Flex your power!
Be energy efficient!

Memorandum

To: MR. JOSEPH MERAZ, PROJECT MANAGER
DEPARTMENT OF TRANSPORTATION
DISTRICT 8
464 WEST 4TH STREET, 6th-FLOOR, MS-1221
SAN BERNARDINO, CA 92401

Date: June 6, 2012

File: DPGR HDC-138 (New)
EA: 07-2600U-0
Project No. 0712000035
High Desert Corridor
(HDC)

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES - MS #5
OFFICE OF GEOTECHNICAL DESIGN SOUTH-2, BRANCH A

Subject: **District Preliminary Geotechnical Report for the proposed High Desert Corridor, San Bernardino County Segment, San Bernardino County, California**

INTRODUCTION

This District Preliminary Geotechnical Report (DPGR) presents preliminary geologic and geotechnical information for the design study for the District 8 Segment of the High Desert Corridor (HDC) in San Bernardino County. The currently proposed alternative for the HDC alignment extends about 63 miles, from State Route 14 near Avenue P-8 in Palmdale, to join with State Route 18 near Bear Valley Road, just east of Apple Valley. The 34 mile long San Bernardino County Segment of the HDC trends west to east from the Los Angeles County line, across Dale Evans Parkway then curving south to join with State Route 18. The location of the District 8 Segment of the project alignment from one mile west of the Los Angeles County line, to SR-18 is depicted on the Site Location Map (Figure 1). The purpose of this report is to provide the preliminary geotechnical information to assist in developing the engineering design studies and cost estimates for the project. A limited subsurface investigation was conducted along the corridor alignment at the proposed structure locations in the preparation of the respective Structure Preliminary Geotechnical Report (SPGR) for each bridge and this DPGR. The Office of Geotechnical Design South 1 (OGDS-1) is preparing a separate DPGR report for that Segment of the project within Los Angeles County.

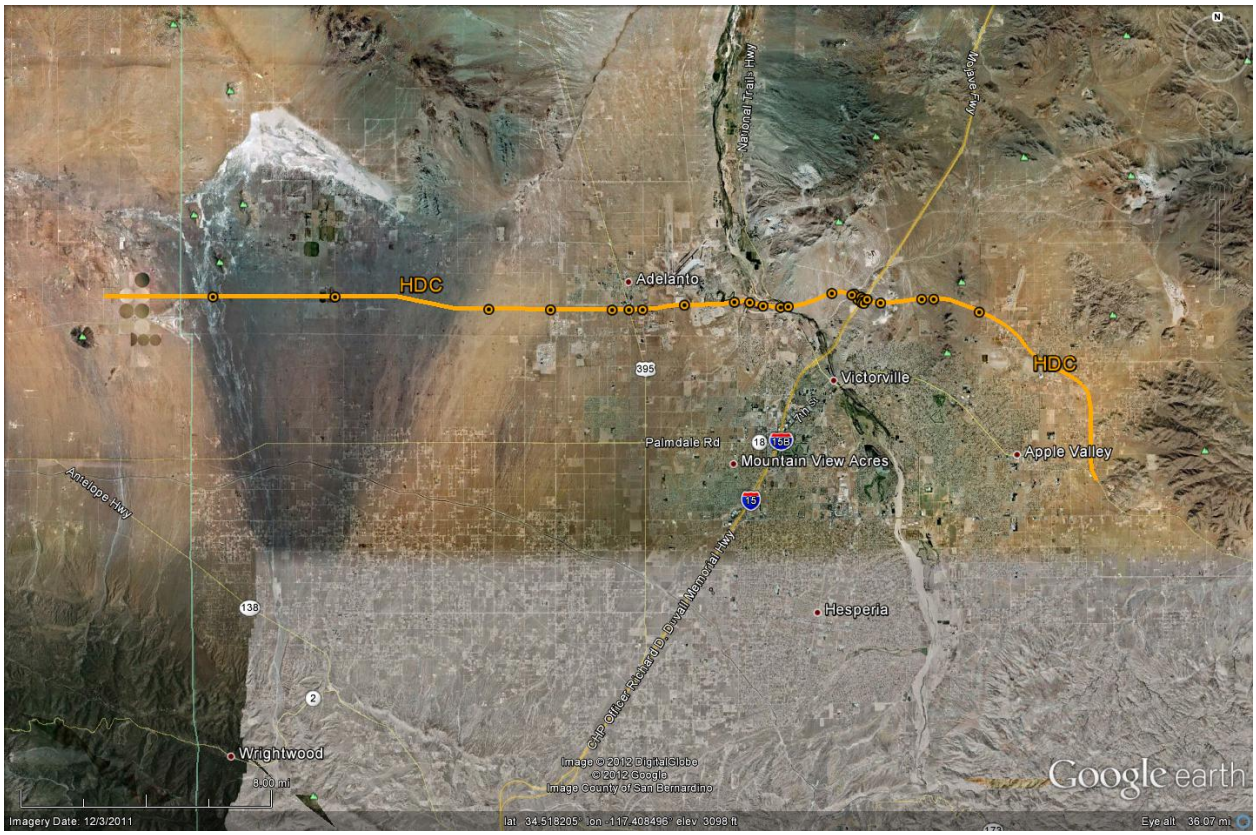

Figure 1 – HDC D8 Segment Site Location Map

EXISTING FACILITIES

With the noted exceptions of crossings at US 395 and I-15, and the eastern terminus junction with SR-18, there are no existing Caltrans facilities along the currently proposed alternative for the HDC Segment alignment within San Bernardino County. The nearest state route is Palmdale Road (SR-18) leading west out of Victorville, located about 4.5 miles south of the proposed alignment, and the eastern end of the alignment at SR 18 near Bear Valley Road, east of Apple Valley. The currently proposed HDC alignment will cross Air Express Way between the Southern California Logistics Airport (SCLA) complex and the three Federal Correctional Facilities (FCFs) in Victorville.

The western area of the proposed alignment alternative for the HDC San Bernardino Segment passes across unimproved desert with few unpaved roads and widely scattered rural residences. The mid portion passes through portions of Adelanto and Victorville where few paved and unpaved roads, with widely scattered residential and commercial properties, along with the SCLA complex, three prisons, then across the Mojave River and two railroad lines. The eastern portion crosses

Bell Mountain wash, Interstate 15, a limestone mine, then extends across the otherwise unimproved desert with few unpaved roads, and widely scattered rural residences. The southern portion of the Segment passes across unimproved desert with few unpaved and fewer paved roads, with widely scattered rural residences and commercial properties.

PROPOSED IMPROVEMENTS

The High Desert Corridor is proposed to provide and east-west freeway route across the western Mojave Desert, linking the high desert communities of Palmdale, Lancaster, Adelanto, Victorville, and Apple Valley. The currently proposed alternative for the HDC D8 Segment alignment within San Bernardino County extends east from the Los Angeles County line generally along the trend of Parkdale Road/Air Express Way though Adelanto, past the Federal Correctional Facilities in Victorville where it curves northeast to cross the Mojave River/BNSF Railroad and on to crossing the Mojave Northern Railroad, then it curves southeast to cross I-15. After crossing I-15 the alignment returns to an easterly trend north of and parallel to Falchion Road, over the topographic saddle south of Bell Mountain, to Dale Evans Parkway. Just past Dale Evans, the alignment curves to a southeasterly trend to past Joshua Road, then continues south to join with SR-18 near Bear Valley Road, just east of the Town of Apple Valley (Plate – 1).

The HDC San Bernardino County Segment is proposed as a 4 to 6 lane wide freeway with the travel directions separated by a center median of varied width. This alignment includes approximately 29 grade separation structures at interchanges (L/R bridges are considered herein as one structure), 8 interchange connecting structures (at I-15), and 5 At-grade intersections (southern reach of the Segment). Each of the 21 overcrossing bridges and 8 connecting structures are proposed to be on spread footings at the abutments and columns on CIDH piles for the bents.

A Structure Preliminary Geotechnical Report (SPGR) is being prepared separately for the respective planning of each structure. A very limited subsurface investigation has been conducted to provide preliminary subsurface information on the soil characteristics for use in the design studies for each of these structures. The location of these borings are shown on Plate – 2. The LOG OF TEST BORINGS (LOTB) for each of these borings will be submitted at a later date.

