GEOTECHNICAL DESIGN & MATERIALS REPORT
SR-68/CORRAL DE TIERRA ROAD
INTERSECTION IMPROVEMENT PROJECT
MONTEREY COUNTY, CA

05-Mon-68 PM 12.8/13.2
EA 05-0H8230
ID No. 05 0000 0085

For

Wood Rodgers, Inc.
3301 C Street Bldg 100-B
Sacramento, California 95816

PARIKH CONSULTANTS, INC.

2360 Qume Drive, Suite A
San Jose, CA 95131
(408) 452-9000

December 4, 2012
(updated from 10/2009 version)

Job No. 206148.10

PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

Wood Rodgers, Inc.
3301 C Street Bldg 100-B
Sacramento, CA 95816

Job No.: 206148.10
December 4, 2012
(updated from 10/2009 version)

Attn: Mr. Keith Hallsten

Sub: GEOTECHNICAL DESIGN & MATERIALS REPORT
SR-68/Corral De Tierra Road Intersection Improvement Project,
Monterey County, CA 05-Mon-68 PM 12.8/13.2
EA 05-0H8230 ID No. 05 0000 0085

Dear Mr. Hallsten:

Transmitted herewith is the Geotechnical Design & Materials Report for the subject project. The report was prepared in accordance with the scope of work outlined in our proposal.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning our findings or conclusions, please feel free to contact this office at (408) 452-9000.

Very truly yours,
PARIKH Consultants, Inc.

Y. David Wang for
Gary Parikh, P.E., G.E.
President

Attachment: Geotechnical Design & Materials Report

"Approved as to impact on State facilities and conformance with applicable State standards and practices, and the technical oversight were performed as described in the California Department of Transportation A&E Consultant Services Manual."

Caltrans_____

Title_____

Date_____

Caltrans_____

Title_____

Date_____

TABLE OF CONTENTS **page**

1. INTRODUCTION 1
2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS 2
3. PERTINENT REPORTS AND INVESTIGATION 2
4. PHYSICAL SETTING 3
   4.1 Climate 3
   4.2 Topography and Drainage 3
   4.3 Man-Made and Natural Features of Engineering and Construction Significance 3
   4.4 Regional Geology and Seismicity 3
5. EXPLORATION 4
   5.1 Drilling and Sampling 4
   5.2 Geologic Mapping 5
   5.3 Geophysical Studies 5
   5.4 Instrumentation 6
   5.5 Exploration Notes 6
6. GEOTECHNICAL TESTING 6
   6.1 In-Situ Testing 6
   6.2 Laboratory Testing 6
7. GEOTECHNICAL CONDITIONS 6
   7.1 Site Geology 6
      7.1.1 *Lithology* 7
      7.1.2 *Structure* 7
   7.2 Subsurface Soil Conditions 7
   7.3 Water 7
      7.3.1 *Surface Water* 7
      7.3.1.1 *Scour* 7
      7.3.1.2 *Erosion* 7
      7.3.2 *Groundwater* 8
   7.4 Project Site Seismicity 8
      7.4.2 *Ground Rupture* 9
8. GEOTECHNICAL ANALYSIS AND DESIGN 9
   8.1 Dynamic Analysis 9
      8.1.1 *Parameter Selection* 9
      8.1.2 *Liquefaction Potential* 9
   8.2 Cuts and Excavations 10
      8.2.1 *Stability* 10
      8.2.2 *Rippability* 10
      8.2.3 *Grading* 10
   8.3 Embankments 10
   8.4 Earth Retaining System 10
   8.5 Culverts 11
      8.5.1 *Corrosion Investigation* 11
9. STRUCTURAL PAVEMENTS 12

10. MATERIAL SOURCES 13
11. MATERIAL DISPOSAL 13
12. CONSTRUCTION CONSIDERATIONS 14
12.1 Construction Advisories 14
12.2 Construction Consideration that Influence Specifications 15
12.3 Hazardous Waste Considerations 15
12.4 Differing Site Conditions 15
13. RECOMMENDATIONS AND SPECIFICATIONS 15
13.1 Summary of Recommendations 15
13.2 Recommended Materials Specifications 16
13.2.1 *Standard Specifications* 16
13.2.2 *Special Provisions* 16
14. INVESTIGATION LIMITATIONS 17
REFERENCES 19

Appendix A
Log of Test Borings

Appendix B
Laboratory Tests ..... Plate B-1
R-value Test Results ..... Plates B-2A, B-2B and B-2C
Corrosion Test Results ..... Plates B-3A and B-3B

Appendix C
Calculation of Pavement Section

Appendix D
CULVERT 4 Analysis Result

LIST OF TABLES

1 Boring Program 05

2 Earthquake Data 09

3 Summary of Corrosion Test Results 11

4 Summary of R-Value Test Results 12

5 Recommended (Minimum) Structural Pavement Sections 13

6 Sources of Asphalt and Aggregate Material 13

LIST OF FIGURES

Location Map ..... Plate 1

Site Plan ..... Plate 2

Geologic Map ..... Plate 3

Fault Map ..... Plate 4

Attenuation Relationships for Shallow Crustal Earthquakes ..... Plate 5

GEOTECHNICAL DESIGN & MATERIALS REPORT
SR-68/CORRAL DE TIERRA ROAD
INTERSECTION IMPROVEMENTS
MONTEREY COUNTY, CALIFORNIA
05-Mon-68 PM 12.8/13.2
EA 05-0H8230 ID No. 0000 0085

1. INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed improvements on the SR-68/Corral de Tierra Road Intersection in Monterey County. The general location of the project site and its limits are shown in Plate 1, Project Location Map.

This report addresses the design of structural pavement sections, and corrosion investigation recommendations. The investigation included review of readily available soils and geologic literature pertaining to the site including as-built information, site reconnaissance, obtaining representative samples and logging soil materials encountered in exploratory borings, laboratory testing of the representative samples, performing engineering analyses, and preparation of this report.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the project. This report also establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions, if any.

