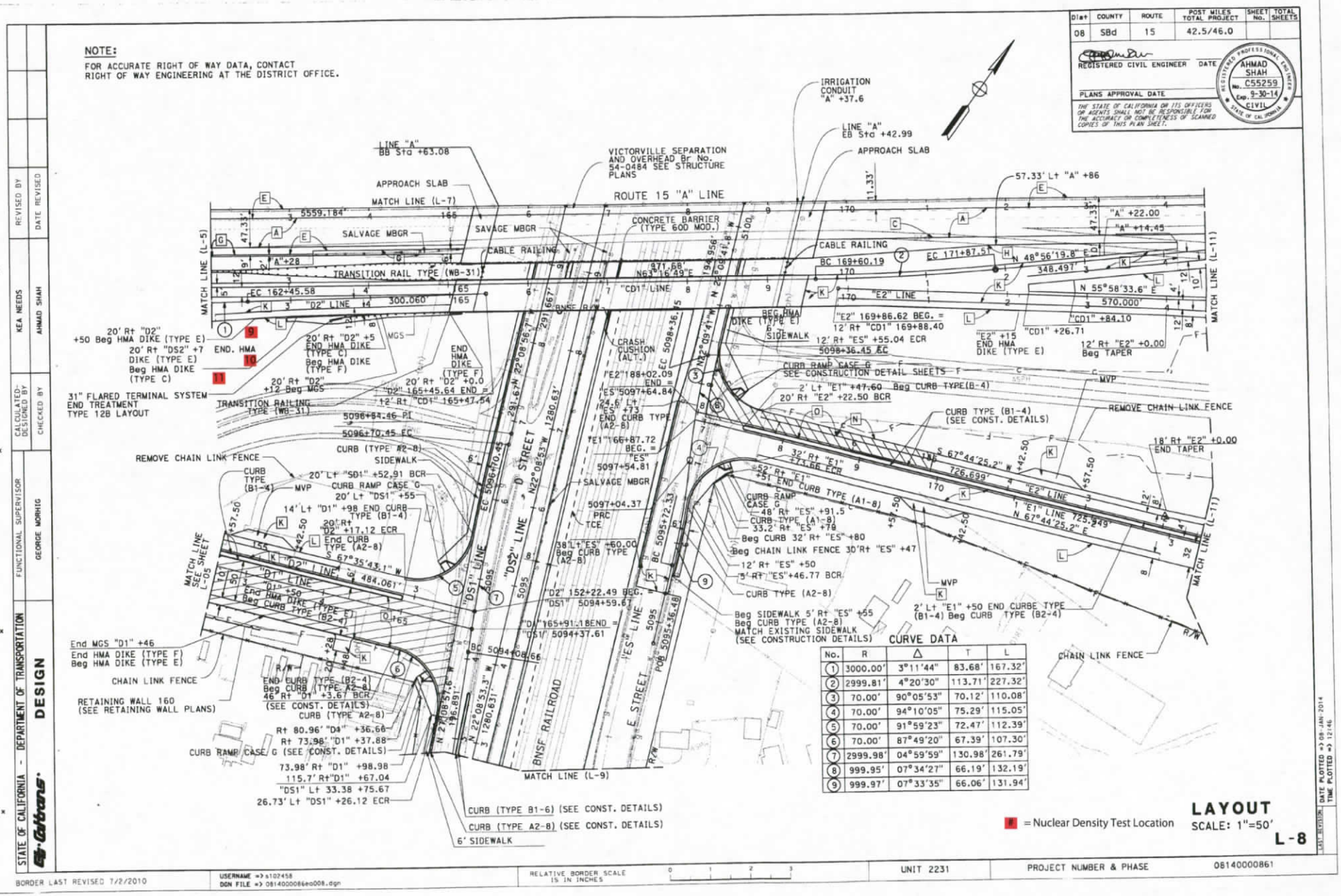
No.	R	Δ	T	L
1	850.00'	21°50'01"	163.94'	323.91'
2	3500.00'	4°51'01"	148.22'	296.27'
3	3000.00'	3°11'44"	83.68'	167.32'
4	132.00'	161°20'37"	803.59'	371.71'
5	660.00'	12°23'15"	71.63'	142.69'

7 = Nuclear Density Test Location

LAYOUT
SCALE: 1"=50'
L-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY
DATE REVISED
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000086ea005.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA
ROUTE 15 "A" LINE
IRRIGATION CONDUIT "A" +37.6
LINE "A" EB Sta +42.99
APPROACH SLAB
LINE "A" BB Sta +63.08
VICTORVILLE SEPARATION AND OVERHEAD Br No. 54-0484 SEE STRUCTURE PLANS
MATCH LINE (L-7)
SALVAGE MBGR
CONCRETE BARRIER (TYPE 60D MOD.)
CABLE RAILING
TRANSITION RAIL TYPE (WB-31)
MATCH LINE (L-5)
MATCH LINE (L-11)
57.33' Lt "A" +86
"A" +22.00
"A" +14.45
EC 162+45.58
"D2" LINE
300.060
"CD1" LINE
"E2" LINE
BC 169+60.19
EC 171+87.51
N 48°56'19.8" E
348.497'
N 55°58'33.6" E
570.000'
"CD1" +84.10
"CD1" +26.71
"E2" 169+86.62 BEG. = 12' Rt "CD1" 169+88.40
12' Rt "ES" +55.04 ECR
5098+36.45 EC
CURB RAMP CASE G SEE CONSTRUCTION DETAIL SHEETS
2' Lt "E1" +47.60 Beg CURB TYPE(B-4)
20' Rt "E2" +22.50 BCR
"E2" +15 END HMA DIKE (TYPE E)
12' Rt "E2" +0.00 Beg TAPER
18' Rt "E2" +0.00 END TAPER
REMOVE CHAIN LINK FENCE
CURB TYPE (B1-4) (SEE CONST. DETAILS)
MVP
20' Rt "D2" +50 Beg HMA DIKE (TYPE E)
20' Rt "DS2" +7 DIKE (TYPE E) Beg HMA DIKE (TYPE C)
END. HMA
20' Rt "D2" +5 END HMA DIKE (TYPE C) Beg HMA DIKE (TYPE F)
END HMA DIKE (TYPE F)
20' Rt "D2" +12 Beg MGS
20' Rt "D2" +0.0
"D2" 165+45.64 END = 12' Rt "CD1" 165+47.54
31" FLARED TERMINAL SYSTEM END TREATMENT TYPE 12B LAYOUT
TRANSITION RAILING TYPE (WB-31)
5096+54.46 PI
5096+70.45 EC
CURB (TYPE A2-8)
SIDEWALK
CURB TYPE (B1-4)
20' Lt "DS1" +52.91 BCR
CURB RAMP CASE G
20' Lt "DS1" +55
14' Lt "D1" +98 END CURB TYPE (B1-4)
20' Rt "D2" +17.12 ECR
End CURB TYPE (A2-8)
S 67°35'43.1" W
484.061'
"D1" LINE
End HMA DIKE (TYPE E) Beg CURB TYPE (B2-4)
MATCH LINE SEE SHEET L-05
"D2" LINE
"DS1" LINE
"DS2" LINE
D STREET
N22°08'53"W
1280.63'
EC 5096+70.45
"E2" 188+02.09 END = "ES" 5097+64.84
24.6' Lt "ES" +73 END CURB TYPE (A2-8)
"E1" 166+87.72 BEG. = "ES" 5097+54.81
SALVAGE MBGR
5097+04.37
PRC
TCE
38' Lt "ES" +60.00 Beg CURB TYPE (A2-8)
"D2" 152+22.49 BEG. = "DS1" 5094+59.67
"D1" 165+91.18 END = "DS1" 5094+37.61
BC 5094+08.66
"ES" LINE
BC 5095+72.33
POB 5095+36.48
E STREET
BNSF RAILROAD
MATCH LINE (L-9)
CRASH CUSHION (ALT.)
EC 5098+36.
N 22°09'41" W
194.956'
N 22°08'56.7" W
291.667'
291.6'
N 22°08'53.3" W
1280.631'
136.891'
End MGS "D1" +46
End HMA DIKE (TYPE F) Beg HMA DIKE (TYPE E)
CHAIN LINK FENCE
RETAINING WALL 160 (SEE RETAINING WALL PLANS)
END CURB TYPE (B2-4) Beg CURB (TYPE A2-8) 46' Rt "D1" +3.67 BCR (SEE CONST. DETAILS)
CURB (TYPE A2-8)
Rt 80.96' "D1" +36.66
Rt 73.98' "D1" +37.88
CURB RAMP CASE G (SEE CONST. DETAILS)
73.98' Rt "D1" +98.98
115.7' Rt "D1" +67.04
"DS1" Lt 33.38 +75.67
26.73' Lt "DS1" +26.12 ECR
CURB (TYPE B1-6) (SEE CONST. DETAILS)
CURB (TYPE A2-8) (SEE CONST. DETAILS)
6' SIDEWALK
S 67°44'25.2" W
726.699'
"E1" LINE 725.249'
N 67°44'25.2" E
32' Rt "E1" +73.66 ECR
52' Rt "E1" +51 END CURB TYPE (A1-8)
CURB RAMP CASE G
48' Rt "ES" +91.5
CURB TYPE (A1-8)
33.2' Rt "ES" +78
Beg CURB 32' Rt "ES" +80
Beg CHAIN LINK FENCE 30' Rt "ES" +47
12' Rt "ES" +50
5' Rt "ES" +46.77 BCR
CURB TYPE (A2-8)
Beg SIDEWALK 5' Rt "ES" +55
Beg CURB TYPE (A2-8)
MATCH EXISTING SIDEWALK (SEE CONSTRUCTION DETAILS)
2' Lt "E1" +50 END CURBE TYPE (B1-4) Beg CURB TYPE (B2-4)
CHAIN LINK FENCE
MATCH LINE (L-11)
CURB DATA
No. R Δ T L
1 3000.00' 3°11'44" 83.68' 167.32'
2 2999.81' 4°20'30" 113.71' 227.32'
3 70.00' 90°05'53" 70.12' 110.08'
4 70.00' 94°10'05" 75.29' 115.05'
5 70.00' 91°59'23" 72.47' 112.39'
6 70.00' 87°49'20" 67.39' 107.30'
7 2999.98' 04°59'59" 130.98' 261.79'
8 999.95' 07°34'27" 66.19' 132.19'
9 999.97' 07°33'35" 66.06' 131.94'
= Nuclear Density Test Location
LAYOUT
SCALE: 1"=50'
L-8
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086ea008.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Subsurface Conditions at Four Proposed Pipe Jacking Locations on the Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing descriptions of subsurface conditions that will be encountered at four (4) proposed pipe jacking locations on the Interstate 15 (I-15) Widening Project in Victorville, California. The pipe jacking locations are depicted on the attached Drainage and Sanitary Sewer plans and are listed in Table 1.

No subsurface investigation was conducted specifically for this memorandum. Pertinent site information was gathered from published information, previously issued geotechnical reports, as-built plans, and site reconnaissance. The subsurface soil conditions anticipated to be encountered at each proposed pipe jacking location are described in Table 1.

The evaluations contained in this memorandum are based on the information discovered and data gathered. If conditions are encountered during the project that appear to differ from the conditions conveyed in this memorandum, or if construction difficulties related to soil conditions are encountered, a representative of OGDS2 should be consulted to assist with the assessment of the prevailing geotechnical conditions and to assist in formulating appropriate strategies to facilitate project completion.

Should project design features vary significantly from those described in this memorandum an updated memorandum should be prepared by OGDS2 to address the geotechnical considerations related to those features.

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

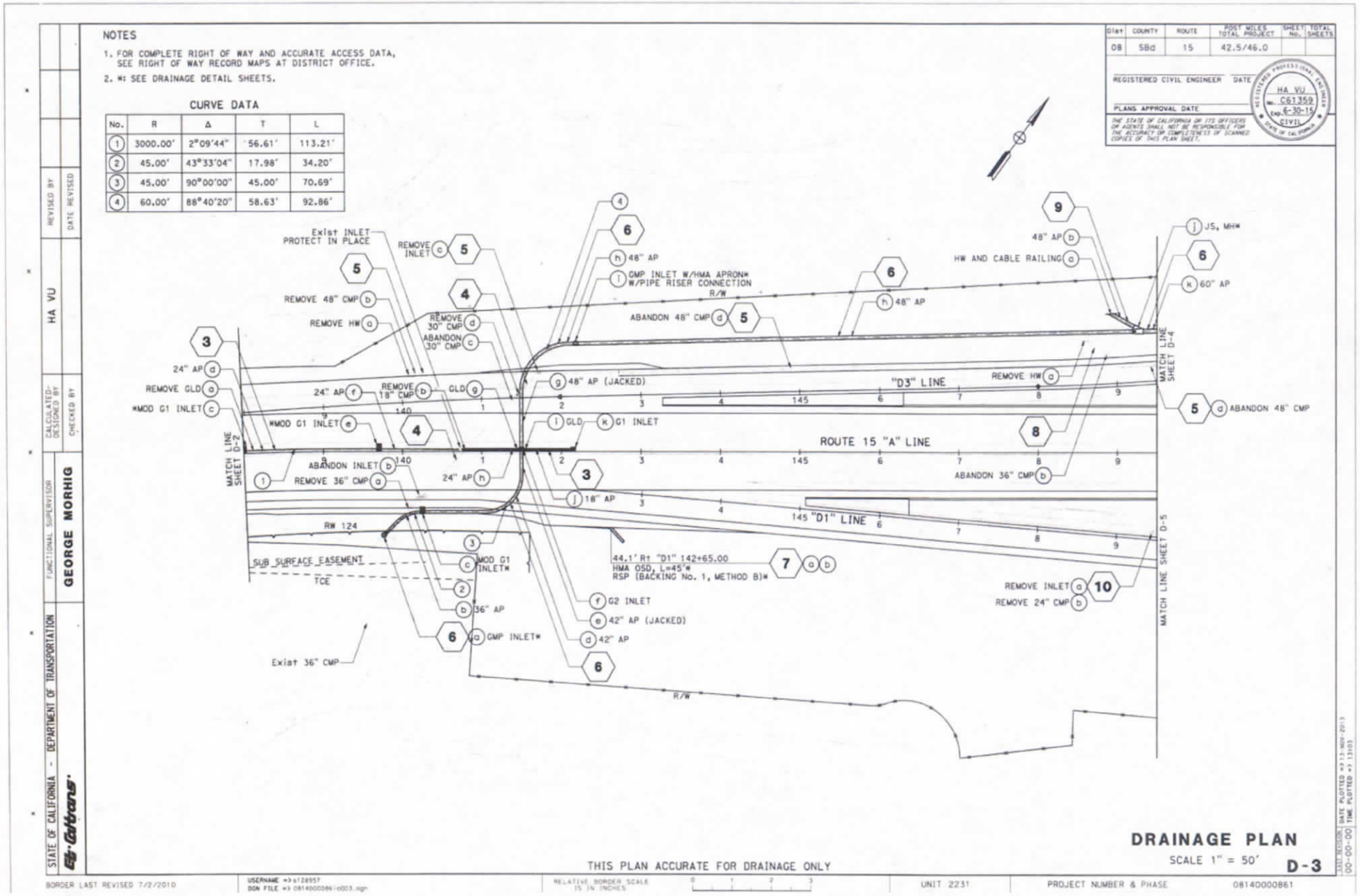
Table 1: Subsurface Soil Conditions at Proposed Pipe Jacking Locations