Shallow cuts and thin fill embankments on the order of 10 feet or less from existing natural grade are currently planned for the majority of the proposed roadway along the alignment. Typical Cross Sections for Alternative 2 and Alternative 3 are attached. Approach embankment fills up to 45 feet high are proposed for the overcrossing structures at the interchanges, railroads overheads, washes and

Mojave River crossings. Cuts up to 45 feet deep are proposed for the topographic highs in the areas of the National Trails Highway crossing, and the topographic saddle in the hills just east of I-15 (limestone mine area). A Design Study Alt 1 Cross Section is attached for the mine cut area.

PHYSICAL SETTING

Topography

The HDC San Bernardino County Segment is located in the High Desert area of southern California, consisting of broad alluvial filled valleys, dry washes, and playas separated by localized mountains. Topographically, elevations across the project range from 3000 feet at the county line, to a Segment low of 2660 feet at the Mojave River crossing near the lower narrows. The Segment's high of 3200 feet is near the limestone mine in the hills just east of I-15, and then at 2970 feet when joining SR-18 just east of Apple Valley.

The topographic terrain of the Segment is varied. West of the Mojave River area the alignment is situated on the relatively gentle undulating terrain across the distal fan slopes of the Palmdale-Victorville plain, with some rolling topography crossing the three wash areas east of the SCLA/FCFs. Gentle topography across the outwash fan slopes from Quartzite Mountain is found between the Mojave River and Bell Mountain Wash. East of Bell Wash is the low saddle between the bedrock hills located between the wash and the freeway. East of the freeway are the limestone quarry hills and the gentle topography of the Bell Mountain valley leading up to the saddle south of Bell Mountain. East of the saddle the Segment alignments trends across the gentle terrain of the Apple Valley.

The northwest flowing Mojave River crosses the project in Victorville. West of the Mojave River the regional topography drains by sheet flow to the north across the HDC Segment then into El Mirage dry lake. The portion of the HDC Segment west of Caughlin Road is situated on the distal portion of the Sheep Creek fan with numerous shallow dry washes. East of Caughlin Road to the Mojave River the alignment is situated on older alluvial valley fill with drainage via sheet flow to the north. East of the Mojave River, the HDC Segment drains by sheet flow to the north and into the local washes (Turner and Ossam) then to the north into the Mojave River, or south off the fans from Quartzite Mountain into the southwest flowing Bell Mountain Wash, then ultimately into the Mojave River. The hills east of I-15 drain west across the existing freeway by sheet flow or a few shallow washes into Bell Mountain Wash. East of the hillcrest, drainage is by sheet flow to the east and north. East of the Bell Mountain saddle, the eastern and southern portions of the HDC Segment drains to the south and east into the local dry lakes.

The major drainages of the HDC Segment are the north flowing dry washes on the alluvial Sheep Creek fan, Turner Wash, Ossam Wash, Mojave River, and Bell Mountain Wash. Of these only the Mojave River contains year round surface flow as released though Cedar Springs Dam. The other drainages are normally dry, with surface flow in response to seasonal locally intense rain fall, or runoff from prolong winter seasons with heavy rain and/or snow fall, particularly on the San Gabriel Mountains to the south of the Segment.

REGIONAL AND LOCAL GEOLOGY

Physiography

As previously indicated, High Desert Corridor project is located in the High Desert area of southern California. The high desert is the westernmost part of the Mojave Desert Geomorphic province of California. It may be characterized as an elevated, internally draining area, comprised of broad desert alluvial fans, valley plains, and lacustrine basins, separated by mountainous bedrock blocks, predominantly controlled by the seismically active northwest - southeast trending strike slip fault pattern of the region. It is bounded between the Transverse Ranges across the San Andres fault on the southwest, both 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.

Stratigraphy

The District 8 San Bernardino County Segment of the High Desert Corridor project alignment crosses several types of soils, sediments, and rock types. Local geology consists of recent alluvium of the drainages, washes and Mojave River. Younger alluvial fan deposits, older alluvial valley deposits, with bedrock outcrops in the local mountains of quartz monzonite “granitics” and metamorphic carbonate skarn (altered limestone deposits) as depicted on Figure 2.

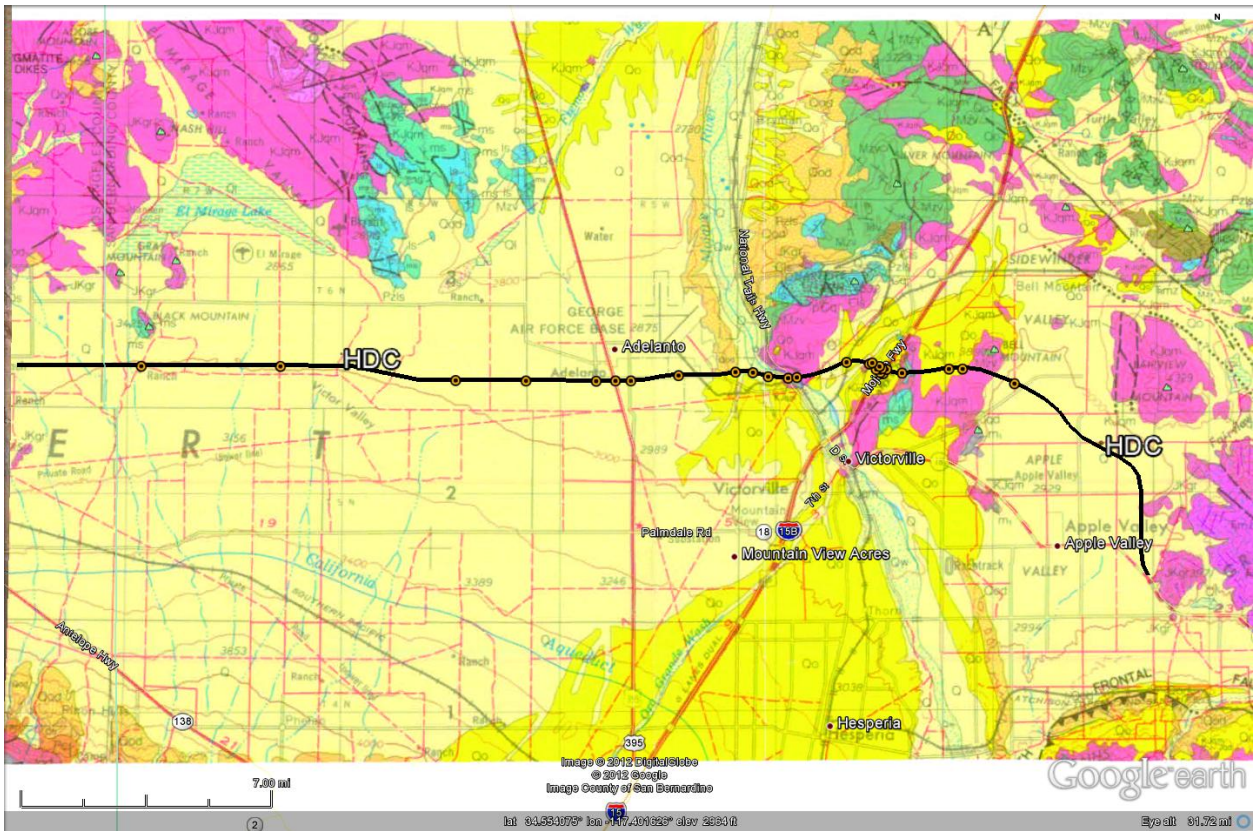

Figure 2 - HDC D8 Segment Regional Geologic Map

Soils locally derived from the recent wash alluvium consist of interbedded braided layers of sands and silts, locally with fine gravel. Traces of caliche or a weak carbonate cementation are known to occur in the underlying sands and gravels at depth. In the Mojave River the sandy soils were found to contain few "granitic" cobbles. In the area of the Sheep Creek fan, the soils consist of fine sands, silts, and clays with traces of fine gravel, derived from the Pelona Schist of the San Gabriel Mountains south of the alignment.

Soils locally derived from the younger alluvium fan deposits primarily consist of layers of sands and silts, locally with gravel. Thin layers of caliche or a weak to moderately well developed carbonate cementation are known to occur in these soils. The older alluvial valley deposits soils primarily consist of layers of sands, silts, and sandy clays, locally with gravel. Moderately well to strongly developed layers of caliche or carbonate cementation are known to occur in these older alluvial soils. Some of the valley fill deposits are of lacustrine (dry lake) origin, and contain silts and lean clays that are generally found at depth under the area of the Sheep Creek fan on the western portion of the Segment. Silts and clays may also be encountered on the southern Segment of the alignment as it crosses the area of the Apple Valley Dry Lake playa.