The report is intended for use by the project roadway design engineer, construction personnel, bidders, and contractors for information and reference purposes only and should not be construed directly as project specifications.

Due to limitations inherent in geotechnical investigations, it is neither uncommon to encounter unforeseen variations in the soil conditions during construction nor is it practical to determine all such variations during an acceptable program of drilling and sampling for a project of this scope. Such variations, when encountered, generally require additional engineering services to attain a properly constructed project. We, therefore recommend that a contingency fund be provided to accommodate any additional charges resulting from technical services that may be required during construction.

2. EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

SR-68 is the main connector between City of Salinas and the Monterey Peninsula, the County's two principal urbanized areas. SR-68 has one traffic lane in each direction. It serves as the main connector between the Monterey Peninsula, including Carmel Valley and the former Fort Ord area, and Southern California via US 101 and is the main commuter route between Salinas and Monterey providing access to residential developments, schools and businesses adjacent to the SR-68 corridor. The SR-68/Corral de Tierra Road Intersection is currently experiencing significant traffic congestion and needs traffic operation improvements. Based on the information provided, the proposed project consists of following improvements:

- Widening SR-68 on the north side for a distance of approximate 1,200 feet to the east of the Corral de Tierra Road intersection to accommodate a second westbound SR-68 left turn lane to southbound Corral de Tierra Road,
- Widening SR-68 on the north side for a distance of approximately 600 feet west of the intersection with Corral de Tierra Road. In order to avoid impact to potential habitat for the federally-threatened California Tiger Salamander, the designer is proposing to incorporate a retaining wall to widen the steep mechanically-stabilized embankment slope on the north side of SR-68, west of Corral de Tierra Road,
- Widening Corral de Tierra Road, primarily on the east side, from the intersection with SR-68 for a distance of approximately 1,000 feet south.
- Potentially constructing drainage system improvements on the north side of SR-68 & relocating existing utilities located on the east side of the Corral de Tierra Road and on the north side of SR-68.

3. PERTINENT REPORTS AND INVESTIGATION

Except Traffic Index (TI) value provided by the designer, no other report or investigation pertinent to the site was available.

4. PHYSICAL SETTING

4.1 Climate

The climate in the project area is characterized by moderate climatic conditions, which consists of mild winters, mild summers, small daily and seasonal temperature ranges, and mild humidity. Based on the statistical data from "Western Regional Climate Center", the average total annual precipitation along the project vicinity is approximately 9.5 inches and is principally during the months of December through February. January usually has the most precipitation accumulation and July the least. Extreme temperature ranges from location and the average minimum temperature is approximately 50.0° F in January to average maximum temperature of 70.0° F in July.

4.2 Topography and Drainage

The topography within the project site along SR-68/ Corral de Tierra Road Intersection is mainly at level with existing grade ranging from Elev. 271.6 to 308.6 ft. The site drainage is generally by sheet flow, or collected by local drainage systems.

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

The subject was considered and was determined to be not significant for the project.

4.4 Regional Geology and Seismicity

General geologic features pertaining to the site were evaluated by reference to the Geologic Map of Spreckels 7.5 Minute Quadrangle; Monterey County, CA (Joseph C. Clark, Earl E. Brabb, and Lewis I. Rosenberg 1997). The Spreckels Quadrangle lies at the north end of the Sierra De Salinas and extends from the Salinas Valley on the northeast across Los Laurelles Ridge south to Carmel Valley, an Intermontane Valley that separates the Santa Lucia Range from the Sierra De Salinas. The Toro Regional Park occupies the east-central part of the Quadrangle, whereas the former Fort Ord Military Reservation covers the northwestern part of the area. Subdivisions largely occupy the older floodplain of Toro Creek and the adjacent foothills, with less dense development along the narrower canyons of the Corral de Tierra and San Benancio Gulch to the south. The foothills

southwest of the Salinas River are the sites of active residential development. A geologic map of the general project area is shown on Plate 3.

Liquefaction, which seriously affected the Spreckels area in the 1906 San Francisco earthquake (Lawson, 1908), and landsliding are the two major geological hazards in the area. The landslides consist mainly of older larger slides in the southern and younger debris flows in the northern part of the Quadrangle.

The regional structure of the area is similar to the other portions of the California Coast Ranges, consisting of a complex series of steeply dipping, northwesterly striking faults extends into the Spreckels Quadrangle from the south and locally bounds Salinian granitic rocks. Significant earthquakes, which have occurred in this area, are generally associated with crustal movements along well-defined active fault zones. The attached Fault Map (Plate 4) presents the locations of the fault systems relative to the project site. Maximum Credible Earthquake Magnitudes (MCE) for the major faults in the area are determined by Mualchin (California Seismic Hazard Map 1996). These magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure. Faults in the vicinity include the King City Reliz fault and Zayante Vergales fault. Based on Caltrans updated map and readily available geological data, the governing fault for the structure is the Zayante Vergales (a strike-slip fault, Mw = 7.25).

5. EXPLORATION

5.1 Drilling and Sampling

Based on the preliminary plans, discussions with the design team, and readily available geotechnical data in the area, 6 borings were drilled at selected locations to a depth of 5 ft below the existing ground surface.

- Six borings, namely A-07-B1 through A-07-B6 were drilled in the vicinity for the design of roadway. Bulk Samples were collected at shallow depth (approximately 5ft).

Borings A-07-B1 through A-07-B6 was drilled by a Jeep Rig on March 14th, 2007 under the supervision of our field engineer. The borings were advanced using a Jeep-mounted rig using 8" auger. The boring locations are shown on Plate 2, Site Plan. The descriptions of the soils encountered and relevant boring information are presented on the Log of Test Boring (LOTB) in Appendix A. The samples were sealed and transported to our laboratory for further evaluation and testing. The field investigation was conducted under the supervision of our field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation. Table 1 below summarizes the boring program.