Approximate "A" Line Station	Facility	Approximate Lowest Elevation of Pipe (ft. MSL)	Soil Description Along Pipe Alignment	Groundwater
141+50	48-inch Alternative Pipe Culvert	2,820	Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel, and hard lean clay.	None
213+50	24-inch Steel Casing for Sanitary Sewer	2,691.5	Flood Plain Alluvium comprised of loose to very dense interbedded silty sand, clayey sand, sand with gravel and cobbles.	Measured at 2,683 and 2,684 ft. MSL in 1956 and 2013. May be higher due to seasonal rainfall, recent storm events, or water level in the nearby Mojave river.
238+50	2 (two) 60-inch Alternative Pipe Culverts	2,777	Contact between Older Alluvium and medium dense Embankment Fill derived from Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel and occasional cobbles, and hard lean clay.	None
249+10	2 (two) 60-inch Alternative Pipe Culverts	2,805	Contact between Older Alluvium and medium dense Embankment Fill derived from Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel and occasional cobbles, and hard lean clay.	None

ATTACHMENTS:
Attachment 1: Drainage Plans D-3, D-18, and D-19
Attachment 2: Sanitary Sewer Plan SS-5

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	


NOTES
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. *: SEE DRAINAGE DETAIL SHEETS.
CURVE DATA
No. R Δ T L
1 3000.00' 2°09'44" 56.61' 113.21'
2 45.00' 43°33'04" 17.98' 34.20'
3 45.00' 90°00'00" 45.00' 70.69'
4 60.00' 88°40'20" 58.63' 92.86'
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
HA VU
C61359
Exp. 6-30-15
CIVIL
Exist INLET PROTECT IN PLACE
REMOVE INLET
REMOVE 48" CMP
REMOVE HW
REMOVE 30" CMP
ABANDON 30" CMP
24" AP
REMOVE GLD
*MOD G1 INLET
24" AP
REMOVE 18" CMP
GLD
*MOD G1 INLET
ABANDON INLET
REMOVE 36" CMP
24" AP
RW 124
SUB SURFACE EASEMENT
TCE
MOD G1 INLET
36" AP
GMP INLET*
Exist 36" CMP
48" AP
GMP INLET W/HMA APRON* W/PIPE RISER CONNECTION
R/W
ABANDON 48" CMP
48" AP (JACKED)
GLD
G1 INLET
18" AP
44.1' Rt "D1" 142+65.00
HMA OSD, L=45'*
RSP (BACKING No. 1, METHOD B)*
G2 INLET
42" AP (JACKED)
42" AP
R/W
48" AP
HW AND CABLE RAILING
48" AP
"D3" LINE
ROUTE 15 "A" LINE
"D1" LINE
REMOVE HW
ABANDON 36" CMP
REMOVE INLET
REMOVE 24" CMP
JS, MH*
60" AP
ABANDON 48" CMP
MATCH LINE SHEET D-2
MATCH LINE SHEET D-4
MATCH LINE SHEET D-5
THIS PLAN ACCURATE FOR DRAINAGE ONLY
DRAINAGE PLAN
SCALE 1" = 50'
D-3
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
FUNCTIONAL SUPERVISOR
GEORGE MORHIG
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED
HA VU
BORDER LAST REVISED 7/2/2010
USERNAME => s128957
DGN FILE => 0814000086i003.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
LAST REVISION 00-00-00
DATE PLOTTED => 13-NOV-2013
TIME PLOTTED => 13:03

NOTES

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. #: SEE DRAINAGE DETAIL SHEETS.

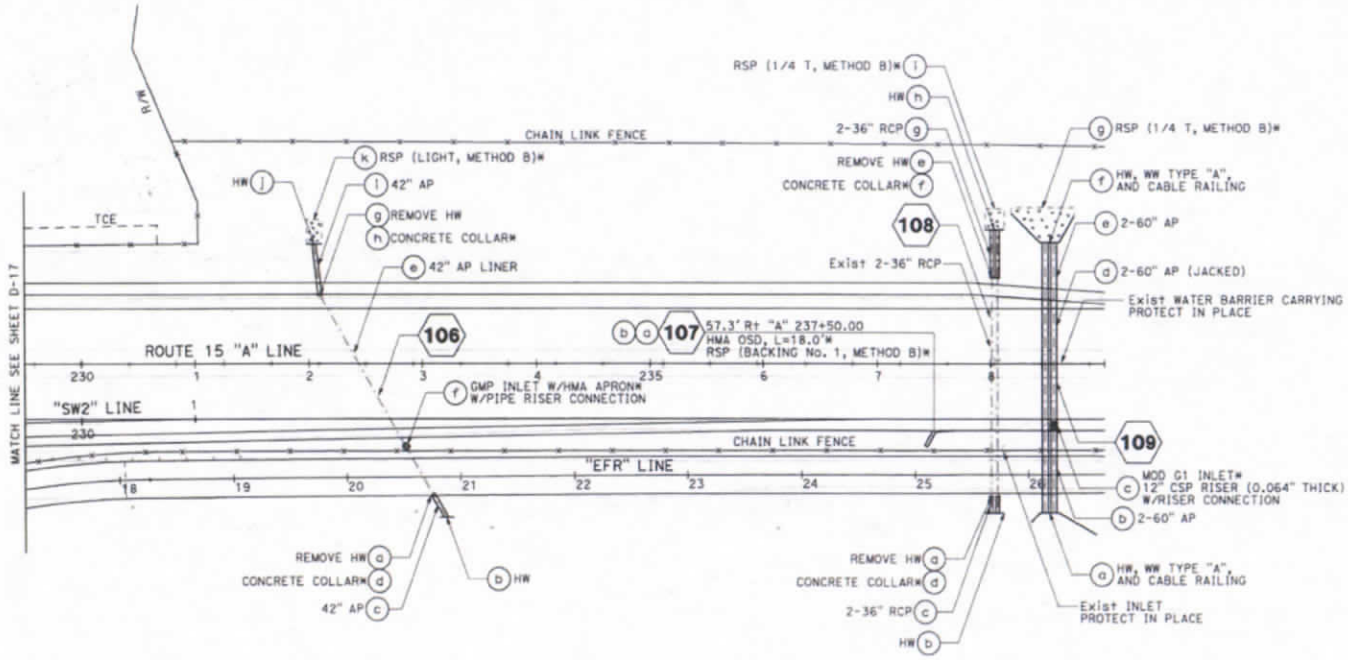
Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER HA VU No. C61359 Exp. 6-30-15 CIVIL STATE OF CALIFORNIA



THIS PLAN ACCURATE FOR DRAINAGE ONLY

DRAINAGE PLAN

SCALE 1" = 50'

D-18

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR GEORGE MORHIG

CALCULATED-DESIGNED BY HA VU

CHECKED BY

REVISED BY

DATE REVISED

BORDER LAST REVISED 7/2/2010

USERNAME => s128957
DGN FILE => 08140000861d018.dgn

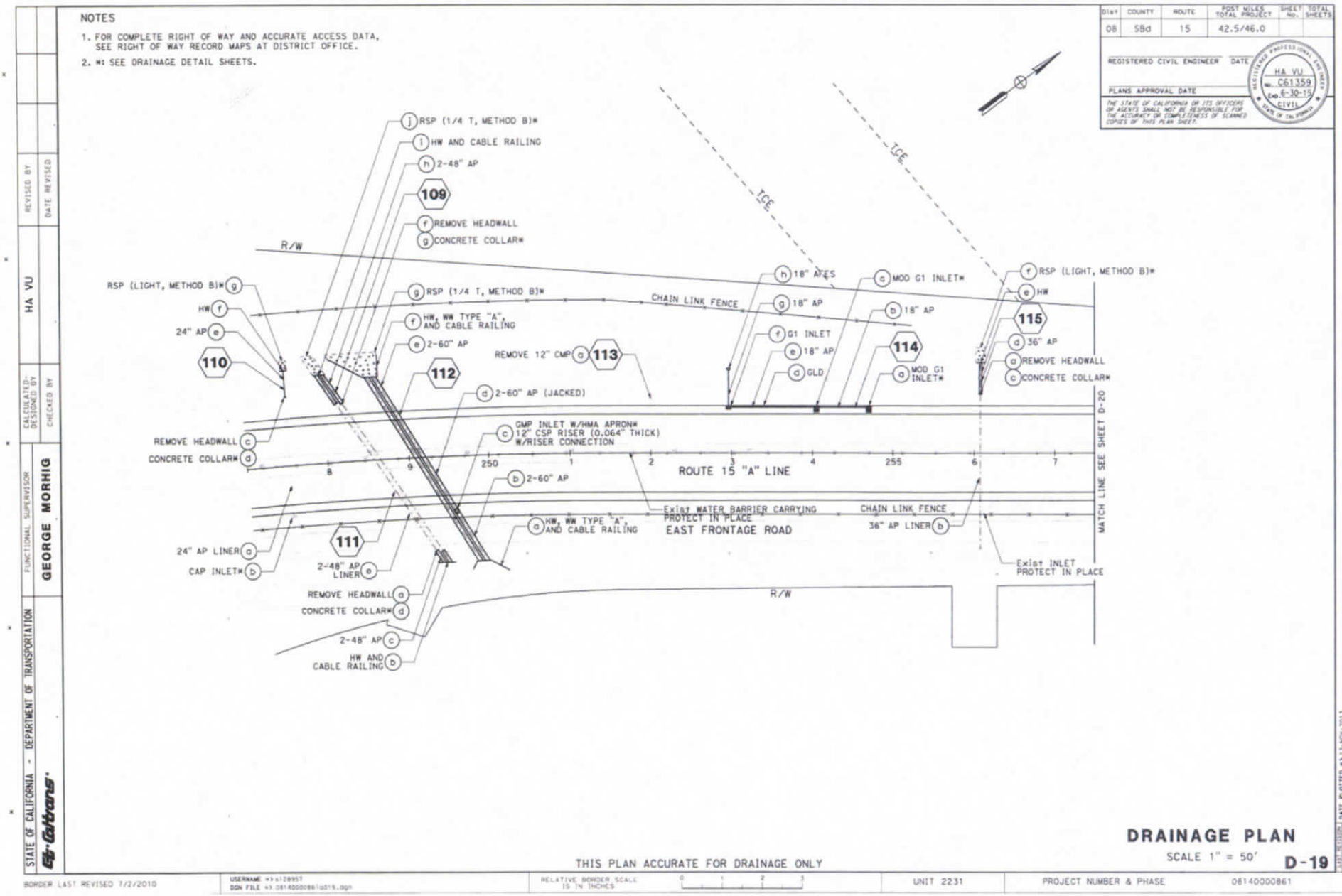
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