Geologic Structures

The predominant geologic features of the District 8 San Bernardino Segment of the High Desert Corridor alignment area are: the San Andreas Fault (located south of the HDC), and the more local northwest trending strike slip faults common to the western Mojave Desert. It is the San Andreas fault that separates the Mojave Desert from the San Gabriel Mountains on the south. The more local northwest trending strike slip faults generally separate the alluvial valley basins from the bedrock mountains within the Mojave Desert. However, there are no known faults that trend across the Segment. The Palmdale-Victorville plain underlies the western portion of the Segment, with bedrock hills and an unnamed alluvial valley between I-15 and Bell Mountain, and the Apple Valley on the east and south.

Geologic Hazards

The principal hazard is considered to be strong ground shaking associated with regional seismic events. Several active and potentially active faults are known to occur in the region. These faults include the San Andreas, Llano, Mirage Valley, Blake Ranch, Helendale, and North Frontal faults. Several of which have been included within an Earthquake Fault-Rupture Hazard Zone by the state of California. The Mirage Valley fault has been mapped to within 6 miles of the Segment alignment and projects to near Caughlin Road with a broad zone of weak photolineaments extending east to near the Adelanto Road area. As no faults are known to transect the Segment alignment, the potential for ground rupture from known faults is considered low at this time.

There are several natural slopes in the area of the Mojave River, and the hills adjacent to I-15. These slopes are underlain by crystalline bedrock and are not prone to natural slope instability or landsliding. The fill embankments and cut slopes will be engineered and not prone to slope instability under gravitational forces or seismic loading. Consequently, landsliding and slope instability does not appear to be an issue. However, slopes constructed in or with the local alluvial soils will be subject to erosion.

SEISMICITY

Sesimicity

The HDC San Bernardino County Segment is located in the high desert area in the seismically active southern California region, and is subject to moderate to strong ground shaking from local and more distant earthquake events. Faulting in the immediately surrounding area includes strike slip, thrust, and reverse fault motions. In the vicinity of the alignment, the San Andreas and Llano faults are

located to the southwest, Mirage Valley and Blake Ranch faults to the north, both the Helendale and Lenwood-Lockhart faults to the northeast, with the Cleghorn and North Frontal faults on the Southeast. Both the Cucamonga and San Jacinto faults are at some distance south and south east of the site. The major faults of the region are shown on Figure 3. Other lesser faults are also known to occur in the area.

The largest historical earthquakes in the region have occurred along the San Andreas (Mojave Segment) fault. Geologic studies have documented about 30 events with surface rupture along this section of the fault in the past 6,000 years. These have occurred at intervals ranging from about 321 years to 165 years with a mean recurrence interval of 105 years. These events have had displacements ranging from 2.3 to 23 feet. Two of these events were the 1812 (Mw 7) and 1857 (Mw 7.8) which ruptured a length of about 190 miles, from central California to the Cajon Pass area just south of the Segment alignment. The 1992 Landers event (Mw 7.3) involved up to 21 feet of ground displacement along the Lenwood and related faults east of the HDC Segment alignment.

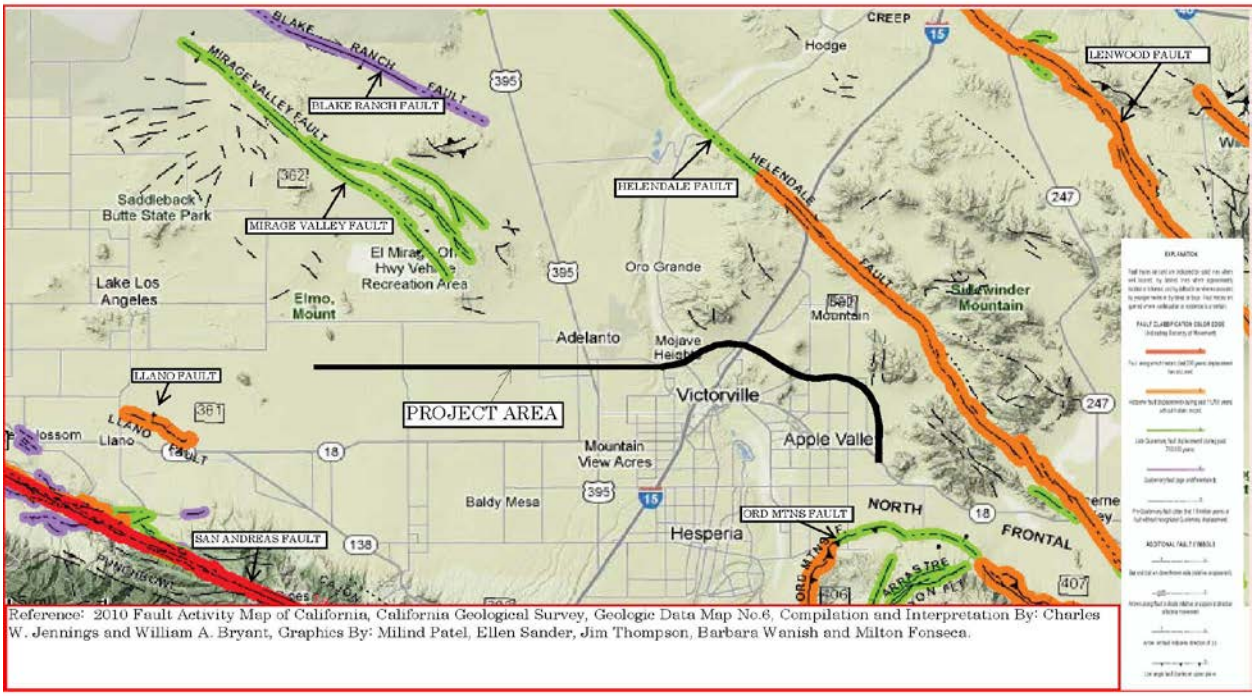

Figure 3 Regional Faults

Ground Motion

Detailed fault parameters including the fault name, fault type, slip rate and moment magnitude of the Maximum Earthquake (M_{max}) associated with the nearby major faults as per Caltrans 2011 are presented in Table 1, *Faulting and Seismicity*, below. This fault database is used in the Caltrans's current seismic hazard evaluation of bridge structures (CALTRANS, 2011). The slip rates presented in Table 1 are based on the 2008 California Fault Database published by the California Geologic Survey and the United States Geological Survey (CGS/USGS, 2011). As can be seen from Figure 3, the San Andreas Fault (Mojave Section) is the nearest major seismic source to the project area.

TABLE 1. FAULTING AND SEISMICITY PARAMETERS

Fault Name	Fault Type[1]	Slip Rate[2] (mm/year)	Maximum Earthquake Moment Magnitude (M_{max}) [1]
San Andreas Fault (Mojave Section)	RLSS	29.0±7.0	7.8
Helendale Fault	RLSS	0.6±0.4	7.3
Cleghorn fault zone (Southern Cleghorn section)	LLSS	N/A	6.5
Mirage Valley	RLSS	1.0±0.5	6.9
Lenwood Fault	RLSS	0.9±0.4	7.5

Notes: (1) Based on Caltrans 2011 Fault Database, (2) Based on CGS/USGS 2011 Fault Database; (RLSS) Right Lateral Strike Slip, (LLSS) Left Lateral Strike Slip.

Ground Rupture

The HDC San Bernardino County Segment alignment does not cross any known active or potentially active faults, or faults contained in an Earthquake Fault-Rupture Hazard Zone as determined by the state of California. As such this Segment of the HDC alignment is not considered to be susceptible to ground surface rupture or displacement hazard due to fault movements. However, the Mirage Valley fault has been mapped to within 6 miles of the Segment alignment and projects to near Caughlin Road with a broad zone of weak photolineaments extending east to near the Adelanto Road area.

Secondary Seismic Hazards

The secondary seismic hazards at a project site include soil liquefaction during earthquake, slope instability or landslides/movements, and seismically-induced ground and structure settlements, lateral spreading of mildly sloped grounds, and, for site near large water bodies, flooding due to earthquake motion induced seiches and tsunamis.

In the absence of groundwater within the shallow depths, the majority of the project sites are not likely to be susceptible to soil liquefaction or lateral spreading hazards. However, near surface soils at the bridge sites that are crossed by the Mojave River and Washes (when flowing) may be susceptible to soil liquefaction hazard during wet seasons. Site-specific subsurface investigation and analysis is required to further evaluate the liquefaction hazards at these sites.

Based on the elevated inland location of the high desert area, the Segment alignment is not considered susceptible to tsunami hazard. A potential seiche flooding hazard may exist in the area of the alignment near the Mojave River should a seiche occur and top the Cedar Springs Dam.