TABLE 1 – BORING PROGRAM

Boring No.	Station (ft.)	Offset (ft.) From "SR 68" line	Description
A-07-B1	20+41	Lt. 29	SILTY SAND (SM), brown, moist
A-07-B2	29+00	Lt. 31	SILTY SAND (SM), brown, moist
A-07-B3	34+85	Lt. 38	SILTY SAND (SM), brown, moist
A-07-B4	38+20	Lt. 18	SILTY SAND (SM), brown, moist
A-07-B5	24+14	Rt. 391	SILTY SAND (SM), brown, moist
A-07-B6	22+52	Rt. 719	SILTY SAND (SM), brown, moist

5.2 Geologic Mapping

No site-specific geologic mapping was conducted. However, general geologic features pertaining to the site were evaluated by reference to Spreckels 7.5 Minute Quadrangle Geology of Monterey County, California by Joseph C. Clark, Earl E. Brabb, and Lewis I. Rosenberg 1997 (Plate 3). Detailed descriptions of the geology are described in Sections 4.4 & 7.1.

5.3 Geophysical Studies

The subject was considered and was determined to be not applicable to the project.

5.4 Instrumentation

The subject was considered and was determined to be not applicable to the project.

5.5 Exploration Notes

The exploratory borings mainly encountered older flood plain deposits (Holocene). Drilling conditions using augers were considered normal for this site.

6. GEOTECHNICAL TESTING

6.1 In-Situ Testing

The subject was considered and was determined to be not applicable to the project. The borings were drilled using a jeep rig with solid stem auger to collect bulk samples.

6.2 Laboratory Testing

Laboratory tests performed for the study include the following: R-value Test (California Test Method 301), and Corrosion Test (California Test Method 643). The laboratory test results are attached in Appendix B.

7. GEOTECHNICAL CONDITIONS

7.1 Site Geology

General geologic features pertaining to the site were evaluated by reference to the Geologic Map of Spreckels 7.5 Minute Quadrangle; Monterey County, CA (Joseph C. Clark, Earl E. Brabb, and Lewis I. Rosenberg 1997). Based on the map, the site subsoil's consist of Older Flood Plain Deposits (Qof) and Continental Deposits, undivided (QTc). A geologic map of the project vicinity is shown on Plate 3.

Qof – Older flood-plain Deposits (Holocene) – Older flood-plain Deposits are stratigraphically between terrace deposits and younger flood-plain deposits and are Holocene in age. Older flood-plain deposits consist of unconsolidated, relatively fine-grained, heterogenous deposits of sand and silt, commonly including relatively thin layers of clay. The grain size of levee deposits decreases away from abandoned channel-fill deposits. Interpretation of well log data suggests that the older flood-plain deposits are typically less than 60 ft thick in the study area, but locally may

be as much as much as 40 m thick.

7.1.1 *Lithology*

The site consists of older flood-plain deposits. The subject was considered and was determined to be not applicable for the project. Detailed description of subsoil conditions are presented in Section 7.2.

7.1.2 *Structure*

The subject was considered and was determined to be not applicable for the project

7.2 Subsurface Soil Conditions

Based on the boring data, the subsurface soil conditions of the site generally consist of silty sand with some clay and gravel to the maximum depth explored (5 ft below existing grade). Detailed descriptions of the materials encountered in the exploratory borings are presented in the LOTB in Appendix A "Log of Test Borings". It should be noted that these descriptions and related information depict subsurface conditions only at the locations indicated and on the particular date noted on the LOTB. Because of the variability from place to place within soil/rock in general, subsurface soil conditions at other locations may differ from conditions occurring at the locations explored. The abrupt stratum changes shown on the logs may be gradational and relatively minor changes in soil types within a stratum may not be noted due to field limitations. Also, the passage of time may result in a change in the soil conditions at the locations due to environmental changes.

7.3 Water

7.3.1 *Surface Water*

There is no surface water body at the site.

7.3.1.1 *Scour*

The subject was considered and was determined to be not applicable for the roadway project.

7.3.1.2 *Erosion*

Based on the U.S. Department of Agricultural Soil Survey for the project site area, following soil

type exists:

- Gorgonio sandy loam (GkB): Texturally it is defined as gravelly sandy loam and has high conductivity, high infiltration or water transmission rate, excessively draining capability and low runoff potential. Erosion hazard in this soil is generally considered moderately high.
- Santa Ynez sandy loam (ShE): Texturally it is defined as fine sandy loam and has moderately high conductivity, moderately high draining capability, very slow infiltration or water transmission rate and high runoff potential. Erosion hazard in this soil is also considered moderately high.

Majority of the road way alignment is generally in level area, covered with vegetation and appears to be in good condition. Normal erosion control measures should be applied to prevent erosion on the newly constructed embankment.

7.3.2 *Groundwater*

Groundwater was not encountered to the depth of 5 ft. It is anticipated that groundwater level will vary with the passage of time due to seasonal runoff, groundwater fluctuations, surface and subsurface flow, ground surface run-off, and other factors that were not existent at the time of investigation.

7.4 Project Site Seismicity

7.4.1 *Ground Motions*

The project is located in a seismically active part of northern California. Many faults in the Monterey County Area are capable of producing earthquakes, which may cause strong ground shaking at the site. The attached Fault Map (Plate 4) presents the locations of the fault systems relative to the project site.

Maximum Credible Earthquake (MCE) magnitudes for some of the major faults in the area determined by Mualchin (California Seismic Hazard Map 1996) are summarized below. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 2 - EARTHQUAKE DATA

Fault	Estimated Closest Distance to the Project Area (miles)	Maximum Credible Earthquake
Zayante Vergales (strike - slip)	5.9	7.25
King City Reliz (strike – slip)	6.5	7.0
Monterey Bay Zone (Reverse-Oblique)	12.4	6.5
Sargent (strike – slip)	13.1	6.75
Tularcitos Navy (strike – slip)	13.4	7.0
Cypress Point (Unknown)	18.0	6.0
San Gregorio-Palo Colorado (strike – slip)	21.1	7.5

7.4.2 *Ground Rupture*

Since no active faults pass through the project site, the potential for fault rupture is low.