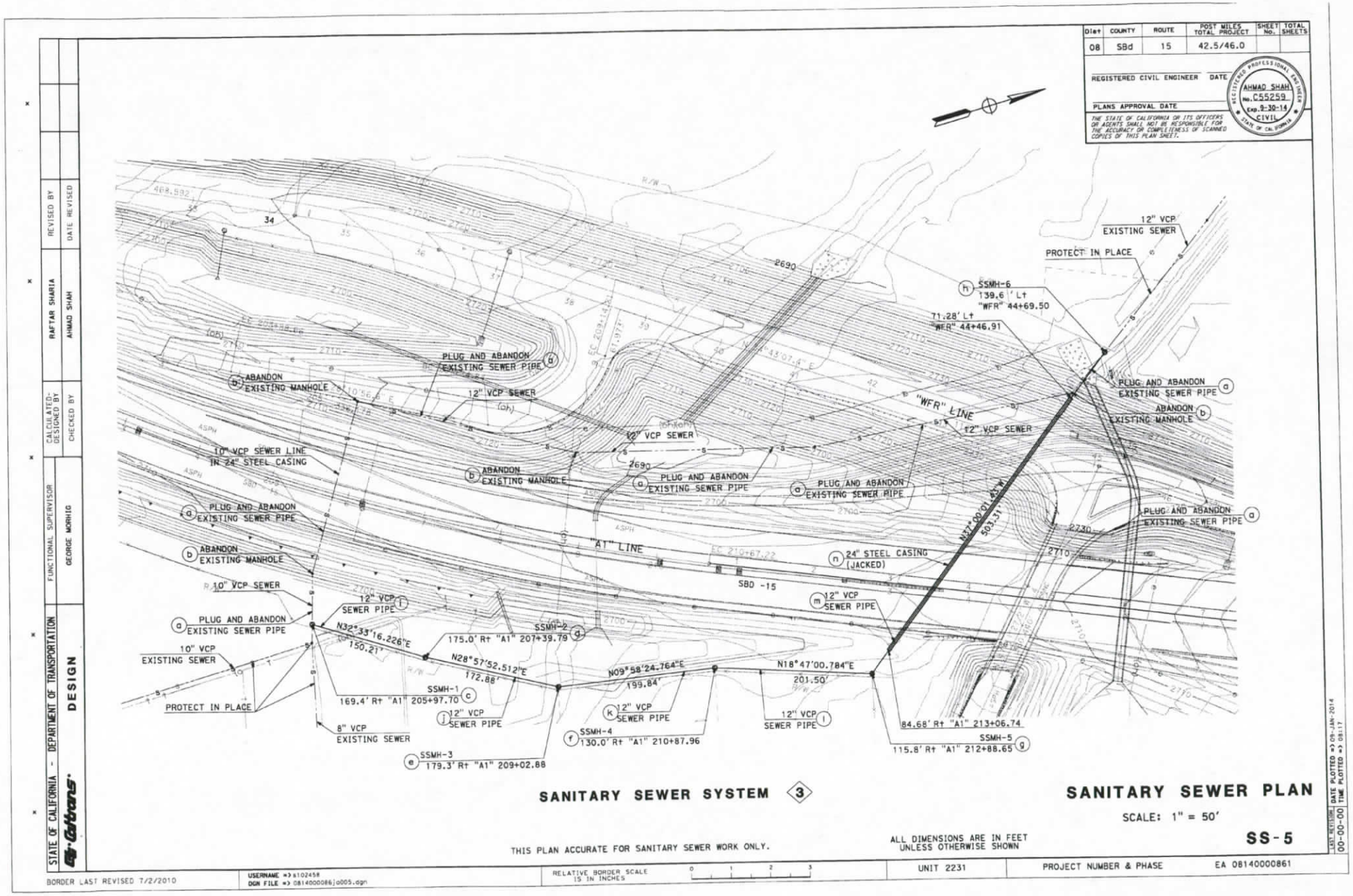
UNIT 2231

PROJECT NUMBER & PHASE 08140000861

LAST REVISION 00-00-00

DATE PLOTTED => 13-NOV-2013
TIME PLOTTED => 13:27


NOTES
1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. #: SEE DRAINAGE DETAIL SHEETS.
Dist 08 | COUNTY SBd | ROUTE 15 | POST MILES TOTAL PROJECT 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
HA VU C61359 Exp. 6-30-15 CIVIL
RSP (1/4 T, METHOD B)*
HW AND CABLE RAILING
2-48" AP
109
REMOVE HEADWALL
CONCRETE COLLAR*
R/W
TCE
RSP (LIGHT, METHOD B)*
HW
24" AP
110
RSP (1/4 T, METHOD B)*
HW, WW TYPE "A", AND CABLE RAILING
2-60" AP
112
REMOVE 12" CMP
113
2-60" AP (JACKED)
CHAIN LINK FENCE
18" APES
18" AP
G1 INLET
18" AP
GLD
MOD G1 INLET*
MOD G1 INLET*
18" AP
114
RSP (LIGHT, METHOD B)*
HW
115
36" AP
REMOVE HEADWALL
CONCRETE COLLAR*
REMOVE HEADWALL
CONCRETE COLLAR*
GMP INLET W/HMA APRON* 12" CSP RISER (0.064" THICK) W/RISER CONNECTION
250
1
2
3
4
255
6
7
8
9
ROUTE 15 "A" LINE
2-60" AP
Exist WATER BARRIER CARRYING PROTECT IN PLACE
EAST FRONTAGE ROAD
HW, WW TYPE "A", AND CABLE RAILING
CHAIN LINK FENCE
36" AP LINER
MATCH LINE SEE SHEET D-20
24" AP LINER
CAP INLET*
111
2-48" AP LINER
REMOVE HEADWALL
CONCRETE COLLAR*
2-48" AP
HW AND CABLE RAILING
Exist INLET PROTECT IN PLACE
R/W
THIS PLAN ACCURATE FOR DRAINAGE ONLY
DRAINAGE PLAN
SCALE 1" = 50'
D-19
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
FUNCTIONAL SUPERVISOR
GEORGE MORHIG
CALCULATED-DESIGNED BY
CHECKED BY
REVISED BY
DATE REVISED
HA VU
BORDER LAST REVISED 7/2/2010
USERNAME => s128957
DGN FILE => 08140000861d019.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
DATE PLOTTED => 13-NOV-2013
TIME PLOTTED => 13:28
00-00-00


Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA
12" VCP EXISTING SEWER
PROTECT IN PLACE
SSMH-6 139.6' Lt "WFR" 44+69.50
71.28' Lt "WFR" 44+46.91
PLUG AND ABANDON EXISTING SEWER PIPE
ABANDON EXISTING MANHOLE
12" VCP SEWER
"WFR" LINE
10" VCP SEWER LINE IN 24" STEEL CASING
"A1" LINE
24" STEEL CASING (JACKED)
N37°00'01.43"W 503.31'
SBD -15
10" VCP SEWER
12" VCP SEWER PIPE
N32°33'16.226"E 150.21'
175.0' Rt "A1" 207+39.79
SSMH-2
N28°57'52.512"E 172.88'
N09°58'24.764"E 199.84'
N18°47'00.784"E 201.50'
10" VCP EXISTING SEWER
169.4' Rt "A1" 205+97.70
SSMH-1
8" VCP EXISTING SEWER
SSMH-3 179.3' Rt "A1" 209+02.88
SSMH-4 130.0' Rt "A1" 210+87.96
84.68' Rt "A1" 213+06.74
SSMH-5 115.8' Rt "A1" 212+88.65
SANITARY SEWER SYSTEM 3
SANITARY SEWER PLAN
SCALE: 1" = 50'
SS-5
THIS PLAN ACCURATE FOR SANITARY SEWER WORK ONLY.
ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY RAFTAR SHARIA
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => b102458
DGN FILE => 08140000861o005.dgn
RELATIVE BORDER SCALE IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
EA 08140000861
LAST REVISION 00-00-00
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 08:17

State of California
DEPARTMENT OF TRANSPORTATION

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Mr. George Morhig
District 8
Office Chief
Design C and L, MS 1020

Date: February 14, 2014

File: 08-SBd-15-(PM) 42.5/46.0
EA 08-355561
EFIS 0800000621

From: DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design-South 2, Branch-D

Subject: Foundation and Cut Slope Soil Conditions at Retaining Wall No. 160 and Retaining Wall No. 163 on the Interstate 15 Widening Project in Victorville.

Pursuant to your request, the Office of Geotechnical Design-South 2, Branch D (OGDS2) has prepared this memorandum providing descriptions of soil conditions that exist at the planned locations of Retaining Wall No. 160 and Retaining Wall No. 163 on the Interstate 15 (I-15) Widening Project in Victorville, California. The proposed retaining walls will retain cuts in the southwest and northwest quadrants of the I-15/D Street Interchange.

Due to project schedule and resource constraints, no subsurface investigation was conducted specifically for this memorandum; therefore, no Log-of-Test-Boring (LOTB) have been prepared for Retaining Wall No. 160 and Retaining Wall No. 163. Pertinent site information was gathered from published information, previously issued geotechnical reports, as-built plans, project plans, and site reconnaissance.

The project site geology is exposed in existing cut slopes along I-15 west of D Street. The soil observed in the cut slopes consists of Older Alluvium comprised of medium dense to very dense interbedded sand, silt, silty sand, sand with gravel, and hard lean clay. LOTB have been prepared for Retaining Wall No. 124. These LOTB represent soil conditions that are typical of the Older Alluvium west of D Street; therefore, the anticipated soil conditions and interbedded stratigraphy at Retaining Wall No. 160 and Retaining Wall No. 163 are represented by the Retaining Wall No. 124 LOTB.

The evaluations contained in this memorandum are based on the information discovered and data gathered. If conditions are encountered during the project that appear to differ from the conditions conveyed in this memorandum, or if construction difficulties related to soil conditions are encountered, a representative of OGDS2 should be consulted to assist with the assessment of the prevailing geotechnical conditions and to assist in formulating appropriate strategies to facilitate project completion.

Should project design features vary significantly from those described in this memorandum an updated memorandum should be prepared by OGDS2 to address the geotechnical considerations related to those features.

If you have any questions regarding this memorandum, please contact the undersigned.

Brian Hinman

Brian Hinman
Senior Transportation Engineer (Civil)
Office of Geotechnical Design-South2, Branch-D
(858) 705-1344

REGISTERED PROFESSIONAL ENGINEER
BRIAN K. HINMAN
No. 55654
Exp. 12/31/14
CIVIL
STATE OF CALIFORNIA

ATTACHMENTS:
Attachment 1: Layout Plans L- through L-8
Attachment 2: Retaining Wall No. 124 Log of Test Boring

CC:

Melecio Chalco	District 8 Project Manager
Bruce Kean	District 8 Materials Engineer
Shawn Wei	Branch Chief OGDS2 C and D
Geotechnical Archives	

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

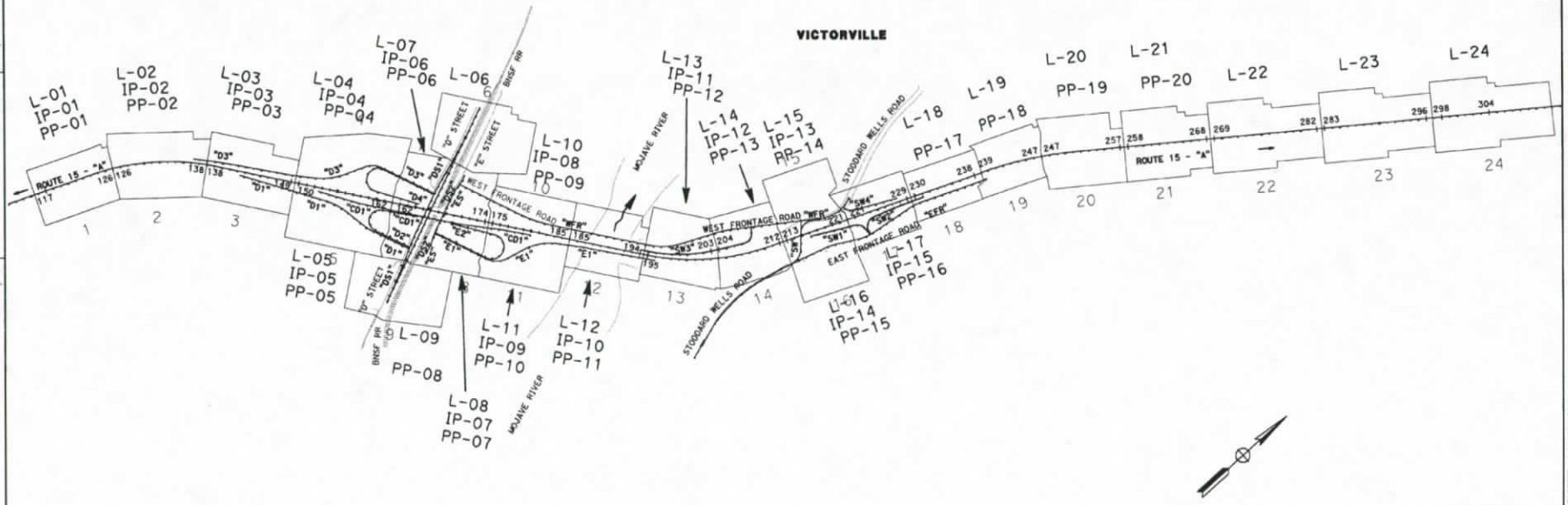
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

ALIGNMENT DESCRIPTION

"A" LINE	C/L IMPROVEMENT I-15	"SW1" LINE	LOL NB STODDARD WELLS RD EXIT RAMP
"D1" LINE	LOL NB D ST EXIT RAMP		
"D2" LINE	LOL NB D ST ENTRANCE RAMP	"SW2" LINE	LOL NB STODDARD WELLS RD ENTRANCE RAMP
"D3" LINE	LOL SB D ST ENTRANCE RAMP		
"D4" LINE	LOL SB D ST EXIT RAMP	"SW3" LINE	LOL SB STODDARD WELLS RD ENTRANCE RAMP
"DS1" LINE	LOL EB D ST		
"DS2" LINE	LOL WB D ST	"SW4" LINE	LOL SB STODDARD WELLS RD EXIT RAMP
"ES" LINE	LOL E ST		
"E1" LINE	LOL NB E ST EXIT RAMP	"SW" LINE	LOL STODDARD WELLS RD OVERCROSSING
"E2" LINE	LOL NB E ST ENTRANCE RAMP		
"CD" LINE	LOL NB COLLECTOR DISTRIBUTOR	"EFR" LINE	LOL EAST FRONTAGE ROAD
"CD" LINE	LOL NB COLLECTOR DISTRIBUTOR	"WFR" LINE	LOL WEST FRONTAGE ROAD