SUBSURFACE SOIL AND GROUNDWATER CONDITIONS

Subsurface Soil Conditions

Based on the "As-Built" plans for those structures located along I-15 in the area of the HDC and the field logs from the recently conducted limited field investigation, it appears that the native soils are predominantly brown, light brown, or gray medium- to coarse-grained sands, silty sand with minor amounts of gravel. Also, cobbles and boulders were noted on many of the boring logs excavated within the project area. Based on the available boring logs, soils appear to be predominantly medium dense to dense.

The above soil description is general and is intended to describe the subsurface in very broad terms. Soil type and consistency at locations of proposed improvements should be verified by excavating additional site-specific exploratory borings during the PS&E phase of the project.

Groundwater

The regional groundwater map generally indicates the depth to water is deep below the ground surface in the region. However, depth to groundwater can be quite variable throughout the 35 mile long segment alignment. Groundwater was not encountered within any of the borings excavated during the recent investigation

(2012). However, it is possible that isolated or perched groundwater zones will be encountered due to local irrigation, groundwater injection, construction activities, locally intense rain fall, or runoff from prolong winter seasons with heavy rain and/or snow fall, or numerous other man-made or natural sources. Shallow groundwater should be anticipated due to seasonal variations in rain fall, runoff, and surface water flows in the Mojave River, the other washes or drainages, and dry lake beds along the Segments alignment.

Soil Corrosivity

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." The corrosivity potential of the soils along the Segment alignment are unknown at this time. However, based on our experience, wet fine-grained soils are the typical soil types responsible for corrosive site conditions. Since native subsurface soils within the project area are composed predominantly of coarse-grained soils (sand), corrosive soils are not anticipated to be a design issue. Additional representative soil samples should be obtained and tested for corrosivity during the future geotechnical investigations. The results of corrosivity testing conducted on samples obtained from the concurrent investigations for the SPGRs will be reported under separate cover when completed.

MATERIAL SOURCES

It is anticipated that the Segment alignment will be internally balanced with the shallow cuts and fills proposed for grading of the roadway. Fill materials for the overcrossing embankments may be out of balance. Numerous commercial suppliers for sand, gravel, aggregate base, and concrete are located in the High Desert area of San Bernardino and Los Angeles counties. These suppliers and other potential sources of fill materials will be identified during future phases of the project. Caltrans must approve the use of any and all material sources proposed.

HAZARDOUS WASTE IMPACT

No hazardous waste materials are anticipated to occur along the project alignment. Should the Environmental Impact Report for the project identify potentially hazardous waste sites, or such sites be encountered during future investigations they will have to be addressed at that time by the District Hazardous Waste Unit. Any proposed remedial measures should be reviewed by geotechnical design group as they may have potential geotechnical implications.

CONCLUSIONS AND RECOMMENDATIONS

The geotechnical aspects discussed in this section are preliminary and are based on our observations, mapped geologic, and soil conditions. Generally, the site is suitable for construction provided site development is performed in accordance with Caltrans standard design and construction procedures.

Earthwork

Earthwork should be conducted in accordance with the latest edition of Caltrans Standard Specifications (Currently, Section 19 of the 2010 Caltrans Standard Specifications). In areas where compacted fill will be placed, the existing compressible surficial materials including topsoil, loose or soft alluvium or fill soil, dry or saturated soil, and otherwise unsuitable materials must be removed prior to fill placement. A minimum over-excavation of 3 feet below existing grade is recommended within areas to receive fill; the over-excavation should extend horizontally a minimum distance of 3 feet from edges of new fills or structures. Fill placed on sloping ground should be properly keyed and benched into existing ground and placed as specified in 2010 Caltrans Standard Specifications. Over-excavations should be observed by qualified geotechnical personnel to verify that firm and unyielding bottoms are exposed. Over-excavated areas should be cleaned of loose materials and debris, scarified, moisture conditioned, and recompacted as specified by the Caltrans Standard Specifications before receiving fill soils.

The alluvial soils are anticipated to be readily excavatable using appropriately sized earthmoving equipment in well maintained operating condition. Heavy ripping of the well cemented soils (caliche layers) may be required. Heavy ripping or blasting maybe required in the bedrock cut areas of “granitic” or “metamorphic” (ie limestone) rocks.

Soil Expansion Potential

Based on local As-built and the current field boring logs, the soils encountered along the alignment are predominantly fine to coarse-grained sands with minor amounts of gravel and are not generally considered to be cohesive. These sandy soils are anticipated to be non-expansive or have a very low expansion potential. However, there may be localized, discontinuous layers of clayey soils or lake bed deposits that can possess higher expansion potential. Soil expansion potential should be evaluated during the PS&E phase of the project.

Soil Erosion Potential

Since the native soils are anticipated to be predominantly fine- to coarse-grained sands with minor amounts of gravel, the soils can suffer moderate to severe erosion. However, by incorporating selective grading and adhering to provisions for site drainage, slope planting, and other measures required be Caltrans, the potential for surface soil erosion can be minimized.

Liquefaction Potential and Seismically-Induced Settlement

Soil liquefaction is a phenomenon in which saturated loose to medium dense, predominantly granular soils lose most, if not all, of shear strength and stiffness due to the development of excess pore pressure when subjected to ground shaking. Effects of liquefaction on ground surface include foundation settlement and reduction in bearing capacity, sand boils, and ground settlement and lateral spreading.

Based on the existing subsurface information, liquefaction of subsurface soils is unlikely due to absence of groundwater and the medium dense to dense nature of the subsurface soils. Consequently, seismic settlement due to liquefaction is unlikely. Also, because of the dense nature of the subsurface soils, seismic settlement of dry in-situ soils is expected to be negligible.

Embankment Settlement

Embankments along the roadway are anticipated to range in height up to 10 feet and locally up to 45 feet at the three wash crossings. Embankments will be constructed with 4H:1V (Horizontal to Vertical) side slopes. Because the subsurface soils are predominantly granular, the soils are not expected to undergo consolidation settlement (settlement over long periods of time). However, the soils can undergo "immediate" elastic settlement which usually occurs during earthwork activities and shortly thereafter. For new embankments, elastic settlement is anticipated to range from less than ¼-inch to 2.5-inches because of the medium dense to dense nature of the subsurface soils. Settlement magnitudes and time rates of settlement should be verified by exploratory borings, laboratory soil testing, and analysis during the PS&E phase of the project.

Stability of Slopes

Assuming the earthen embankments will be constructed using compacted fill having a minimum friction angle of 34 degrees and minimum cohesion of 150 psf, slopes up to 45 feet high and with inclinations of 4H:1V or flatter are expected to be globally stable (i.e. minimum factor-of-safety is 1.5 and 1.1 under static and pseudo-

static conditions, respectively). Foundation soils (existing below proposed embankments) are anticipated to be stable with respect to global slope stability.

In addition, using a friction angle and cohesion of 30 degrees and 150 psf, slopes are expected to be surficially stable for slopes excavated into the native soils. Cuts in excavated areas can be up to 45 feet deep and with slope inclinations of 2H:1V or flatter, are expected to be globally stable (i.e. minimum factor-of-safety is 1.5 and 1.1 under static and pseudo-static conditions, respectively).

Earth Retaining Structures

In areas where right-of-way acquisitions may be difficult or where other physical constraints are present (i.e. areas which are environmentally sensitive or where existing structures will remain), cantilevered retaining walls or tieback walls may be required. Walls may be required at various locations throughout the project to widen existing roadways or confine new embankments (to limit the width of embankments). Walls may be required parallel to the mainline embankments, at the end slopes of bridge approach embankments, or along entrance and exit ramps. Based on the subsurface information shown on preliminary field boring logs, standard spread footings are expected to be suitable for supporting standard Caltrans retaining walls. A minor amount of remedial earthwork below spread footings may be required to remove loose near-surface soils; remedial over-excavations are anticipated to be less than 3 feet. Exploratory boreholes should be performed along alignments of proposed retaining walls to evaluate the competency of the subsurface soils.

Based on the limited soil information at this preliminary stage, we anticipate adequate bearing capacity and lateral resistance parameters for retaining walls using spread footings. All retaining walls will require drainage structues to minimize hydrostatic pressures, and to prevent potential seeps and piping beneath the retaining wall foundations.

Sound Walls

Sound walls may be required along some portions of the project. Standard spread or trench footings are anticipated to be suitable for supporting sound walls. However, some degree of remedial grading (over-excavation and re-compaction) may be necessary. Use of standard foundations for sound walls should be confirmed during the PS&E phase of the project. Exploratory boreholes should be performed along the alignments of the proposed sound walls to evaluate the competency of the subsurface soils.