8. GEOTECHNICAL ANALYSIS AND DESIGN

8.1 Dynamic Analysis

8.1.1 *Parameter Selection*

Based on the seismic hazard map prepared by Mualchin (1996) and the attenuation relationship by Sadigh et al. (1997), the Peak Bedrock Acceleration (PBA) at the project site is 0.41 g.

8.1.2 *Liquefaction Potential*

Liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless sands and silts of low relative density are the type of soils that usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction. For relatively low risk improvements (pavement widening), the liquefaction potential at the project site is generally considered low.

8.2 Cuts and Excavations

Based on the plans and profiles provided by the designer, the proposed SR-68/Corral de Tierra Road Intersection widening work is generally at grade and no deep cuts or excavations are required.

8.2.1 *Stability*

The proposed road way alignment is at existing grade. No cut slopes are proposed for the project.

8.2.2 *Rippability*

Based on the investigation, rippability does not appear to be a concern for construction.

8.2.3 *Grading*

Typical grading specifications should conform to Caltrans Standards. A representative from our office or regulatory agency should observe all grading operations and perform moisture and density tests on prepared subgrade, base rock and asphalt concrete. Should there be any alterations of the proposed construction that will affect the stated bases of our recommendations, we should be informed so that we can review such changes and amend or submit additional recommendations.

8.3 Embankments

Based on the plans and profiles, majority of the project work is at existing grade, generally in level area. The existing small embankment fill northwest of the intersection will be widened with a small retaining wall (Section 8.4). The maximum height of the slope face is about 8 feet. The depth of the new fill under the proposed pavement is relatively small. Settlement resulting from this fill is expected to be negligible and most of it should occur during construction.

8.4 Earth Retaining System

In order to avoid impact to potential habitat for the federally-threatened California Tiger Salamander (CTS), the designer proposes to incorporate a retaining wall to widen the existing steep mechanically-stabilized embankment slope on the north side of SR-68, west of Corral de

Tierra road. The existing embankment slope, constructed in 1993, is steeper than 2H:1V and is mechanically stabilized per as-built information.

Per the designer, the wall height varies from 4 to 8 ft. This assumes a 2.5H:1V fill slope on top of the wall. The wall face would not be visible from SR-68 or any other public road or residence, so the aesthetics of the wall face are not a significant design consideration. The designer considers a Steel Crib Wall per Caltrans 2010 standard plans. This a MSE type of application, similar to the existing mechanically stabilized slope. The subsoil is sandy and the height is relatively low to moderate, we believe the proposed crib wall is feasible. The wall subgrade should be scarified and recompacted to 95% relative compaction per Caltrans standards.

8.5 Culverts

It is our understanding that small diameter culverts (2 ft and under) can be designed and constructed using Standard Plans and Specifications, and no specific geotechnical investigation is required per Caltrans guidelines.

8.5.1 *Corrosion Investigation*

The corrosion investigation for this project was performed in general accordance with the provisions of California Test Method 643. Chemical test was performed on a representative soil sample of Boring R-1, to evaluate the corrosion potential of the subsurface soil. A summary of the corrosion test results is presented in Table 3.

TABLE 3 - SUMMARY OF CORROSION TEST RESULTS

Boring No.	Depth (ft)	Resistivity (ohm-cm)	pH	Sulfate (ppm)	Chloride (ppm)
A-07-B3	0' – 5'	6700	7.70	12.5	6.9
A-07-B6	0' – 5'	9650	7.05	0.2	4.5

Based on the Corrosion Guidelines by Caltrans Division of Engineering Services, the test results indicate that the soil is not corrosive. CULVERT 4 analysis result is attached in Appendix D.

Standard reinforced concrete pipe design is suitable. Thermoplastic pipe can be used as an alternative and should not have corrosion concerns.

9. STRUCTURAL PAVEMENTS

R-value tests were conducted on representative samples collected at proposed subgrade level. The test results are summarized in Table 4.

TABLE 4 - SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Station (ft.)	Offset (ft.) From "SR 68" line	Date Drilled	Description	R-value
A-07-B1	20+41	Lt. 29	03/14/2007	Brown SILTY SAND (SM)	-
A-07-B2	29+00	Lt. 31	03/14/2007	Brown SILTY SAND (SM)	28
A-07-B3	34+85	Lt. 38	03/14/2007	Brown SILTY SAND (SM)	-
A-07-B4	38+20	Lt. 18	03/14/2007	Brown SILTY SAND (SM)	38
A-07-B5	24+14	Rt. 391	03/14/2007	Brown SILTY SAND (SM)	-
A-07-B6	22+52	Rt. 719	03/14/2007	Brown SILTY SAND (SM)	52

Based on these results a design R-value of 25 is considered reasonable for native soils. Based on discussion with the designer, the anticipated Traffic Index (TI) values are 7.5, 8.0 and 8.5 for Corral de Tierra Road and 10.0, 10.5 and 11.0 for SR-68. Based on discussion with the designer, we understand that it is preferred to use a pavement section consisting of HMA, base and subbase for the project.