NO SCALE

KEY MAP AND LINE INDEX

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

LAYOUT

SCALE: 1"=50'

K-01 L-

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FUNCTIONAL SUPERVISOR: GEORGE MORHIG

CALCULATED-DESIGNED BY: RAFTAR SHARIA

CHECKED BY: AHMAD SHAH

REVISED BY

DATE REVISED

LAST REVISION DATE PLOTTED => 10-JAN-2014 TIME PLOTTED => 08:46

00-00-00

BORDER LAST REVISED 7/2/2010

USERNAME => s128764
DGN FILE => 08140000860001.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 2231

PROJECT NUMBER & PHASE 08140000861

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

NOTES:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. FOR COMPLETE RETAINING WALL & SOUND WALL DETAILS SEE RETAINING WALL AND SOUNDWALL PLANS.
3. FOR COMPLETE CURB(S), CURB RAMP(S), SIDEWALK(S) CONCRETE BARRIER(S), CRASH CUSHION(S), SEE CONSTRUCTION DETAILS.
4. FOR HMA DIKE AND SAFETY EDGE LIMIT SEE QUANTITY SHEETS.
5. CHAIN LINK FENCE TO BE H=6'0"

ABBREVIATIONS:

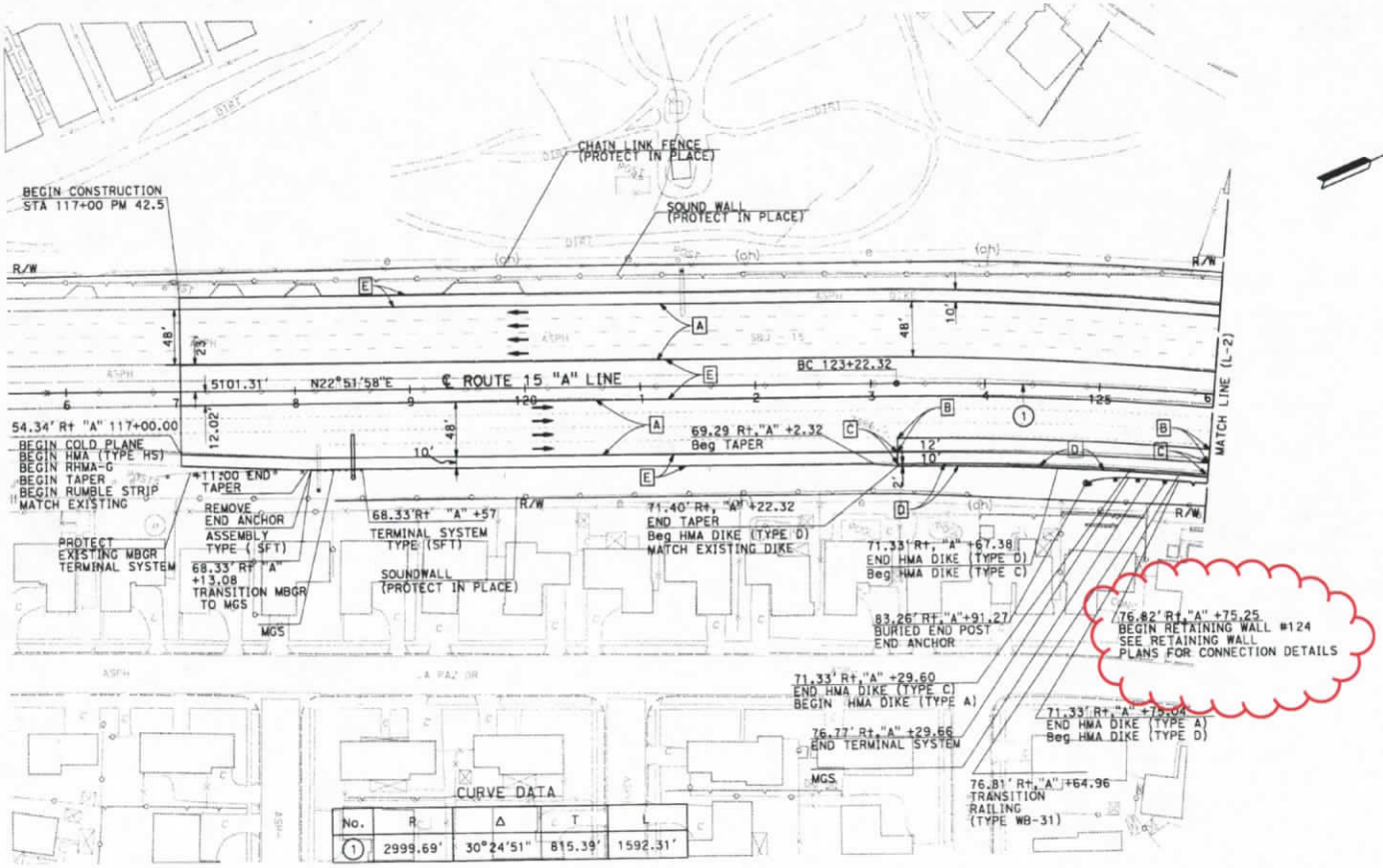
SE - SAFETY EDGE

LEGEND:

TEMPORARY CONSTRUCTION EASEMENT

RAMP TERMINI

[X] SEE TYPICAL CROSS SECTION FOR STRUCTURAL SECTION TYPE



CURVE DATA

No.	R	Δ	T	L
1	2999.69'	30°24'51"	815.39'	1592.31'

LAYOUT
SCALE: 1"=50'
L-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN

FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY / DATE REVISED

DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
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RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

CURVE DATA

NO	R	Δ	T	L
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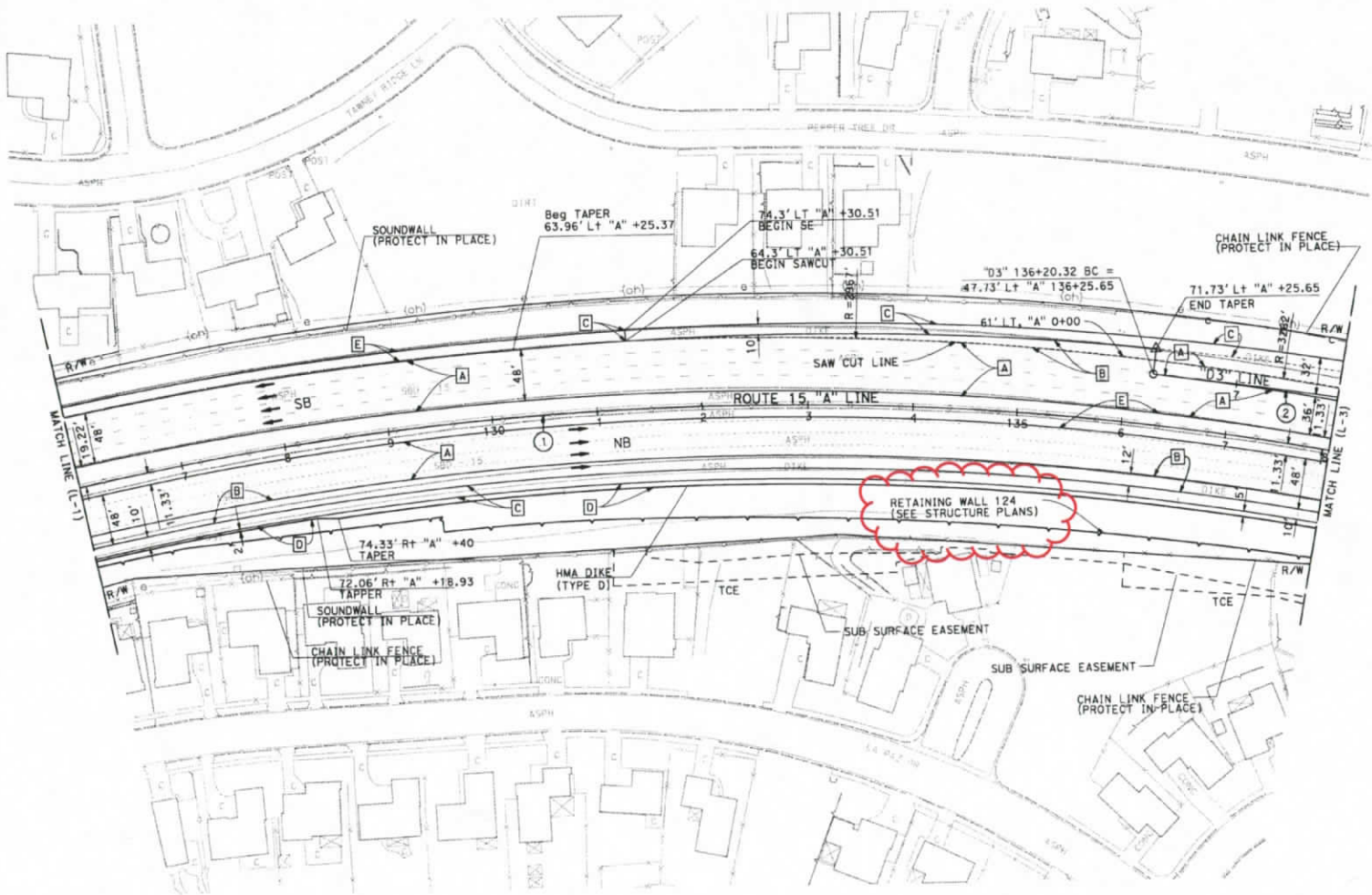
2	8202.87'	4°02'19"	289.22'	578.20'



LAYOUT
SCALE: 1"=50'
L-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN

FUNCTIONAL SUPERVISOR: GEORGE MORNIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY
DATE REVISED

LAST REVISION
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086eo002.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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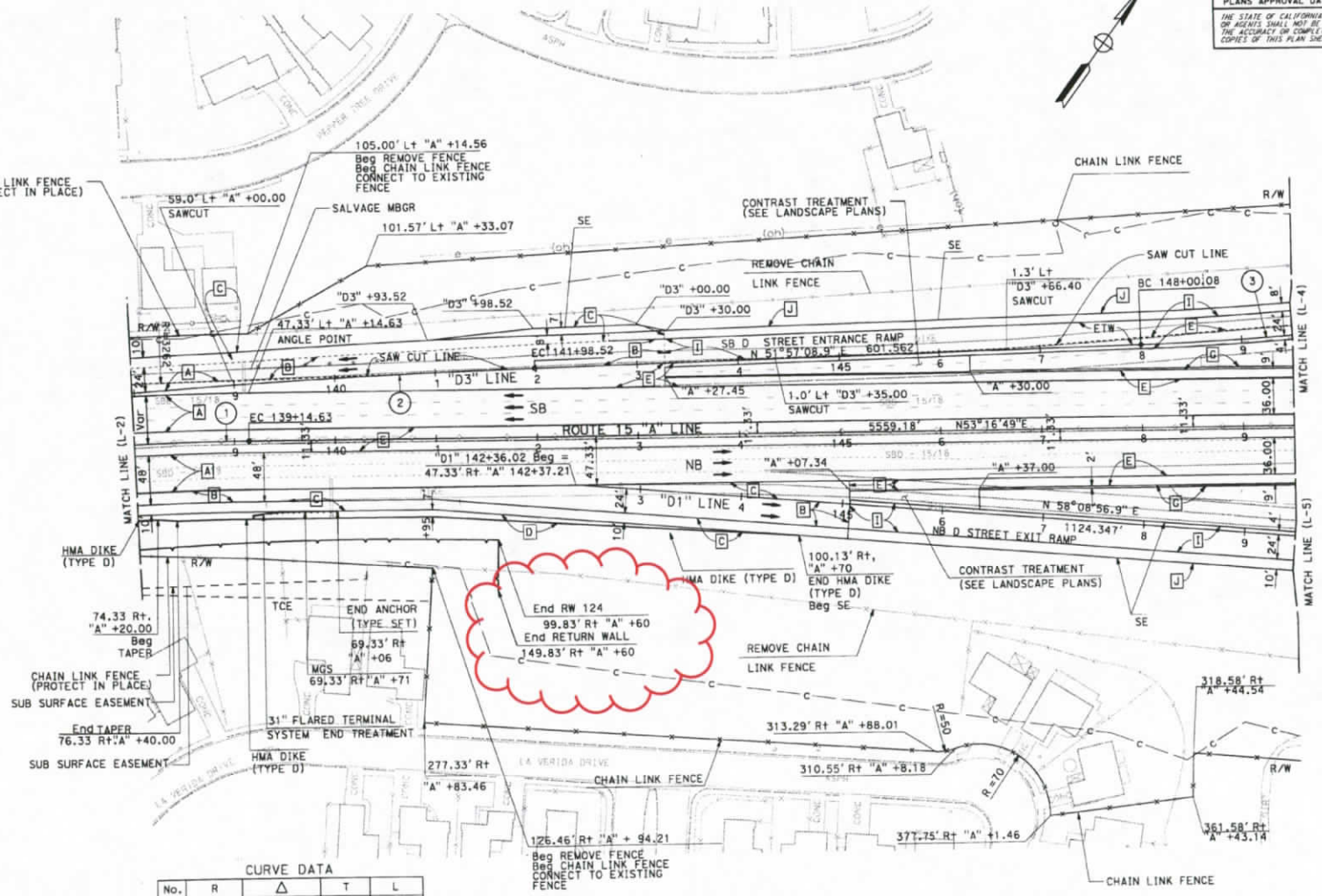
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