Hazardous Waste Considerations

If for any reason hazardous or toxic materials are believed to exist with the project area, an environmental specialist should be consulted. The presence of aerially-deposited lead, as well as other hazardous and toxic materials, should be evaluated during the PS&E phase of the project.

FUTURE GEOTECHNICAL INVESTIGATIONS

We recommend excavating numerous exploratory borings throughout the project alignment, during PS&E phase of the roadway project, and for each of the separate bridge projects, to investigate site-specific soils and conditions, and to collect samples of subsurface soils for laboratory testing. The locations and depths of the borings should be selected once the locations and extent of proposed improvements have been identified. Soil samples recovered during the future geotechnical field investigations should be tested to determine soil type, soil shear strength, compressibility characteristics, R-value, compaction characteristics, permeability, and corrosion potential. In addition the depth and seismic velocity of the soils and bedrock should be evaluated, among others.

Those structures proposed from Caughlin Road to Adelanto Road should be individually evaluated for fault rupture potential from the projection of the Mirage Valley fault.

If you have any question, please contact any of the undersigned at AnhDan Le (916) 227-7211, Douglas Cook (916) 227-4514, or Angel Perez-Cobo (916) 227-7167, Office of Geotechnical Design South-2.

Prepared by:

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K. Douglas Cook, C.E.G.
Engineering Geologist
Geotechnical Design South-2

Attachments: Plate 1: San Bernardino Segment Map
Plate 2: Structure and Boring Location Map
Typical Cross Sections

cc: GS Corporate – Shira Rajendra
PCE (District 07) – Jan Rutenbergs
District 07 Materials Engineer – Kristen Stahl
District 07 Project Manager – Osama Megalla
District 07 Environmental Planning–Karl Price
District 07 Design – Gordon K Leung
District 08 Design – Mark Pertile
HQ Geotechnical Design South-2 – Angel Perez-Cobo
File

ATTACHMENTS
PLATES
AND
TYPICAL CROSS SECTIONS

PROPOSED HIGH DESERT CORRIDOR
SAN BERNARDINO COUNTY SEGMENT (County Line To SR-18)

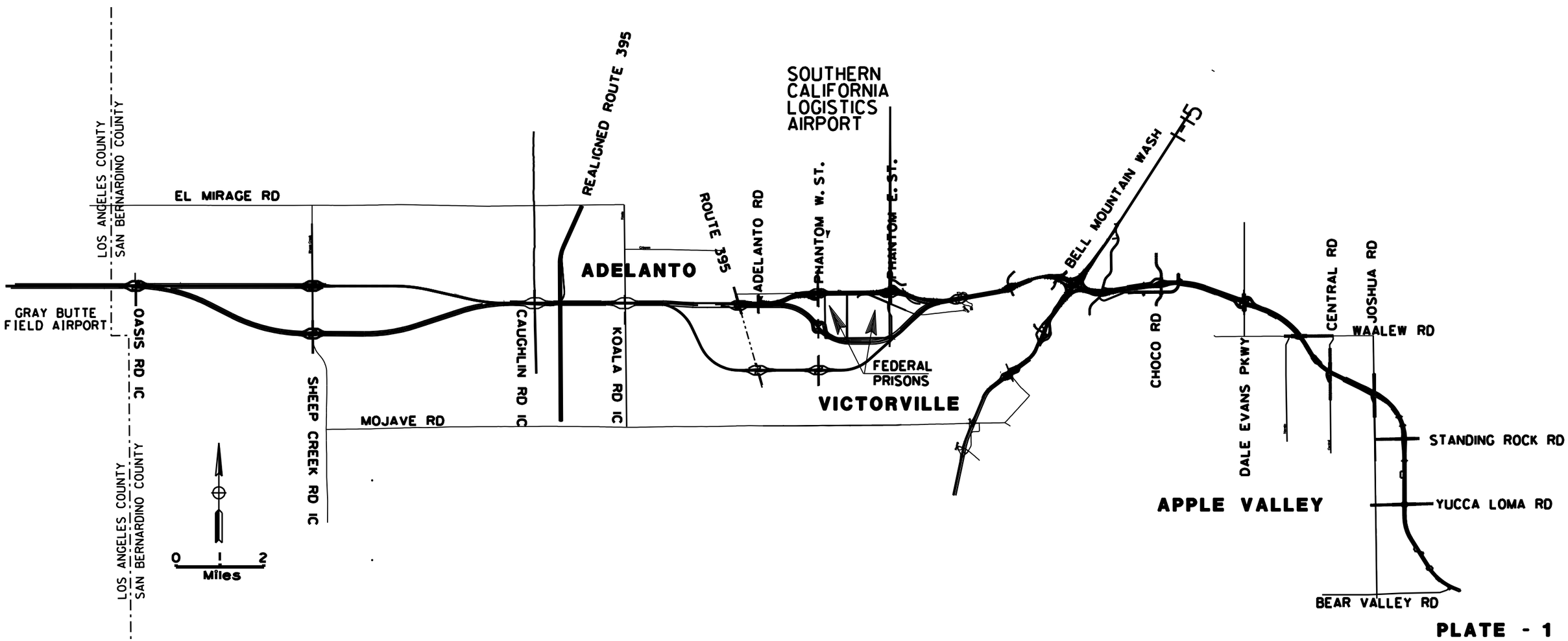
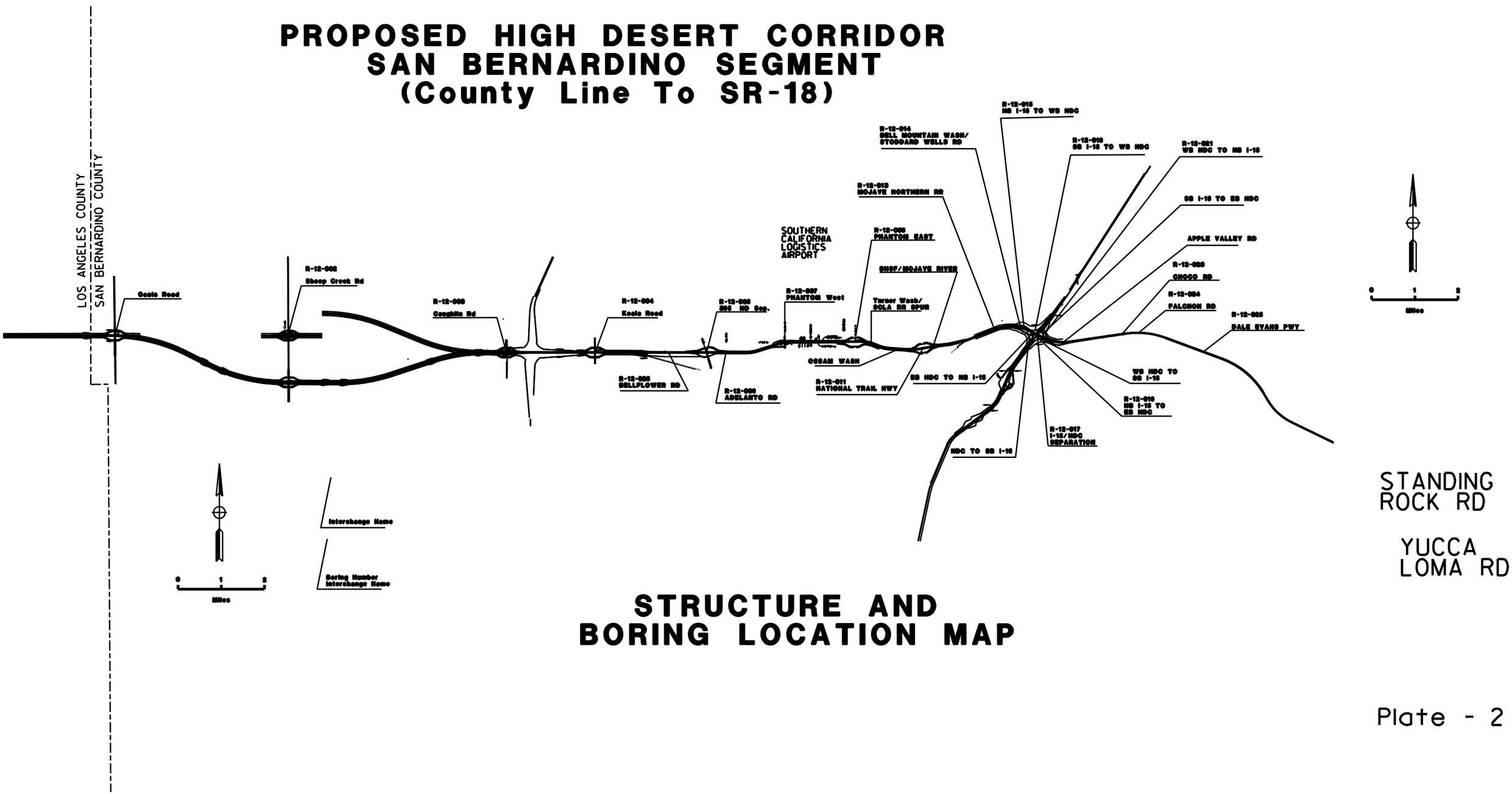