The following pavement sections are provided in accordance with anticipated 20-year design TIs for the roadway:

TABLE 5 – RECOMMENDED (MINIMUM) STRUCTURAL PAVEMENT SECTIONS

Location	R-Value	TI	Structural Pavement Section					
			Option 1			Option 2	Option 3	
			HMA	AB	AS	HMA (Full Depth)	HMA	AB
Corral de Tierra Road	25	7.5	0.40'	0.55'	0.40'	0.85'	0.40'	0.90'
		8.0	0.40'	0.65'	0.45'	0.90'	0.40'	1.05'
		8.5	0.45'	0.65'	0.45'	0.95'	0.45'	1.10'
SR-68	25	10.0	0.50'	0.75'	0.60'	1.10'	0.50'	1.30'
		10.5	0.55'	0.85'	0.65'	1.20'	0.55'	1.45'
		11.0	0.60'	0.85'	0.65'	1.25'	0.60'	1.45'

Design R-value = 25
HMA: Hot Mix Asphalt;
AB: Class 3 Aggregate Base with R-value equal to 78;
AS: Class 4 Aggregate Sub-base with the R-value equal to 50;
Design values are based on the Highway Design Manual Tables (empirical method).

10. MATERIAL SOURCES

There are several commercial sources of asphalt, concrete, and aggregate products in the area. Table 6 lists available commercial suppliers in the area.

TABLE 6 - SOURCES OF ASPHALT AND AGGREGATE MATERIAL

Source	Location	Approx. Haul Dist. (One way, miles)
RMC Pacific Material, Inc.	54 Summers St, Salinas, CA	8.5
Antuzzi Concrete, Inc.	17583 Winding Creek Rd, Salinas, CA	6.5
ABC Supply Comp Inc.	11180 Commercial Pkwy, Castroville, CA	17.0
Granite Rock	1755 Del Monte Blvd SE, Monterey CA	10.0

11. MATERIAL DISPOSAL

Majority of the project will require fill for the proposed widening. Based on our understanding, the project will require minimal disposal of the excess materials.

12. CONSTRUCTION CONSIDERATIONS

12.1 Construction Advisories

The sections are written primarily for the engineer responsible for the preparation of plans and specifications. Since these sections identify potential construction issues related to the project, it may also be of use to the Agency's representatives involved in monitoring of construction activity. The field investigation performed by us primarily addresses design issues and was not planned specifically to identify construction issues.

The project site is located along the existing US Route 68/Corral de Tierra Road junction. Therefore, traffic control is required to maintain traffic flow along Route 68 and the respective local streets. Several underground utilities exist at the site. The contractor should verify the utility lines, be aware of the existing conditions and plan the construction activities accordingly.

In our opinion, conventional equipment may be used to excavate the on-site soil materials. The materials to be excavated may consist of predominantly sandy material. Localized subgrade pumping may be encountered during earthwork construction depending on the weather, moisture condition of the subsurface soils, and surface drainage conditions. Equipment mobility may also be difficult if the subgrade is wet. In which case, the subgrade soils may require reworking, aeration, or over-excavation and replacing with dry granular fill to facilitate earthwork construction. It is possible that unknown old buried utilities or abandoned structures, concrete rubble etc. are located along the alignment. It might require special equipment and additional efforts to remove these buried objects.

Prospective contractors for the project must evaluate construction-related issues on the basis of their own knowledge and experience in the local area, on the basis of similar projects in other localities, or on the basis of field investigation on the site performed by them, taking into account their proposed construction methods and procedures. In addition, construction activities related to excavation and lateral earth support must conform to safety requirements of OSHA and other applicable municipal and Stage regulatory agencies.

12.2 Construction Consideration that Influence Specifications

The contractor should verify the conditions of the existing utility lines. These locations should not be used for stockpiling of borrow materials. Any conflicts with proposed construction should also be reviewed prior to construction.

12.3 Hazardous Waste Considerations

The project environmental study report should be referred to for further details about any potential hazardous materials within the project site.

12.4 Differing Site Conditions

The soil conditions described in this report are based on available boring data. It should be noted that these borings depict subsurface conditions only at the locations drilled. Because of the variability from place to place within soils in general, and the nature of geologic depositions, subsurface conditions could change between the explored locations.

Early communication should be made between the Resident Engineer, the Contractor, and the Geotechnical Engineer as soon as conditions that differ from those established in this report are recognized by any of the parties. Additional recommendations could be provided if such conditions arise.

13. RECOMMENDATIONS AND SPECIFICATIONS

13.1 Summary of Recommendations

If the designer has questions or concerns with any of these recommendations, or, if conditions are found to be different during construction, the Geotechnical Engineer who prepared this report should be contacted. Additional fieldwork, analysis or changes in recommendations may be required. These services may be provided under a separate authorization, as necessary. A concise summary of the geotechnical recommendations is presented below:

- The subsoils consist of silty sand.
- Based on investigation, groundwater was not encountered during exploration below the existing ground surface. The impact of liquefaction is considered low at the site. (Ref: Section 8)
- Pavement Sections (Ref: Section 9). Refer to Tables 5 for the design structural pavement sections.

13.2 Recommended Materials Specifications

13.2.1 *Standard Specifications*

Unless otherwise stated in the special provisions, all materials specifications should conform to Caltrans Standard Specifications, May 2006 edition, including but not limited to the following: Earthwork, Structure Backfill, Pervious Backfill Material, Reinforcing Geofabric, Thermoplastic Pipes, Asphalt Concrete, Aggregate Base, Aggregate Subbase, Cement Treated Base, etc.

13.2.2 *Special Provisions*

Imported Borrow:
Imported material should be in accordance with the specifications set forth in Caltrans Section 19. In particular, for new embankment/roadway construction, the material placed within 4 ft of the finish pavement subgrade should meet the following requirements:

1. Free of organic or other deleterious materials.
2. An R-value of no less than 25.

Aggregate Base: Class 3 aggregate base shall conform to the provisions in Section 26 of the Standard Specifications and to these Special Provisions. It shall also be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 3 aggregate base shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	1-1/2 inch Maximum		¾ inch Maximum	
	Operating Range	Contract Compliance	Operating Range	Contract Compliance
2"	100	100		
1-1/2"	90 – 100	87 - 100		
1"	--	--	100	100
¾"	50 – 85	45 – 90	90 – 100	87 – 100
No. 4	24 - 45	20 – 50	35 – 60	30 – 65
No. 30	10 – 25	6 – 29	10 – 30	5 – 35
No. 200	2 -11	0 -14	2 -11	0 - 14

Quality requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	25 Min.	22 Min.
Resistance (R-value) (301)	-	78 Min.
Durability Index	-	35 Min.