CURVE DATA

No.	R	Δ	T	L
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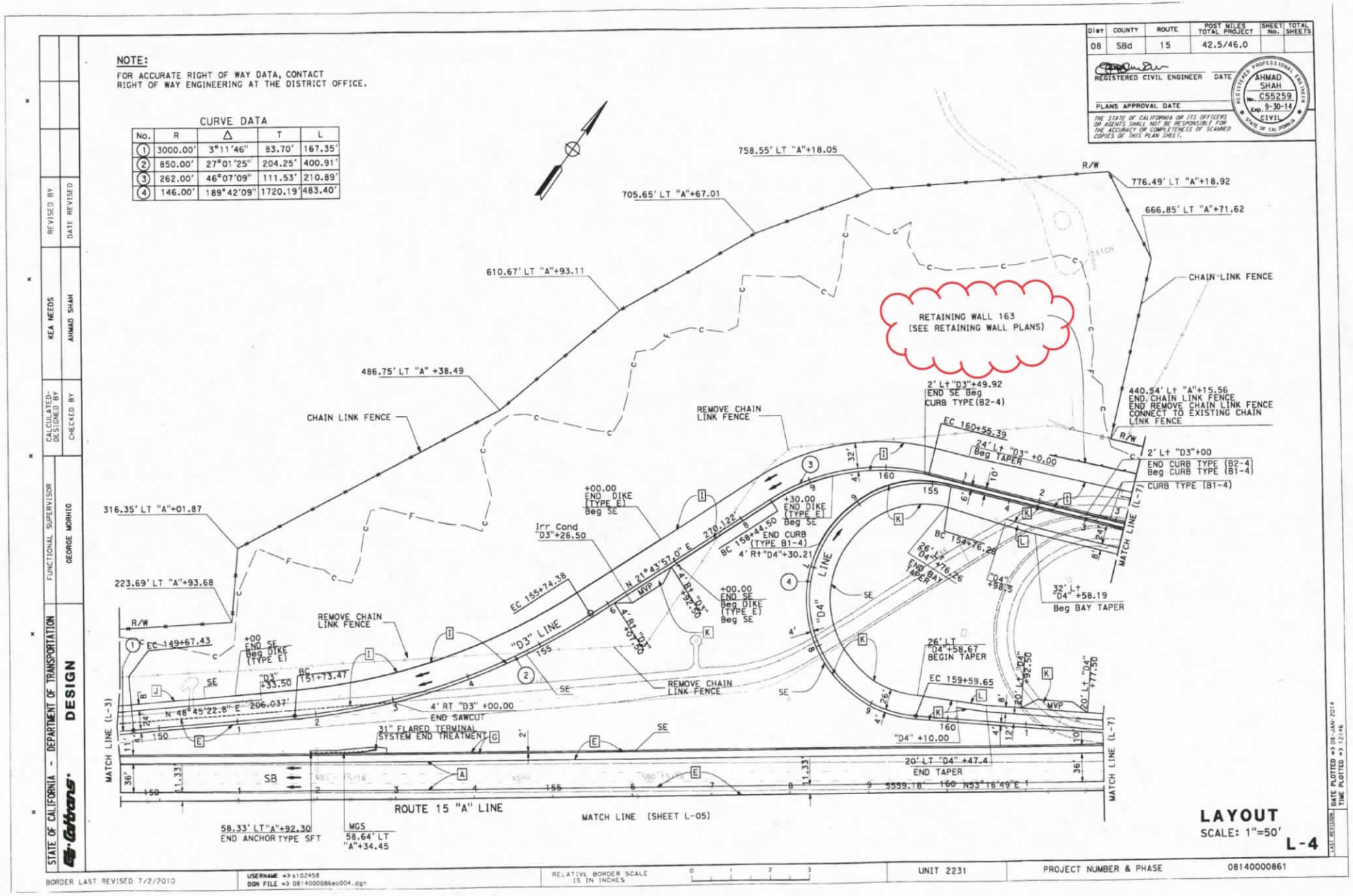
2	8202.87'	4°02'19"	289.22'	578.20'
3	3000.00'	3°11'46"	83.70'	167.35'

LAYOUT
SCALE: 1"=50'
L-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR: GEORGE MORHIG
CALCULATED-DESIGNED BY: KEA NEEDS
CHECKED BY: AHMAD SHAH
REVISED BY / DATE REVISED

LAST REVISION DATE PLOTTED => 08-JAN-2014 TIME PLOTTED => 12:46

BORDER LAST REVISED 7/2/2010 | USERNAME => s102458 DGN FILE => 0814000086ea003.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2231 | PROJECT NUMBER & PHASE 08140000861


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
CURVE DATA
No. R Δ T L
1 3000.00' 3°11'46" 83.70' 167.35'
2 850.00' 27°01'25" 204.25' 400.91'
3 262.00' 46°07'09" 111.53' 210.89'
4 146.00' 189°42'09" 1720.19' 483.40'
Dist COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA
758.55' LT "A"+18.05
705.65' LT "A"+67.01
610.67' LT "A"+93.11
486.75' LT "A" +38.49
316.35' LT "A"+01.87
223.69' LT "A"+93.68
776.49' LT "A"+18.92
666.85' LT "A"+71.62
CHAIN LINK FENCE
RETAINING WALL 163
(SEE RETAINING WALL PLANS)
440.54' Lt "A"+15.56
END CHAIN LINK FENCE
END REMOVE CHAIN LINK FENCE
CONNECT TO EXISTING CHAIN LINK FENCE
2' Lt "D3"+49.92
END SE Beg
CURB TYPE (B2-4)
REMOVE CHAIN LINK FENCE
EC 160+56.39
24' Lt "D3" +0.00
Beg TAPER
2' Lt "D3"+00
END CURB TYPE (B2-4)
Beg CURB TYPE (B1-4)
CURB TYPE (B1-4)
+00.00
END DIKE
(TYPE E)
Beg SE
+30.00
END DIKE
(TYPE E)
Beg SE
Irr Cond
"D3"+26.50
BC 158+44.50
END CURB
(TYPE B1-4)
4' Rt "D4"+30.21
N 21°43'57.0" E
270.122'
EC 155+74.38
"D3" LINE
"D4" LINE
BC 154+76.28
26' Lt
"D4" +76.26
END BAY TAPER
"D4" +98.3
32' Lt
"D4" +58.19
Beg BAY TAPER
+00.00
END SE
Beg DIKE
(TYPE E)
Beg SE
EC 149+67.43
+00
END SE
Beg DIKE
(TYPE E)
"D3" +33.50
BC 151+73.47
N 48°45'22.8" E 206.037'
4' RT "D3" +00.00
END SAWCUT
31" FLARED TERMINAL
SYSTEM END TREATMENT
26' Lt
"D4" +58.67
BEGIN TAPER
EC 159+59.65
"D4" +10.00
20' LT "D4" +47.4
END TAPER
N53°16'49"E
5559.18'
MATCH LINE (L-3)
MATCH LINE (L-7)
SB
ROUTE 15 "A" LINE
MATCH LINE (SHEET L-05)
58.33' LT "A"+92.30
END ANCHOR TYPE SFT
MGS
58.64' LT
"A"+34.45
LAYOUT
SCALE: 1"=50'
L-4
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR
GEORGE MORRIG
CALCULATED-DESIGNED BY
KEA NEEDS
CHECKED BY
AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000086ea004.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
DATE PLOTTED => 09-JAN-2014
TIME PLOTTED => 12:46

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

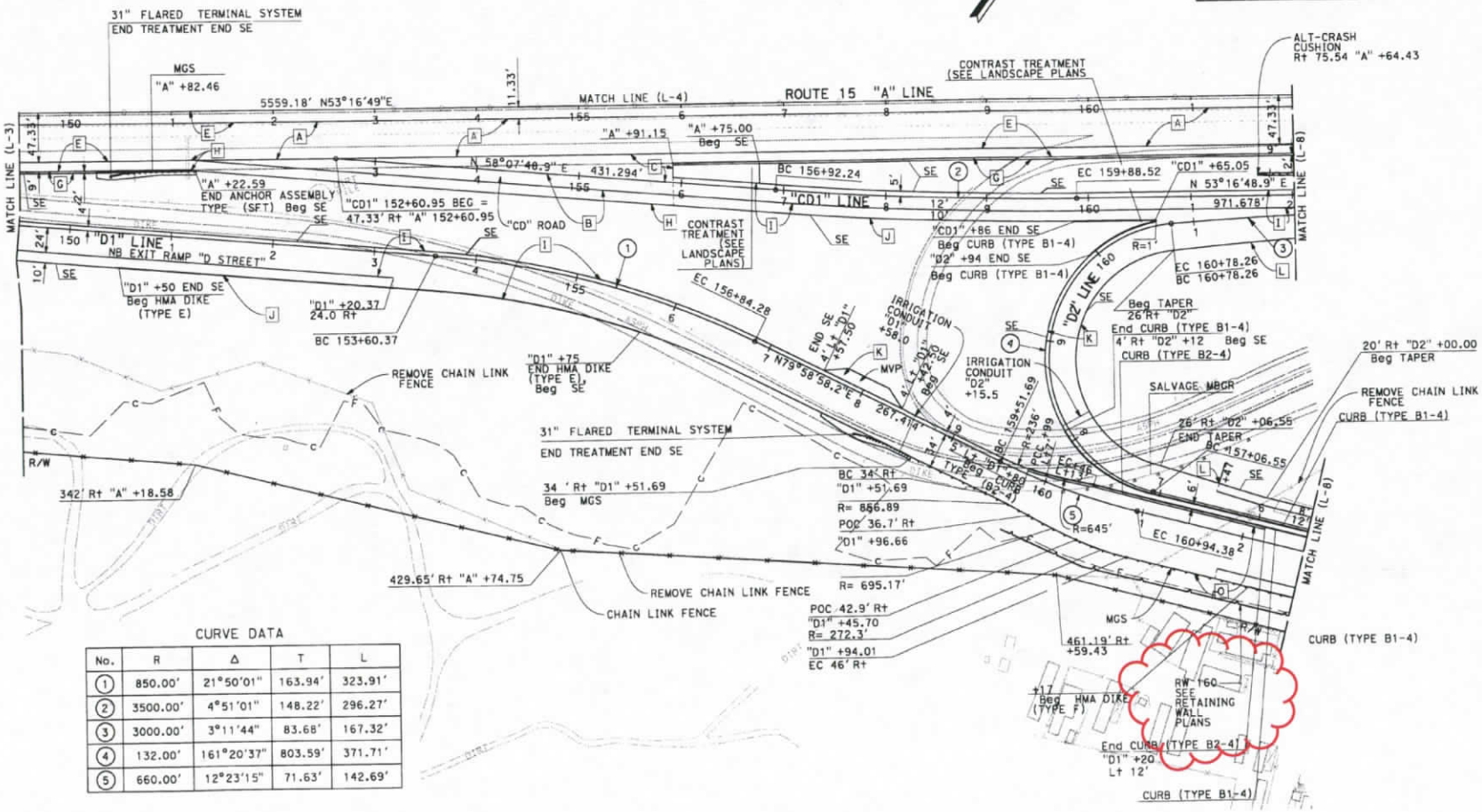
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



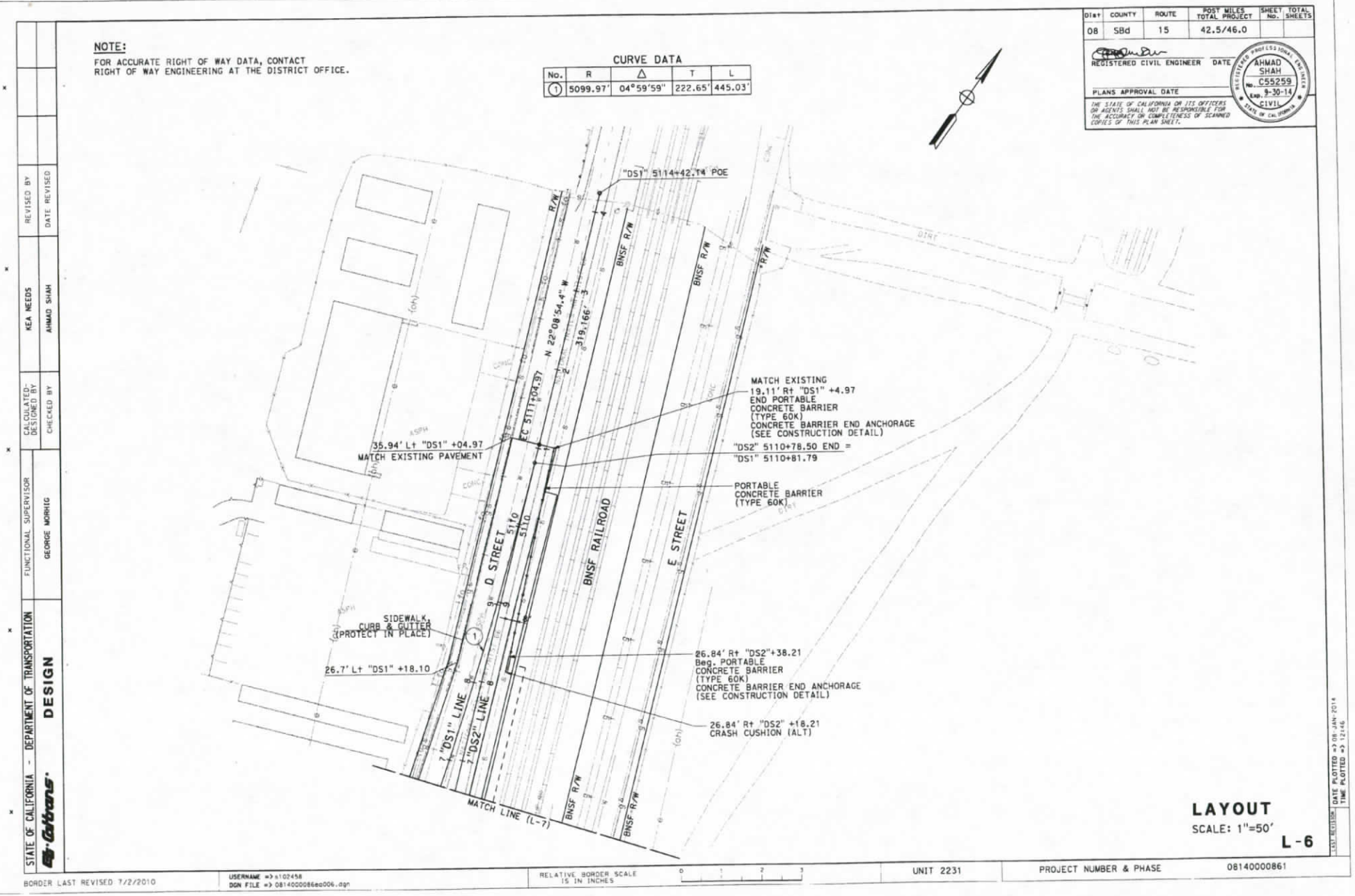
CURVE DATA

No.	R	Δ	T	L
1	850.00'	21°50'01"	163.94'	323.91'
2	3500.00'	4°51'01"	148.22'	296.27'
3	3000.00'	3°11'44"	83.68'	167.32'
4	132.00'	161°20'37"	803.59'	371.71'
5	660.00'	12°23'15"	71.63'	142.69'