PLATE - 1

D8 HDC Alignment PL-1.dgn 6/6/2012 1:41:52 PM

PROPOSED HIGH DESERT CORRIDOR
SAN BERNARDINO SEGMENT
(County Line To SR-18)



STRUCTURE AND BORING LOCATION MAP

Plate - 2

D8 Structure and Boring Pl-2.dgn 6/6/2012 1:20:44 PM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	L.A./ S.B.	HDC			

REGISTERED CIVIL ENGINEER

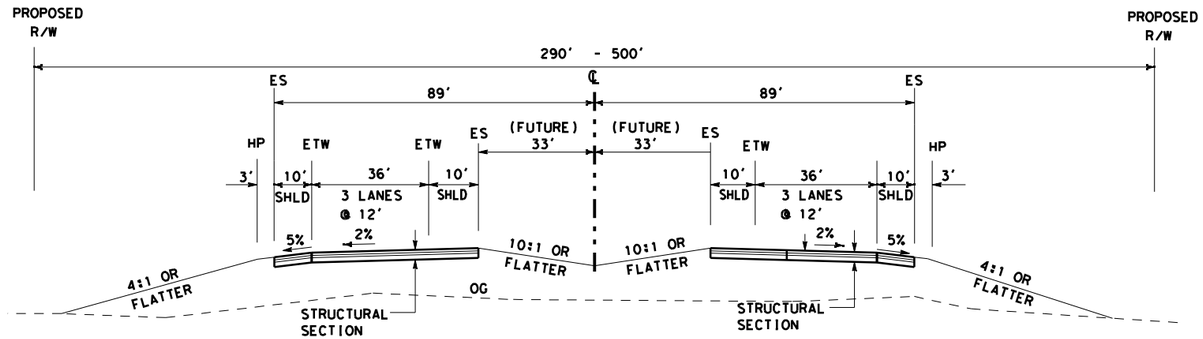
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER NO. EXP. 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.

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

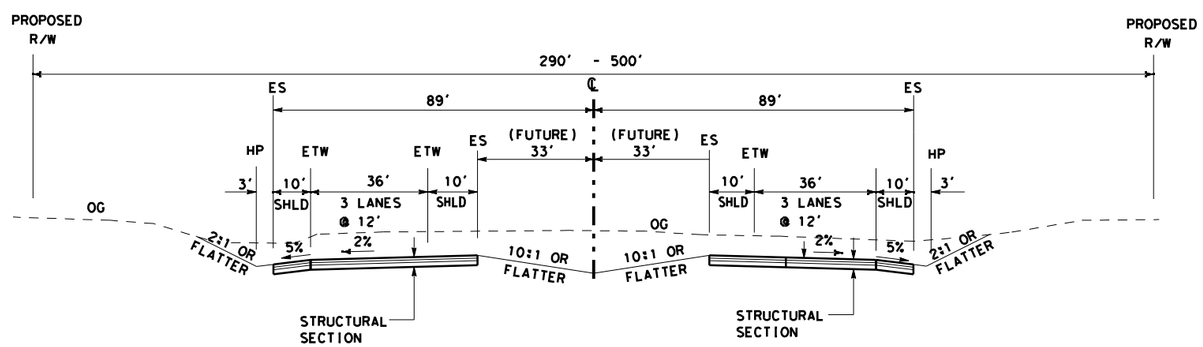
STRUCTURAL SECTION — 0.90' JPCP / 0.50' LCB / 0.70' AB CL3



FOR FILL

PROPOSED HIGH DESERT CORRIDOR (HDC)

STA. 1634+63.56 TO STA. 2322+52.62, 14.5' max. Approx.
STA. 2485+57.28 TO STA. 2505+00.00, 5.5' max. Approx.
STA. 2575+82.23 TO STA. 2580+25.33, 9.5' max. Approx.
STA. 2593+00.00 TO STA. 2609+62.90, 44.5' max. Approx.
STA. 2638+52.86 TO STA. 2667+43.41, 46.5' max, Approx.
STA. 2689+00.00 TO STA. 2726+64.92, 76' max, Approx.
STA. 2753+32.53 TO STA. 2856+00.00, 65' max. Approx.
STA. 2912+48.32 TO STA. 2919+57.37, 5.5' max. Approx.



FOR CUT

PROPOSED HIGH DESERT CORRIDOR (HDC)

STA. 2322+52.62 TO STA. 2485+57.28, 15.5' max. Approx.
STA. 2505+00.00 TO STA. 2575+82.23, 32.5' max. Approx.
STA. 2580+25.33 TO STA. 2593+00.00, 42' max. Approx.
STA. 2609+62.90 TO STA. 2638+52.86, 74' max. Approx.
STA. 2667+43.41 TO STA. 2689+00.00, 50' max. Approx.
STA. 2726+64.92 TO STA. 2753+32.53, 17.5' max. Approx.
STA. 2856+00.00 TO STA. 2912+48.34, 68' max. Approx.

ALIGNMENT ALTERNATIVE 3

TYPICAL CROSS SECTION

SCALE: NO SCALE

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

X-2

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

CHECKED BY

PROJECT ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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CU 07245

EA 2600U0

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	L.A./ S.B.	HDC			

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA

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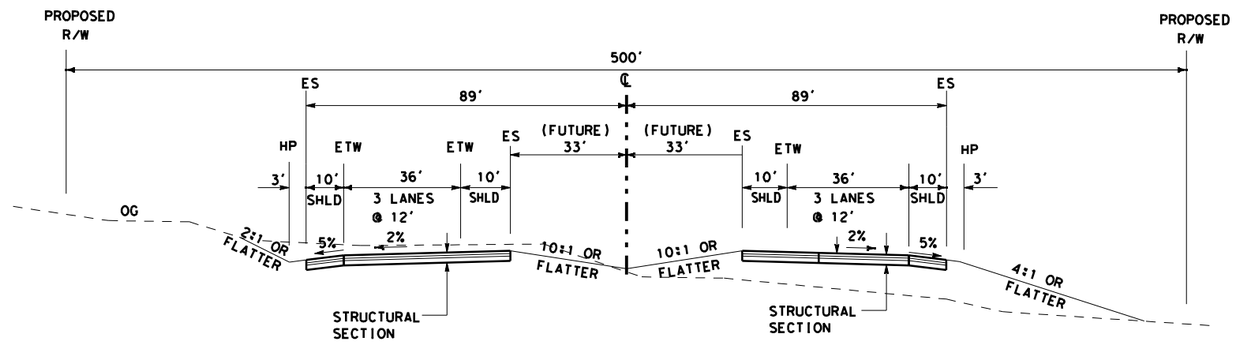
STRUCTURAL SECTION — 0.90' JPCP / 0.50' LCB / 0.70' AB CL3



PROPOSED HIGH DESERT CORRIDOR (HDC)
STA. 1128+00 (DIST 8) TO STA. 1176+00 (DIST 8),
- 33' max CUT (L)
- 4' max. FILL (R)

ALIGNMENT ALTERNATIVE 2

TYPICAL CROSS SECTION

SCALE: NO SCALE

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

X-4

DATE	REVISED BY	DATE REVISED

CALCULATED/DESIGNED BY

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PROJECT ENGINEER

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => $USER
DGN FILE => $REQUEST