Aggregate Subbase: Aggregate Subbase shall be Class 4 and shall conform to the provisions in Section 25 of the Standard Specifications and to these Special Provisions. Class 4 aggregate subbase shall be clean and free from organic matter and other deleterious substances. The percentage composition by weight of Class 4 aggregate subbase shall conform to the following grading as determined by California Test Method No. 202.

Gradation Requirement (Percent Passing)

Sieve Sizes	Operating Range	Contract Compliance
2-1/2"	100	100
No. 4	30 – 65	25 – 70
No. 200	0 – 15	0 – 18

Class 4 aggregate subbase shall also conform to the quality requirements given on the following table:

Quality requirements

California Test Method	Operating Range	Contract Compliance
Sand Equivalent (217)	21 Min.	18 Min.
Resistance (R-value) (301)	50	50 Min.

14. INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions.

No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around

this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our findings and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing.

This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Y. David Wang, Ph.D., P.E., 52911
Senior Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-13
GEOTECHNICAL
STATE OF CALIFORNIA

S:/ONGOING PROJECTS/2006/206148.10

REFERENCES

1. California Department of Transportation, May 2006, Standard Plans, 284p.

2. California Department of Transportation, May 2006, Standard Specifications, Sections 1 through 95.

3. California Department of Transportation, Highway Design Manual, July 2008.

4. Geologic Map of Spreckles 7.5 Minute Quadrangle; Monterey County, CA (Joseph C. Clark, Earl E. Brabb, and Lewis I. Rosenberg 1997).

5. Mualchin, L., A Technical Report To Accompany the Caltrans California Seismic Hazard Map (1996).

6. Mualchin, L., 1996, The Caltrans California Seismic Hazard Map.

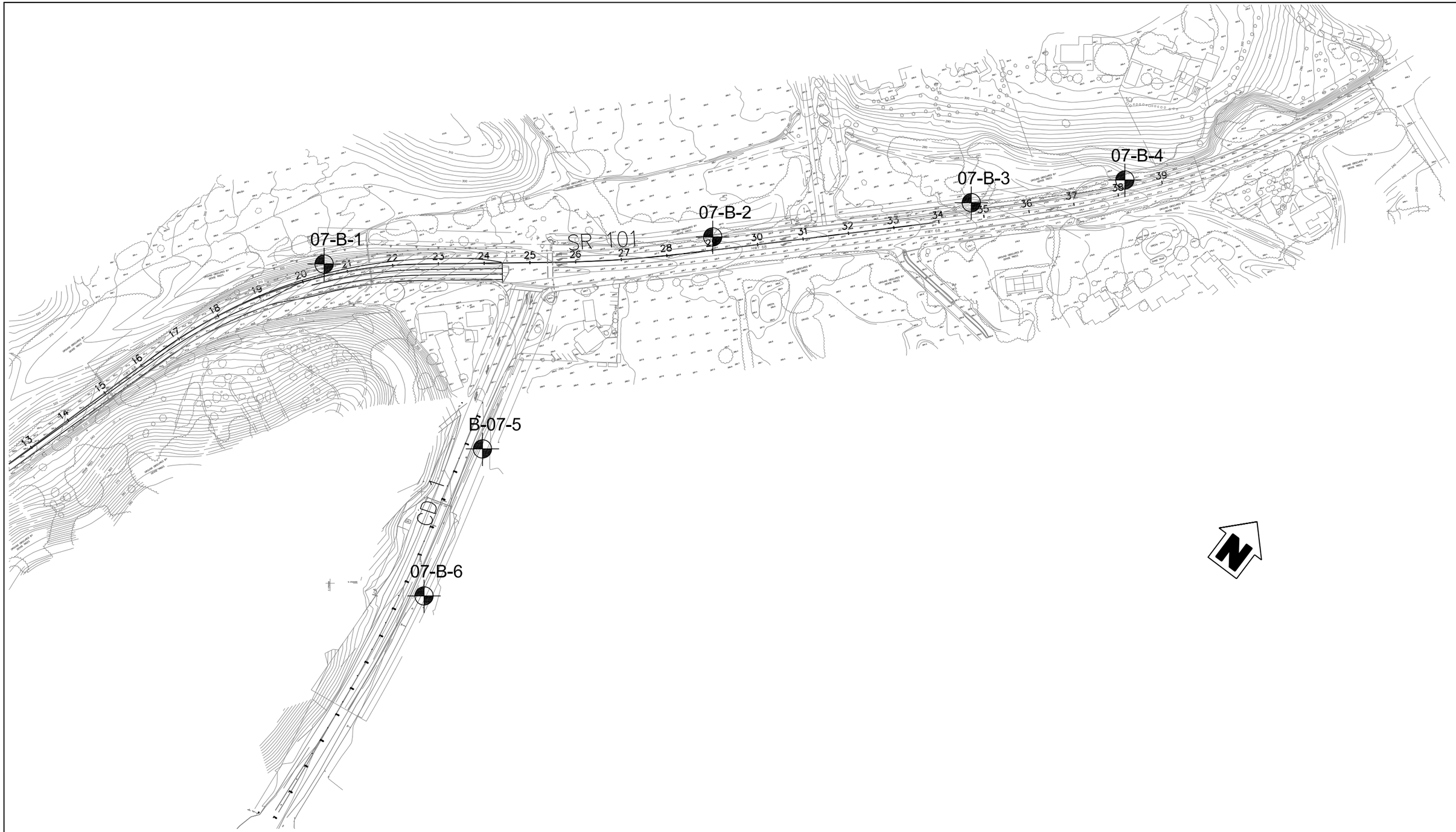
7. Sadigh, K., Chang, C.Y., Egan, J.A., Makdisi, and Youngs, R.R., 1997, "Attenuation Relationships for Shallow Crustal Earthquakes Based on California Strong Motion Data", Seismological Research Letters, Volume 68, No. 1, January/February 1997.