LAYOUT
SCALE: 1"=50'
L-5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000086ea005.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
LAST REVISION DATE PLOTTED => 09 JAN 2014
TIME PLOTTED => 12:46


NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.
CURVE DATA
No. R Δ T L
1 5099.97' 04°59'59" 222.65' 445.03'
DIst COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15 42.5/46.0
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.
AHMAD SHAH
C55259
9-30-14
CIVIL
"DS1" 5114+42.14 POE
N 22°08'54.4" W
319.166'
EC 5111+04.97
35.94' Lt "DS1" +04.97
MATCH EXISTING PAVEMENT
MATCH EXISTING
19.11' Rt "DS1" +4.97
END PORTABLE
CONCRETE BARRIER
(TYPE 60K)
CONCRETE BARRIER END ANCHORAGE
(SEE CONSTRUCTION DETAIL)
"DS2" 5110+78.50 END =
"DS1" 5110+81.79
PORTABLE
CONCRETE BARRIER
(TYPE 60K)
D STREET
BNSF RAILROAD
E STREET
BNSF R/W
SIDEWALK,
CURB & GUTTER
(PROTECT IN PLACE)
26.7' Lt "DS1" +18.10
26.84' Rt "DS2"+38.21
Beg. PORTABLE
CONCRETE BARRIER
(TYPE 60K)
CONCRETE BARRIER END ANCHORAGE
(SEE CONSTRUCTION DETAIL)
26.84' Rt "DS2" +18.21
CRASH CUSHION (ALT)
"DS1" LINE
"DS2" LINE
MATCH LINE (L-7)
LAYOUT
SCALE: 1"=50'
L-6
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
FUNCTIONAL SUPERVISOR
GEORGE MORRIG
CALCULATED-DESIGNED BY
KEA NEEDS
CHECKED BY
AHMAD SHAH
REVISED BY
DATE REVISED
BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 08140000861ea006.dgn
RELATIVE BORDER SCALE IS IN INCHES
UNIT 2231
PROJECT NUMBER & PHASE
08140000861
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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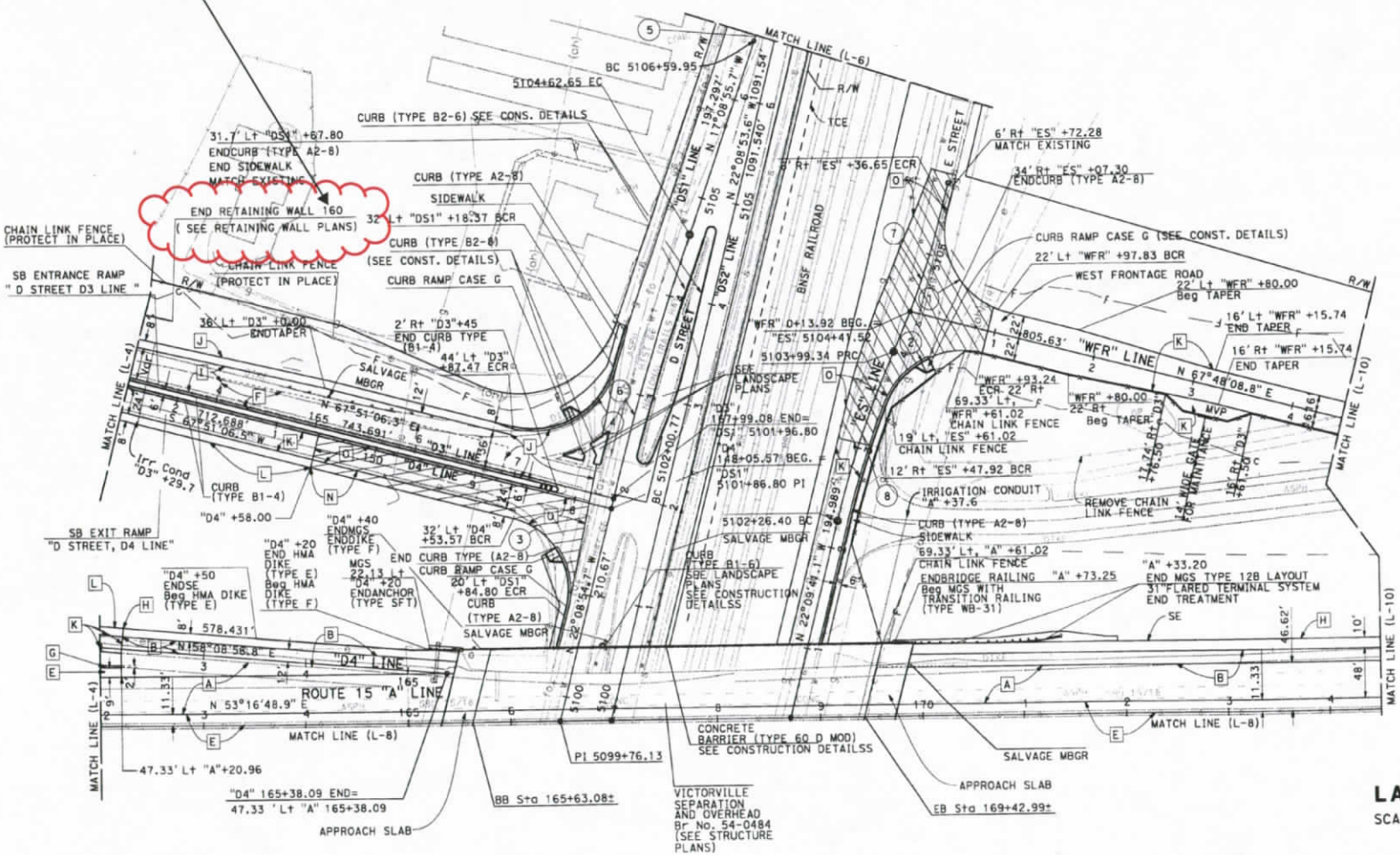
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR PAVEMENT STRUCTURAL SECTION OF D STREET SEE TYPICAL CROSS SECTIONS.

CURVE DATA

No.	R	Δ	T	L
1	70.00'	92°04'39"	72.59'	112.49'
2	82.00'	83°00'02"	72.55'	118.79'
3	70.00'	89°59'59"	70.00'	109.96'
4	82.00'	87°45'22"	78.85'	125.59'
5	5099.97'	04°59'59"	222.65'	445.03'
6	3000.00'	05°00'06"	131.02'	261.88'
7	1000.00'	09°53'48"	86.58'	172.73'
8	999.90'	09°54'42"	86.70'	172.98'



STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010 | USERNAME => s102458 DGN FILE => 0814000086ea007.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2231 | PROJECT NUMBER & PHASE 08140000861

LAST REVISION DATE PLOTTED => 08-JAN-2014 TIME PLOTTED => 12:46

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15	42.5/46.0		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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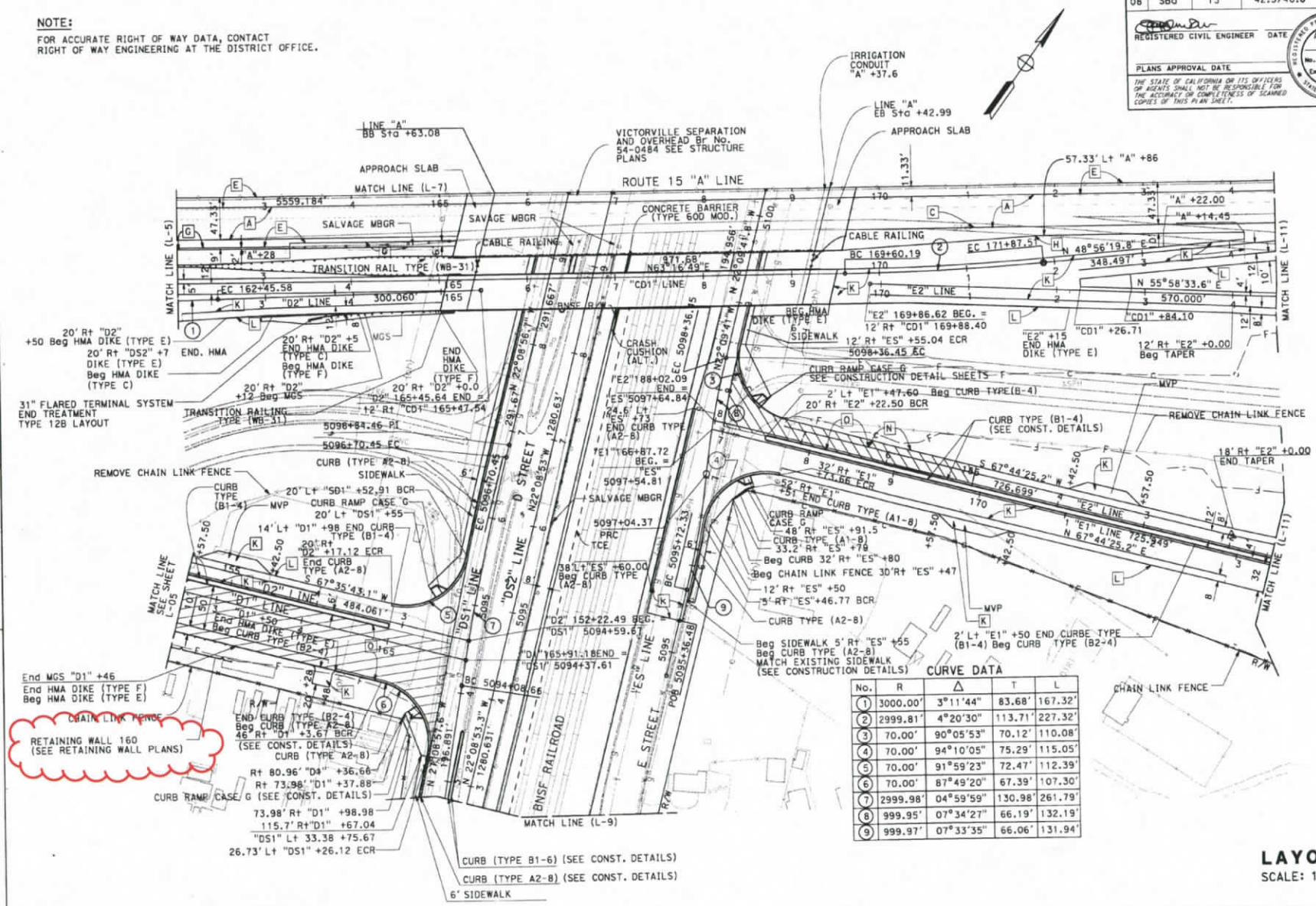
REGISTERED PROFESSIONAL ENGINEER AHMAD SHAH No. C55259 Exp. 9-30-14 CIVIL STATE OF CALIFORNIA

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.