CU 07245

EA 2600U0

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	L.A./ S.B.	HDC			

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA

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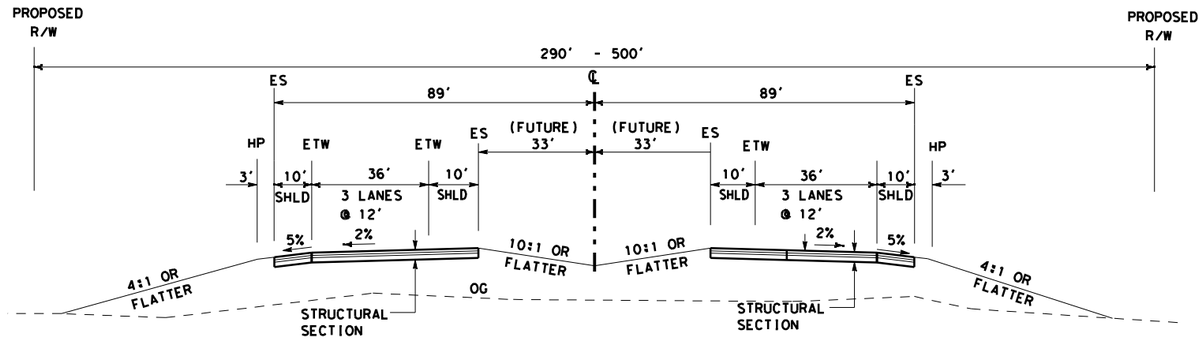
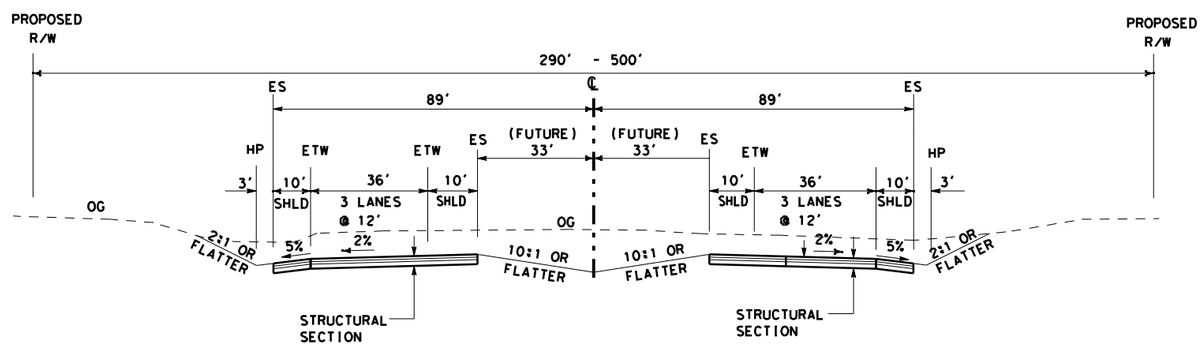
STRUCTURAL SECTION — 0.90' JPCP / 0.50' LCB / 0.70' AB CL3



FOR FILL

PROPOSED HIGH DESERT CORRIDOR (HDC)

STA. 1634+63.56 TO STA. 2310+22.71 , 17' max. Approx.
STA. 902+00.00 (DIST 8) TO STA. 924+00.00 (DIST 8), 14' max. Approx.
STA. 1012+71.27 (DIST 8) TO STA. 1056+26.52 (DIST 8), 67' max. Approx.
STA. 1078+08.41 (DIST 8) TO STA. 1089+00.00 (DIST 8), 35' max. Apporx.
STA. 1119+50.00 (DIST 8) TO STA. 1128+00.00 (DIST 8), 45' max, Approx.
STA. 1176+00.00 (DIST 8) TO STA. 1276+63.85 (DIST 8), 66' max. Approx.



FOR CUT

PROPOSED HIGH DESERT CORRIDOR (HDC)

STA. 2310+22.71 TO STA. 902+00.00 (DIST 8), 13' max. Approx.
STA. 924+00.00 (DIST 8) TO STA. 1012+71.27 (DIST 8), 21.5' max. Approx.
STA. 1056+26.52 (DIST 8) TO STA. 1078+08.41 (DIST 8), 31' max. Approx.
STA. 1089+00.00 (DIST 8) TO STA. 1119+50.00 (DIST 8), 53' max. Approx.
STA. 1276+63.85 (DIST 8) TO STA. 1340+98.20 (DIST 8), 69' max. Approx.

ALIGNMENT ALTERNATIVE 2

TYPICAL CROSS SECTION

SCALE: NO SCALE

ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

X-3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

PROJECT ENGINEER

CALCULATED/ DESIGNED BY

CHECKED BY

DATE REVISED BY

DATE REVISED

LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

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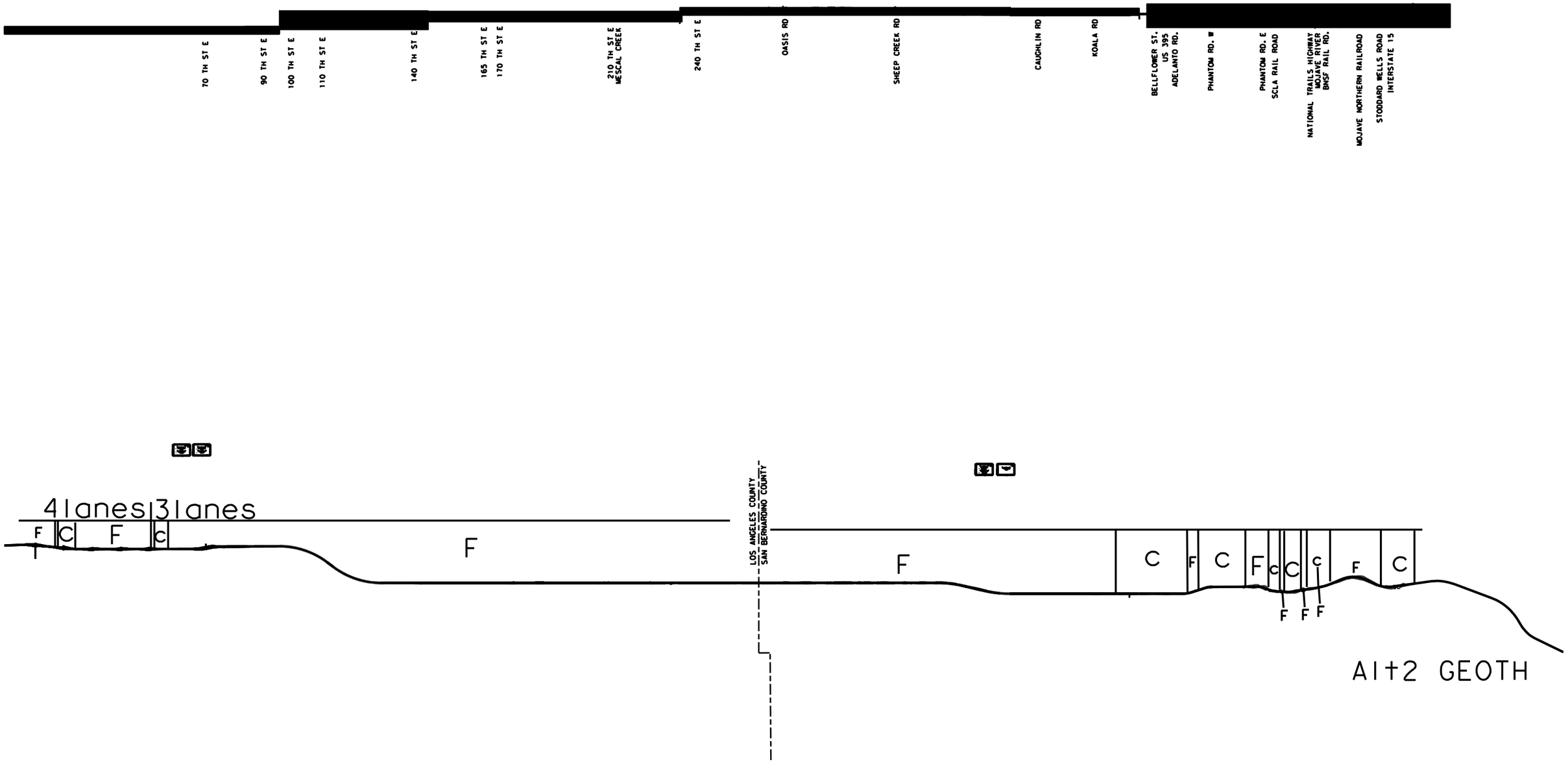
CU 07245