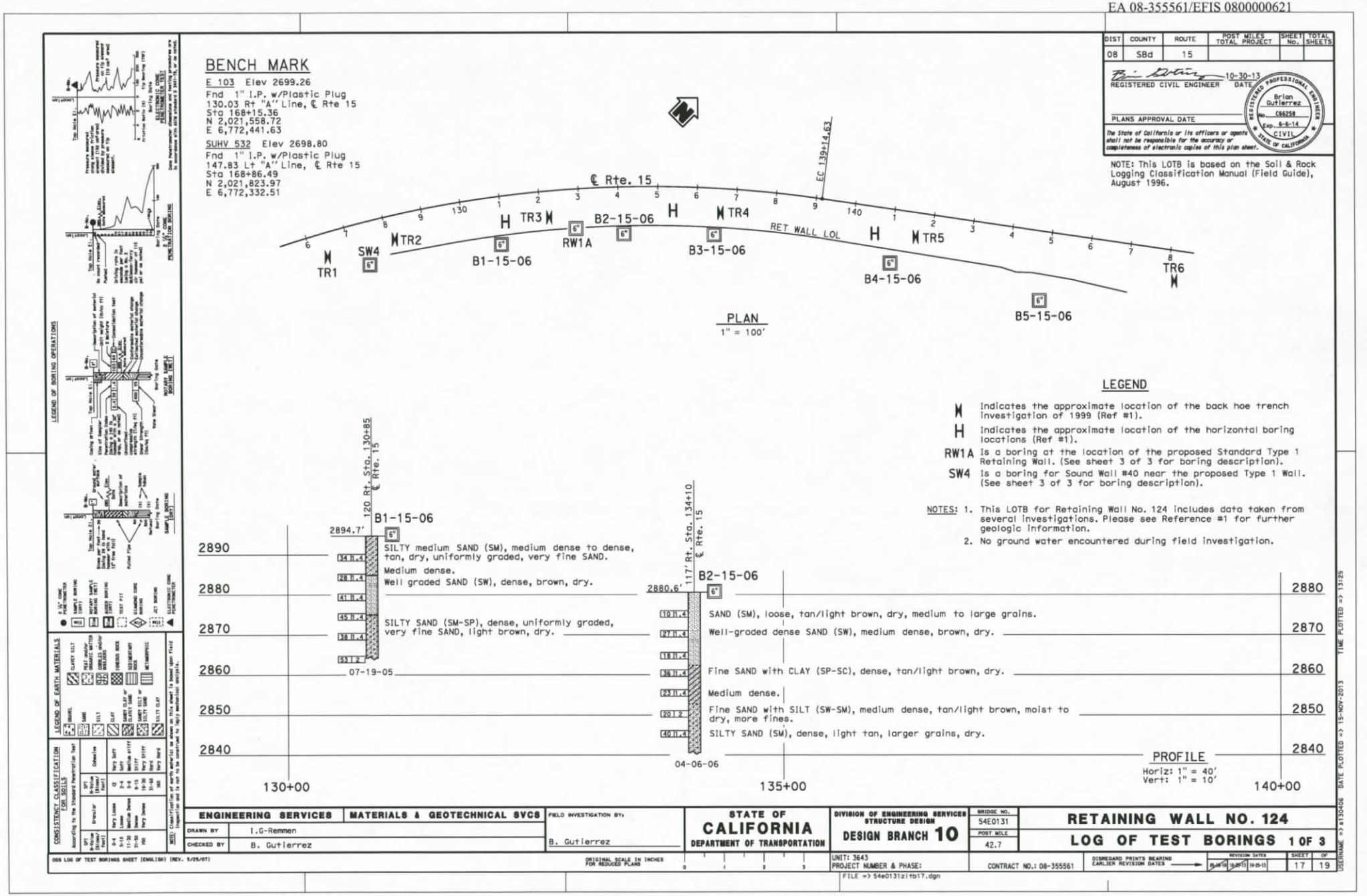
CURVE DATA

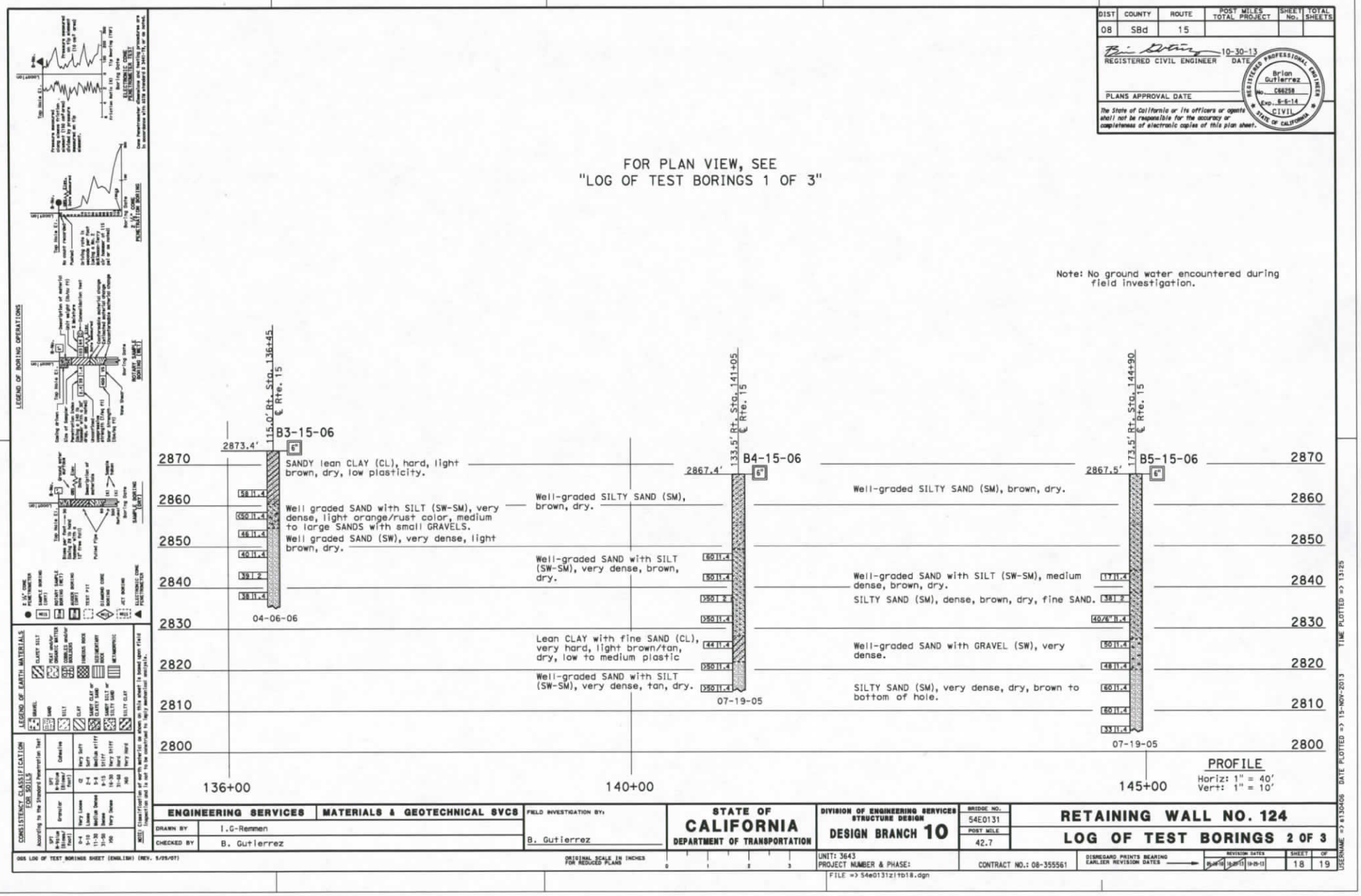
No.	R	Δ	T	L
1	3000.00'	3°11'44"	83.68'	167.32'
2	2999.81'	4°20'30"	113.71'	227.32'
3	70.00'	90°05'53"	70.12'	110.08'
4	70.00'	94°10'05"	75.29'	115.05'
5	70.00'	91°59'23"	72.47'	112.39'
6	70.00'	87°49'20"	67.39'	107.30'
7	2999.98'	04°59'59"	130.98'	261.79'
8	999.95'	07°34'27"	66.19'	132.19'
9	999.97'	07°33'35"	66.06'	131.94'

LAYOUT
SCALE: 1"=50'
L-8

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans DESIGN
FUNCTIONAL SUPERVISOR GEORGE MORHIG
CALCULATED-DESIGNED BY KEA NEEDS
CHECKED BY AHMAD SHAH
REVISED BY
DATE REVISED

BORDER LAST REVISED 7/2/2010
USERNAME => s102458
DGN FILE => 0814000066ea008.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2231
PROJECT NUMBER & PHASE 08140000861
LAST REVISION
DATE PLOTTED => 08-JAN-2014
TIME PLOTTED => 12:46


DIST 08
COUNTY SBd
ROUTE 15
POST MILES TOTAL PROJECT
SHEET No.
TOTAL SHEETS
REGISTERED CIVIL ENGINEER 10-30-13 DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.
BENCH MARK
E 103 Elev 2699.26
Fnd 1" I.P. w/Plastic Plug
130.03 Rt "A" Line, ℄ Rte 15
Sta 168+15.36
N 2,021,558.72
E 6,772,441.63
SUHV 532 Elev 2698.80
Fnd 1" I.P. w/Plastic Plug
147.83 Lt "A" Line, ℄ Rte 15
Sta 168+86.49
N 2,021,823.97
E 6,772,332.51
℄ Rte. 15
EC 139+14.63
RET WALL LOL
TR1
SW4
TR2
TR3
B1-15-06
RW1A
B2-15-06
B3-15-06
TR4
TR5
B4-15-06
B5-15-06
TR6
PLAN
1" = 100'
LEGEND
Indicates the approximate location of the back hoe trench investigation of 1999 (Ref #1).
Indicates the approximate location of the horizontal boring locations (Ref #1).
RW1A Is a boring at the location of the proposed Standard Type 1 Retaining Wall. (See sheet 3 of 3 for boring description).
SW4 Is a boring for Sound Wall #40 near the proposed Type 1 Wall. (See sheet 3 of 3 for boring description).
NOTES: 1. This LOTB for Retaining Wall No. 124 includes data taken from several investigations. Please see Reference #1 for further geologic information.
2. No ground water encountered during field investigation.
120 Rt. Sta. 130+85 ℄ Rte. 15
B1-15-06
2894.7'
SILTY medium SAND (SM), medium dense to dense, tan, dry, uniformly graded, very fine SAND.
Medium dense.
Well graded SAND (SW), dense, brown, dry.
SILTY SAND (SM-SP), dense, uniformly graded, very fine SAND, light brown, dry.
07-19-05
117' Rt. Sta. 134+10 ℄ Rte. 15
B2-15-06
2880.6'
SAND (SM), loose, tan/light brown, dry, medium to large grains.
Well-graded dense SAND (SW), medium dense, brown, dry.
Fine SAND with CLAY (SP-SC), dense, tan/light brown, dry.
Medium dense.
Fine SAND with SILT (SW-SM), medium dense, tan/light brown, moist to dry, more fines.
SILTY SAND (SM), dense, light tan, larger grains, dry.
04-06-06
2890
2880
2870
2860
2850
2840
130+00
135+00
140+00
PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION FOR SOILS
ENGINEERING SERVICES
MATERIALS & GEOTECHNICAL SVCS
DRAWN BY I.G-Remmen
CHECKED BY B. Gutierrez
FIELD INVESTIGATION BY: B. Gutierrez
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH 10
BRIDGE NO. 54E0131
POST MILE 42.7
RETAINING WALL NO. 124
LOG OF TEST BORINGS 1 OF 3
UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561
SHEET 17 OF 19
FILE => 54e0131zltb17.dgn


DIST COUNTY ROUTE POST MILES TOTAL PROJECT SHEET No. TOTAL SHEETS
08 SBd 15
REGISTERED CIVIL ENGINEER 10-30-13 DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
FOR PLAN VIEW, SEE "LOG OF TEST BORINGS 1 OF 3"
Note: No ground water encountered during field investigation.
B3-15-06
115.0' Rt. Sta. 136+45 ℄ Rte. 15
2873.4'
SANDY lean CLAY (CL), hard, light brown, dry, low plasticity.
Well graded SAND with SILT (SW-SM), very dense, light orange/rust color, medium to large SANDS with small GRAVELS.
Well graded SAND (SW), very dense, light brown, dry.
04-06-06
B4-15-06
133.5' Rt. Sta. 141+05 ℄ Rte. 15
2867.4'
Well-graded SILTY SAND (SM), brown, dry.
Well-graded SAND with SILT (SW-SM), very dense, brown, dry.
Lean CLAY with fine SAND (CL), very hard, light brown/tan, dry, low to medium plastic
Well-graded SAND with SILT (SW-SM), very dense, tan, dry.
07-19-05
B5-15-06
173.5' Rt. Sta. 144+90 ℄ Rte. 15
2867.5'
Well-graded SILTY SAND (SM), brown, dry.
Well-graded SAND with SILT (SW-SM), medium dense, brown, dry.
SILTY SAND (SM), dense, brown, dry, fine SAND.
Well-graded SAND with GRAVEL (SW), very dense.
SILTY SAND (SM), very dense, dry, brown to bottom of hole.
07-19-05
2870
2860
2850
2840
2830
2820
2810
2800
136+00
140+00
145+00
PROFILE
Horiz: 1" = 40'
Vert: 1" = 10'
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION FOR SOILS
ENGINEERING SERVICES
MATERIALS & GEOTECHNICAL SVCS
DRAWN BY I.G-Remmen
CHECKED BY B. Gutierrez
FIELD INVESTIGATION BY: B. Gutierrez
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH 10
BRIDGE NO. 54E0131
POST MILE 42.7
RETAINING WALL NO. 124
LOG OF TEST BORINGS 2 OF 3
UNIT: 3643
PROJECT NUMBER & PHASE:
CONTRACT NO.: 08-355561
SHEET 18 OF 19
FILE => 54e0131z1tb18.dgn

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
08	SBd	15			

REGISTERED CIVIL ENGINEER 10-30-13 DATE

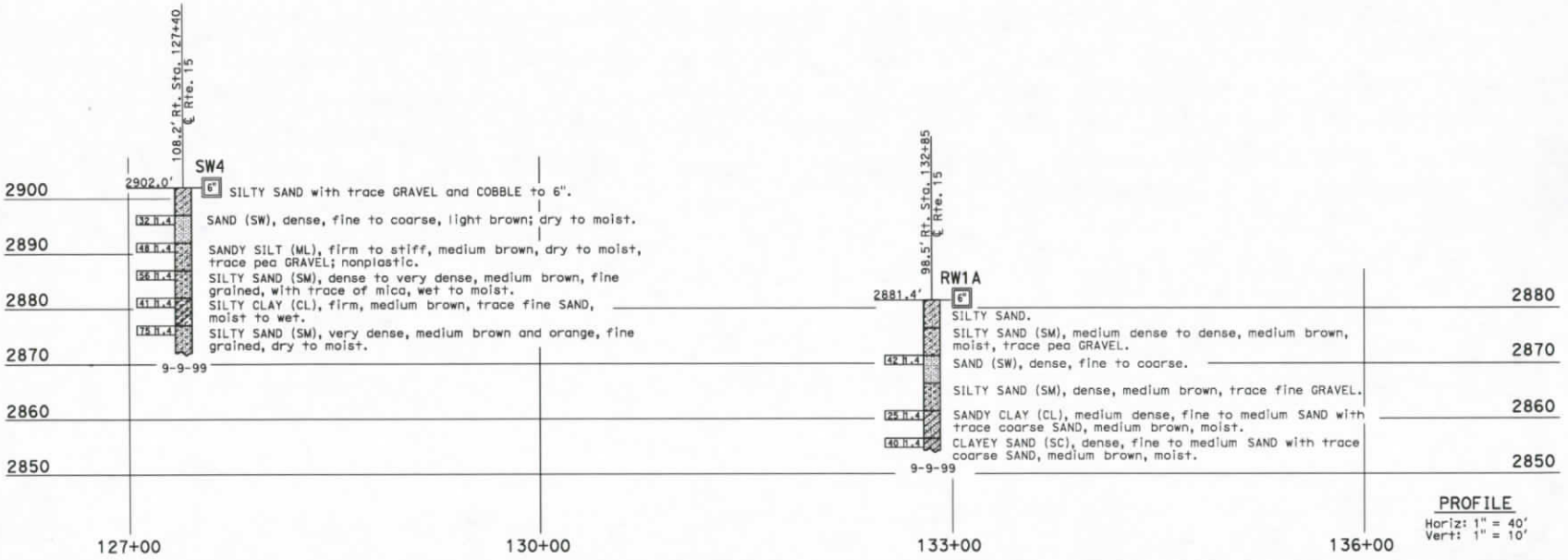
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Brian Gutierrez No. C66258 Exp. 6-6-14 CIVIL STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

NOTE: This LOTB is based on the Soil & Rock Logging Classification Manual (Field Guide), August 1996.

FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 3"



ENGINEERING SERVICES	MATERIALS & GEOTECHNICAL SVCS	FIELD INVESTIGATION BY:	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH 10	BRIDGE NO. 54E0131	RETAINING WALL NO. 124
DRAWN BY I.G-Remmen		B. Gutierrez			POST MILE 42.7	LOG OF TEST BORINGS 3 OF 3
CHECKED BY B. Gutierrez						

OGS LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 5/25/07)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3643
PROJECT NUMBER & PHASE:

CONTRACT NO.: 08-355561

DISREGARD PRINTS BEARING EARLIER REVISION DATES 10-25-13

REVISION DATES | SHEET 19 OF 19

FILE => 54e0131z1tb19.dgn

USERNAME => s130406 DATE PLOTTED => 15-NOV-2013 TIME PLOTTED => 13:25

HW COPY

INFORMATION HANDOUT

21

ASBESTOS CONTAINING MATERIALS AND LEAD-BASED PAINT SURVEY REPORT

WIDEN HIGHWAY
VICTORVILLE SEPARATION BRIDGE (#54-0484)
MOJAVE RIVER BRIDGE (#54-0483)
STODDARD WELLS ROAD OVERCROSSING BRIDGE (#54-0535)
08-SBD-15 PM 42.5/46.0
SAN BERNARDINO COUNTY, CALIFORNIA
PN: 08-00000-6211; EA#355561
TASK ORDER #21
CONTRACT 08A2047

PREPARED FOR:

CALIFORNIA DEPARTMENT OF TRANSPORTATION, DISTRICT 8
464 WEST FOURTH STREET, 6TH FLOOR
SAN BERNARDINO, CALIFORNIA 92401-1400

February 24, 2014

6.1 ASBESTOS HAZARD ASSESSMENT

The hazard assessment is based upon the physical assessment of ACMs for condition of the material and potential disturbance. The physical assessment usually includes the following considerations:

- Location and amount of material.
- Condition of the material which includes damage; the severity of the damage; the extent of the damage over large areas.
- Whether the material is accessible.
- Potential for future disturbance or future damage (air erosion, vibration, water).

The following table includes identified ACMs at the Site and the hazard ranking for each identified material.

ACM HAZARD ASSESSMENT							
Material Description	S/T/M *	Material Location	F/NF**	Condition Code***	Accessibility	Potential for Disturbance	Quantity on Each Bridge
Victorville Separation Bridge (#54-0484)							
Leveling Shims	M	Beneath Guardrail Posts	F	Good	Low (Located Beneath Guardrails)	HIGH (Removal, Demolition, Maintenance)	~24 square feet
Mojave River Bridge (#54-0483)							
Leveling Shims	M	Beneath Guardrail Posts	F	Good	Low (Located Beneath Guardrails)	HIGH (Removal, Demolition, Maintenance)	~16.4 square feet

NOTES:

* **S** = Surface Material; **T** = Thermal System Insulation; **M** = Miscellaneous Material

** **F** = Friable; **NF** = Non-Friable

*****G**ood = < 5% Damage; **D**amage = 5-25% local or 10% General Damage; **S**ignificant **D**amage = 25% local or >10% General Damage

The potential for disturbance is considered high for the Victorville Separation and Mojave River Bridges based on the fact that current plans indicate both bridges will be partially demolished and reconstructed.

6.2 ASBESTOS RECOMMENDATIONS

Based on analytical results, only the leveling shims of the Victorville Separation and Mojave River Bridges were found to contain one percent or greater asbestos. ACMs were not encountered in any other materials sampled from either bridge. In addition, ACMs were not encountered in any materials sampled on the Stoddard Wells Road Overcrossing Bridge.

The leveling shims appeared to be in good condition at the time of the survey, however, if the shims are disturbed during construction/demolition activities, they should be classified and handled as a RACM due to the high probability of becoming crumbled, pulverized, or reduced to a powder by the forces expected to act on the material in the course of demolition or construction. It should be noted however that the asbestos survey was limited to accessible materials only. If demolition of the Victorville Separation, Mojave River, and Stoddard Wells Road Overcrossing Bridges include removal of on-site portions of underground utilities, evaluation of the asbestos content of these components must be performed prior to the removal process. Suspect materials identified in these locations are assumed positive for asbestos until sampling and analysis indicates otherwise. If during the course of a demolition project suspect ACMs are discovered that are not included within this report, those materials are to be assumed positive for asbestos unless additional sampling, analysis and/or assessment indicates otherwise. Asbestos abatement work should be performed in accordance with California Code of Regulations (CCR), Title 8, Section 1529 (Asbestos in Construction Standard). Submission of this report will be required for compliance with the NESHAP in accordance with MDAQMD Rule 306.

Recommendations are provided below to address the asbestos containing leveling shims on the Victorville Separation and Mojave River Bridges should they be disturbed during construction.

- ACM abatement is required by a licensed ACM abatement contractor prior to renovation, refurbishing, or demolition activities. The abatement contractor's responsibilities include:
    - Removal and disturbance of ACMs in accordance with Cal-OSHA requirements. (e.g.; CCR Title 8, Section 341.9 and 1529).
    - Segregation and disposal at a landfill permitted to accept hazardous RACM waste.
    - Compliance with all other local, state and federal regulations and requirements associated with the disturbance, management, handling and disposal of ACM.
    - The amount of ACM that may be generated during bridge demolition/renovation activities is as follows:
        - Victorville Separation Bridge – approximately 24 square feet
        - Mojave River Bridge – approximately 16.4 square feet.
    - The contractor is required to comply with all MDAQMD and other agency notifications and requirements for demolition, renovations, and construction.

Caltrans

Information Brochure

Protection
Of the
DESERT TORTOISE
(Gopherus agassizii)

During

LIMITED SCOPE PROJECTS

WEG/TortoiseBrochure (Limited Scope Projects)

THE

DESERT TORTOISE

(A THREATENED SPECIES)

"IS PROTECTED BY LAW"

**ANY UNAUTHORIZED PERSON
WHO COLLECTS, HANDLES
OR DELIBERATELY MOLESTS A
TORTOISE
CAN
BE
PROSECUTED**

VIOLATIONS CAN RESULT IN

1) FINES UP TO $50,000

AND/OR

2) IMPRISONMENT UP TO 1 YEAR

APPLICABLE LAWS INCLUDE:

The Federal Endangered Species Act of 1973
(16 U.S.C. 1531-1543)

and

The California Endangered Species Act

THIS BROCHURE IS INTENDED TO PROVIDE YOU WITH INFORMATION AND GUIDANCE TO AVOID VIOLATION OF THE ENDANGERED SPECIES ACTS

RESOURCE AGENCY FORMAL CONSULTATION

Limited scope projects normally have a low risk of encountering or harming a tortoise and no "TAKE" is anticipated. Therefore, Formal Consultation between Caltrans and the U.S. Fish and Wildlife Service under Section 7 of the federal Endangered Species Act has not been undertaken for this project to authorize "TAKE" during the conduct of this project.

"TAKE" is defined as:

Harassing, Harming, Pursuing, Hunting, Shooting, Wounding, Killing, Capturing, Collecting, or attempting to engage in any such conduct. Engaging in any of these activities can place you in violation of the law.

Tortoises found within Caltrans Right of Way are not exempt from this protection.

WHAT TO DO AND NOT DO.

CHECK UNDER MOTORIZED EQUIPMENT & VEHICLES – that have been parked over night or stationary for some length of time before moving the vehicle.

CHECK AROUND MATERIAL STACKS & UNITS - that have been stored in the open before moving them.

VISUALLY CHECK AROUND THE WORK AREA – for the presence of live tortoise that may have wandered into the disturbance zone. It is not intended to divert your attention from your work tasks and create a hazard for your or others on the job, but it is good practice to utilize a few seconds and visually scan the area around you when it is safe to do so.

IF A TORTOISE IS PRESENT – stop all work activities that could harm the tortoise and contact the Resident Engineer or designated contact person, or on-site biologist to have the tortoise removed to safety. Contact your supervisor (contractor's) for direction on proceeding with work activities.

DO NOT HANDLE OR MOVE A TORTOISE – yourself. Only a qualified biologist is authorized to do so.

DO NOT RETURN A TORTOISE – to the wild that has been held in captivity. They may have been infected with a pneumonia type virus that is the cause of pneumonia infections in humans. The tortoise is highly susceptible to this virus which attacks the lungs and the tortoise has no means to cure itself. More tortoises die from pneumonia than any other cause. Symptoms of infection include runny or bubbly nose, loss of appetite and gasping for breath. Returning them to the wild increases the potential for exposure of the virus into an otherwise healthy tortoise population.

HELP MAKE THE LITTER CONTROL REQUIREMENTS ON THIS PROJECT – work by using the closeable trash containers to dispose of left over food scraps, wrappers, cans bottles, etc., or secure and remove them from the project with you when you leave the job site. The purpose of litter control is to avoid attracting Ravens which are highly efficient hunters and killers of baby tortoises.

DO NOT NEEDLESSLY VENTURE OUT OF THE DESIGNATED WORK AREA – into adjoining habitat areas unless directed to do so after the area has been approved for such activity. Doing so, disturbs habitat which is also protected under the Endangered Species Acts.

ASK YOUR SUPERVISOR - if any other environmentally related special provisions have been placed in the contract exist that you should know about. We do recommend that environmental protection measures be reiterated and discussed at on-site "tail gate" meetings with safety and other project related issues brought up by your supervisor(s).

WE THANK YOU FOR YOUR COOPERATION AND CARE

IN KEEPING WITH AMERICA'S DESIRE TO PROTECT THE ENVIRONMENT

WEG/Tortoise Brochure (Ltd Scope)

VICTORVILLE WATER DISTRICT

- Frequently Asked Questions regarding your utility services.
- You may Pay Your Bill Online.
- Forms & information to Start or End Water/Sanitation Service or to change address/contact information.
- Water winterizing and frozen pipe information.
- Here's where to request a Backflow Test Report, view a listing of approved Backflow Testers, view RP specifications, view RPDA specifications, or get the approved RP matierials list.

General Information

- District Mission, Vision & Core Values
- District Structure & Leadership
- District Services
- District Service Area Map

Financial Information

- Fees for Services
- Most Recent Rate Survey

Rules and Regulations

Water - go to Municipal Code Section 10.04

Backflow Devices - go to Municipal Code Section 10.06

- **Water Rate & Connection Fee Resolution VWD 12-002**
- **Utility Customer Service and Billing Procedures Resolution VWD 13-001**
- **Finances & Operations Resolution 07-037**

Urban Water Management Plan

- View the most recent Urban Water Management Plan for the Victorville Water District.

Consumer Confidence Reports

- Test results once again show that your drinking water meets or exceeds the high standards set by state and federal regulators. You may view the most recent Consumer Confidence Report for the Victorville Water District

Conservation Programs & Events

Learn about ways to reduce your water bill and help the environment by using these water-reducing conservation tips, programs, and events.

No Drugs Down the Drain!

Flushing prescription and nonprescription pharmaceuticals down the toilet can have dangerous consequences. Read this flyer to find out more.

Stormwater Protection Programs

To find out more ways to safeley use the stormwater system and protect our waterways from common pllutants Group or go to the San Bernardino County Stormwater Program.

Perchlorates and Water Sampling

The Victorville Water District has never had a water sample test positive for perchlorate. For this reason the Department of Public Health (DPH) does not require the District to sample for perchlorate on a regular schedule. The DPH has a projection of required sampling for the District going out two years and perchlorate is not on the projection. However, the Water District prefers to be proactive and conducts sampling for inorganic contaminants every year on all wells and testing for perchlorate is included in the inorganic sampling. The District has never tested positive for perchlorate at any of its sources of water supply.

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