EA 2600U0



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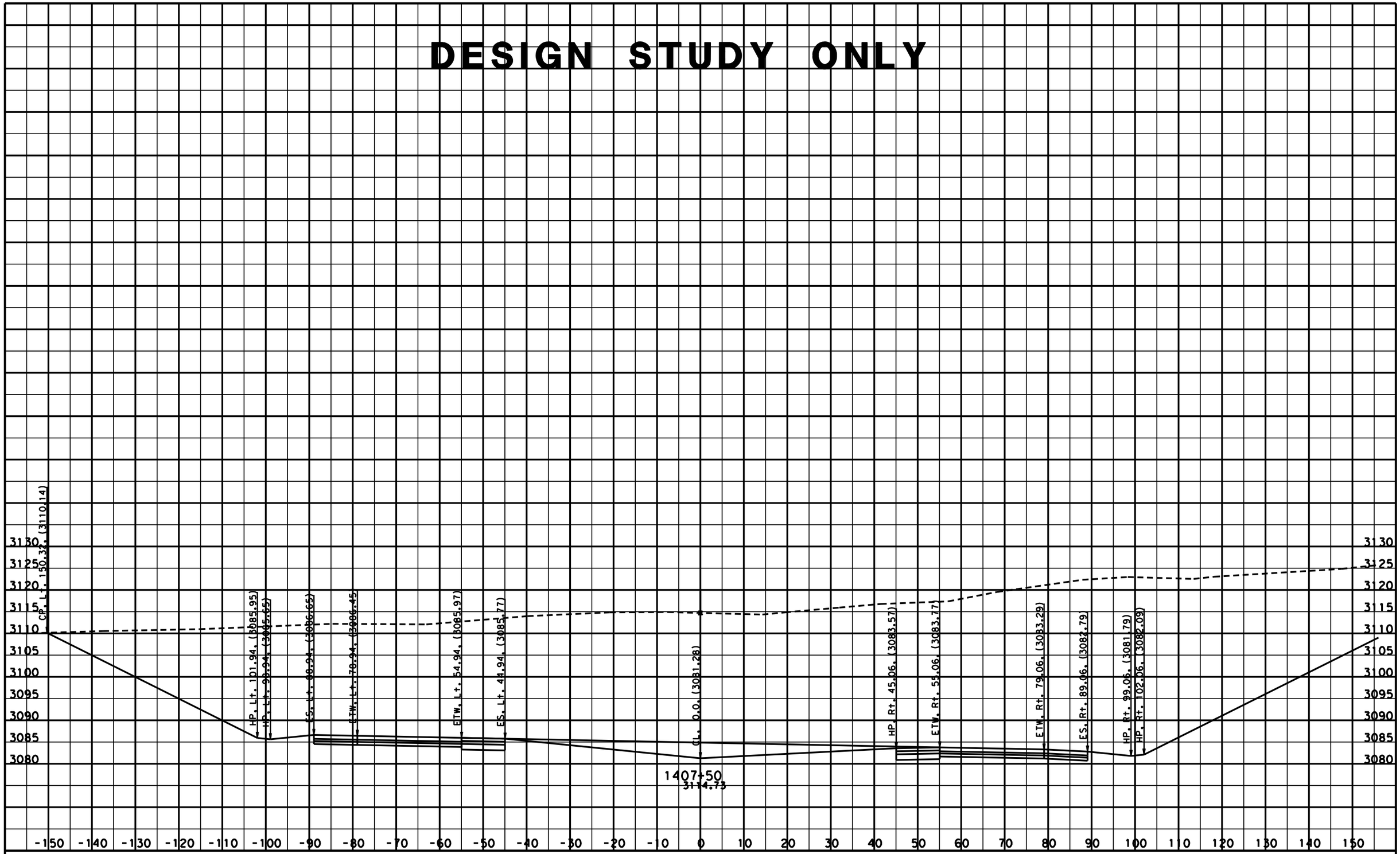
DESIGN STUDY ONLY



CREATED BY: AW
DATE: 3/7/2012
KC Project: 1111

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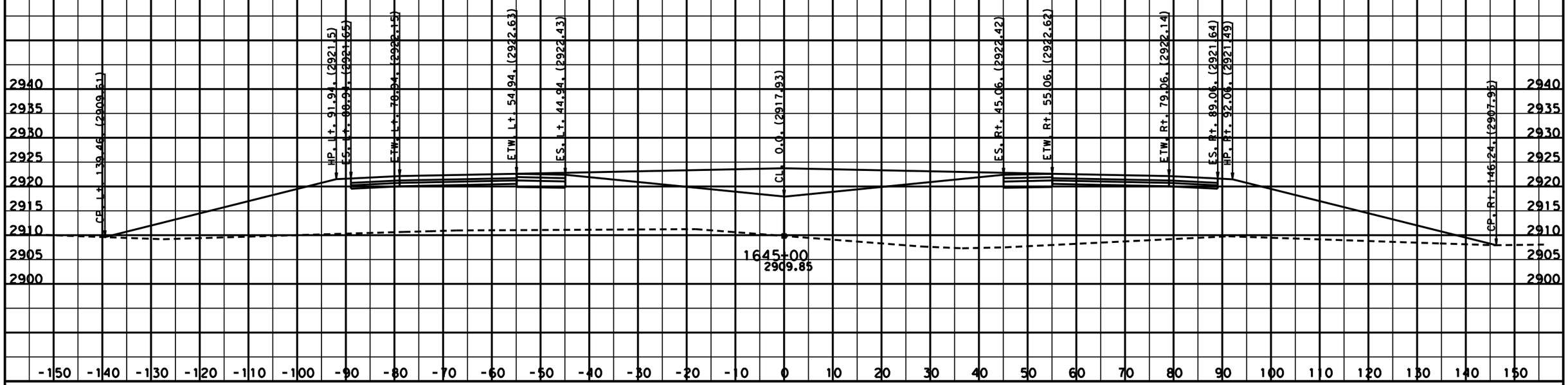
CONTRACT: 2600U
DIST/CO/RTE/PM: 08/SBD/
PROJECT ID: HDC

SCALE: 1" = 10' Horiz.
1" = 10' Vert.

All Dimensions are US Survey Feet

ALT1
CROSS SECTIONS
SHEET 80 OF XXX

DESIGN STUDY ONLY



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KC Project: 1111

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CONTRACT: 2600U0
DIST/CO/RTE/PM: 08/SBD/
PROJECT ID: HDC

SCALE: 1" = 10' Horiz.
1" = 10' Vert.

All Dimensions are US Survey Feet

ALT1
CROSS SECTIONS
SHEET 11 OF XXX

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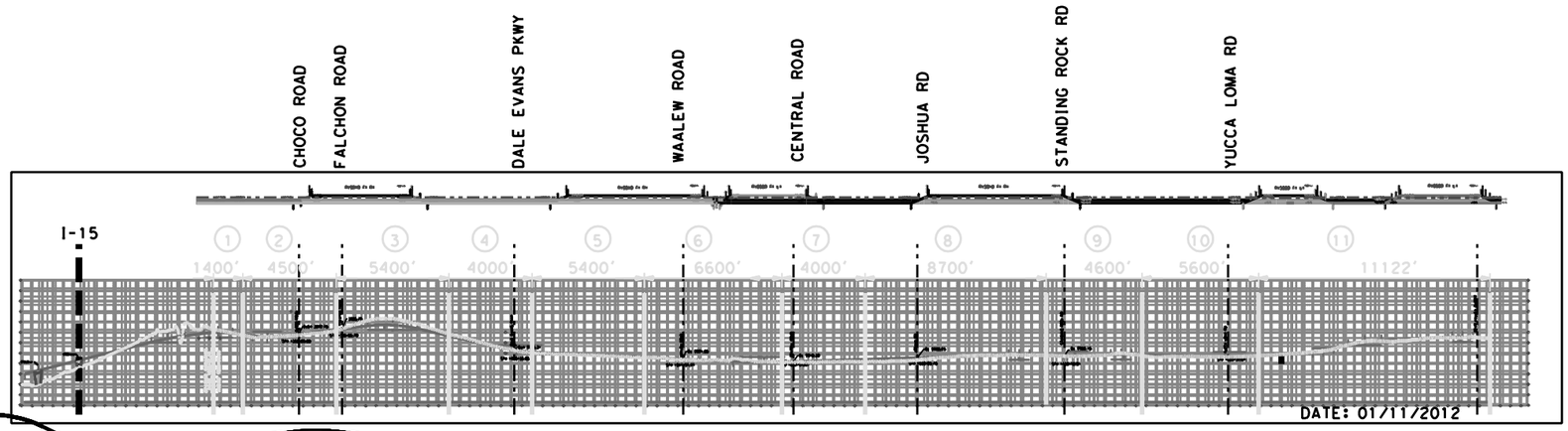

PROFILE
WITH STATION EQUATION

STODDARD WELLS ROAD
INTERSTATE 15

PROFILE_HDC alignments_D8_Update_2.dgn 6/6/2012 2:46:36 PM