PROJECT LOCATION

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

SR-68 / CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
MONTEREY COUNTY, CALIFORNIA

JOB NO.: 206148.10	**PLATE NO.: 1**



SITE PLAN

LEGEND

07-B-1

Approx. Boring Location

0 1 2

PLAN

1" = 100'

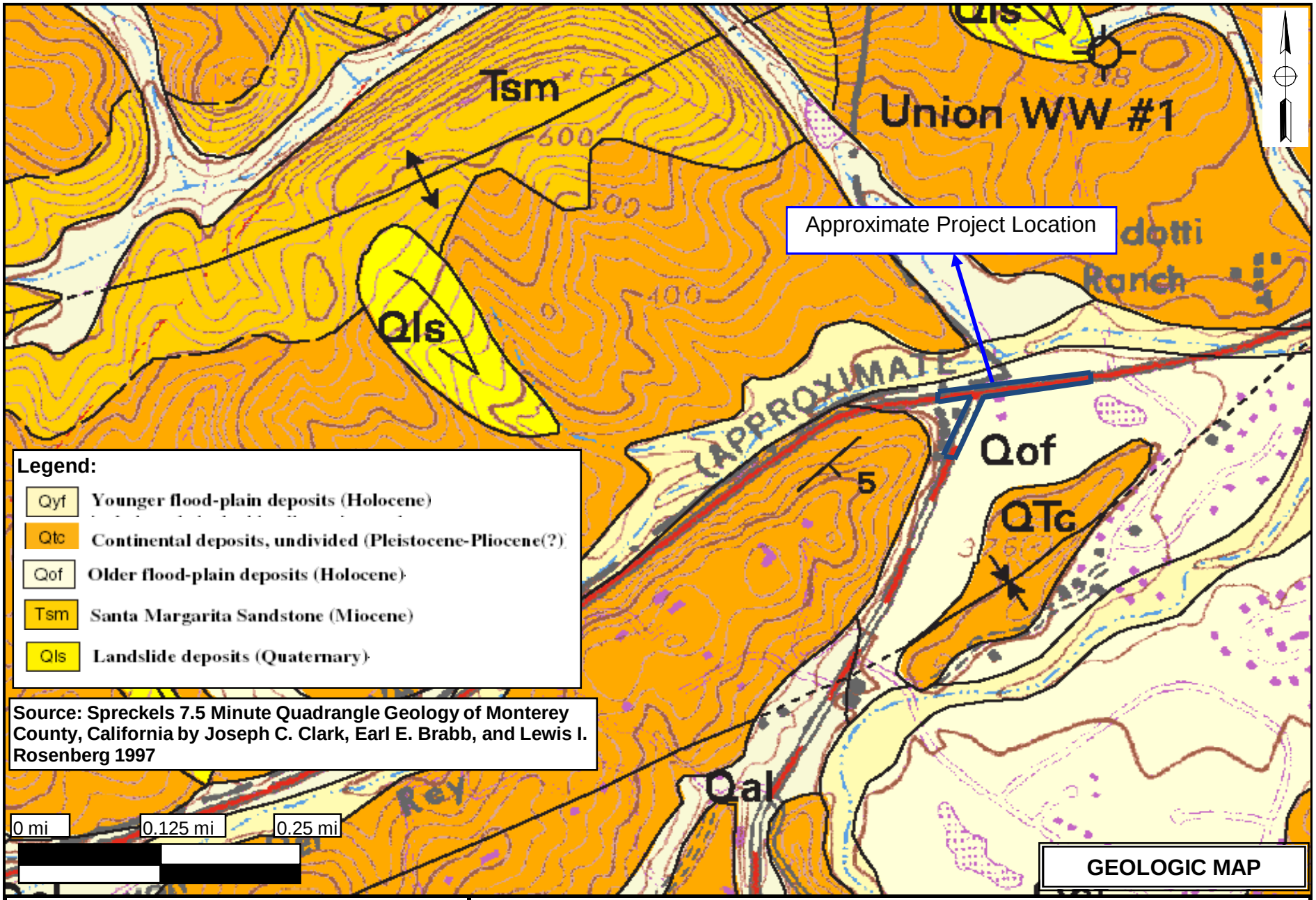
Note: All units are in feet unless otherwise specified
Reference Map was provided by Wood Rodgers Inc.

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

SR-68/CORRAL DE TIERRA ROAD
MONTEREY COUNTY, CALIFORNIA

JOB NO.:206148.10

PLATE NO: 2



Legend:

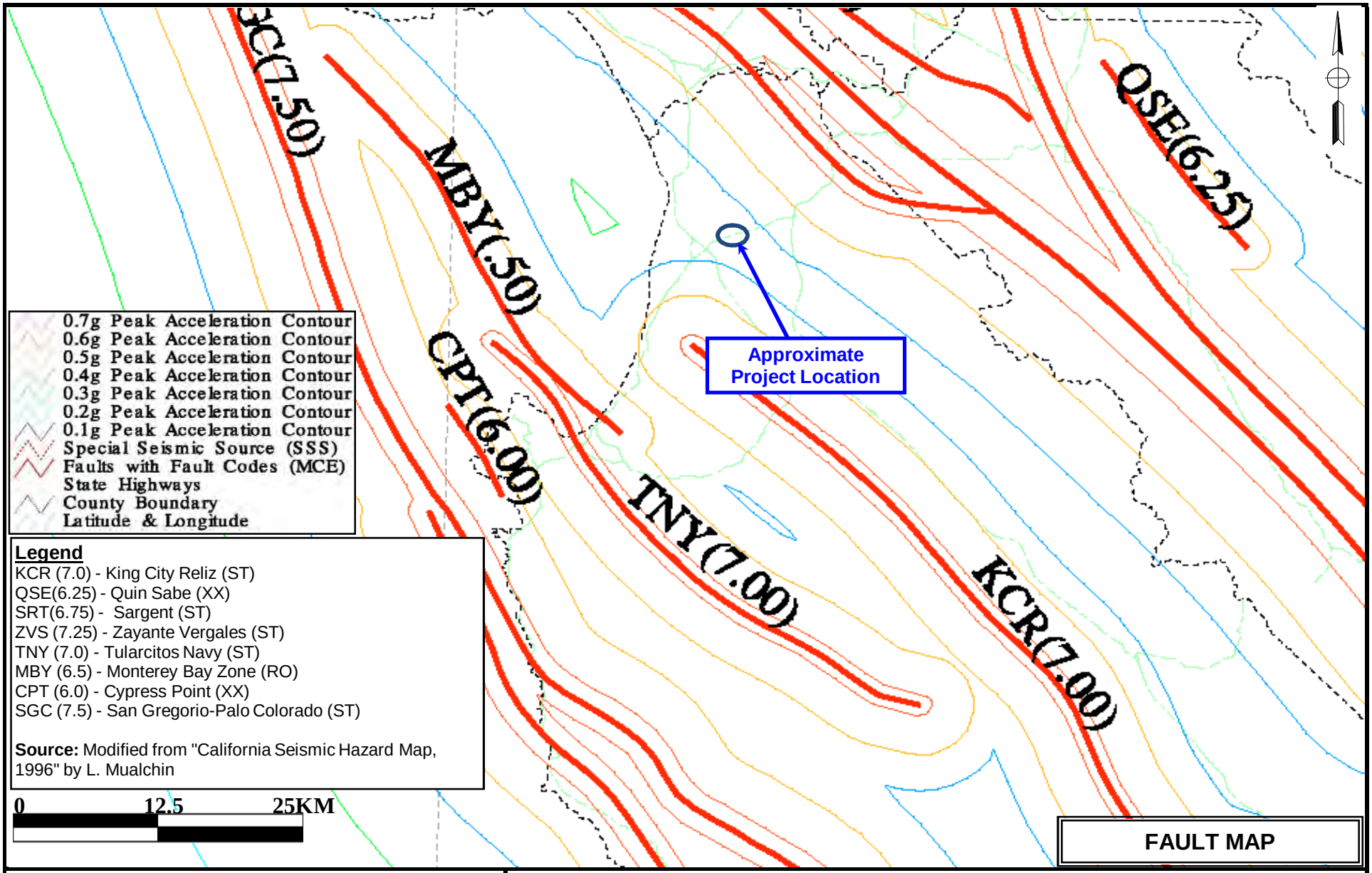
Qyf	Younger flood-plain deposits (Holocene)
Qtc	Continental deposits, undivided (Pleistocene-Pliocene(?)
Qof	Older flood-plain deposits (Holocene)
Tsm	Santa Margarita Sandstone (Miocene)
Qls	Landslide deposits (Quaternary)

Source: Spreckels 7.5 Minute Quadrangle Geology of Monterey County, California by Joseph C. Clark, Earl E. Brabb, and Lewis I. Rosenberg 1997

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
MONTEREY COUNTY, CALIFORNIA

JOB NO.: 206148.10	**PLATE NO.: 3**



PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
MONTEREY COUNTY, CALIFORNIA

JOB NO.: 206148.10	PLATE NO.: 4

Attenuation Relationships for Shallow Crustal Earthquakes (Sadigh, et al, 1997)

Fault = Zayante Vergales (ST) - Strike Slip

Mw = 7.25 **Rrup = 9.5** **km**

M>=6.5 *ROCK SITE:*

C1 = -1.274 C2 = 1.1 C3 = 0 C4 = -2.1

C5 = -0.48451 C6 = 0.524 C7 = 0

A=C1+C2M+C3(8.5M)^2.5= 6.701

B=C4*Ln(Rrup+exp(C5+C6M))= -7.583

C=C7*Ln(Rrup+2)= 0

Ln(y) = A+B+C = -0.882

y = Exp(Ln(y)) = 0.41 **Peak Bed Rock Acceleration (PBA = 0.41g)**

Fault = King City Reliz (ST) -Strike-Slip

Mw = 7 **Rrup = 10.5** **km**

A= 6.426

B= -7.444

C= 0

Ln(y) = -1.018

y = 0.36 **Peak Bed Rock Acceleration PBA = 0.36g**

Fault = Monterey Bay Zone (RO) - Reverse-Oblique

Mw = 6.5 **Rrup = 20** **km**

A= 5.876

B= -7.670

C= 0

Ln(y) = -1.794

y = 0.17 **Peak Bed Rock Acceleration PBA = 0.17*1.2 = 0.20g**

APPENDIX A

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	MON	SR 68	12.8 TO 13.2		

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER GARY PARIKH No. G.E. 666 Exp. 12/31/13 GEOTECHNICAL STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CA 95131

WOOD RODGERS, INC.
3301 C STREET, BLDG 100-B
SACRAMENTO, 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.

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content-% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166) Unconfined Compression-Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)
- (VS) Vane Shear (AASHTO T 223)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 inches)
Very loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

PARTICLE SIZE

Description		Size
Boulder		> 12"
Cobble		3" to 12"
Gravel	Coarse	3/4" to 3"
	Fine	No. 4 to 3/4"
Sand	Coarse	No. 10 to No. 4
	Medium	No. 40 to No. 10
	Fine	No. 200 to No. 40

CEMENTATION

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

CONSISTENCY OF COHESIVE SOILS

Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 to 1.0	0.50 to 1.0	0.25 to 0.50	Penetrated several inches by thumb with moderate effort
Stiff	1 to 2	1 to 2	0.50 to 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2 to 4	2 to 4	1.0 to 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

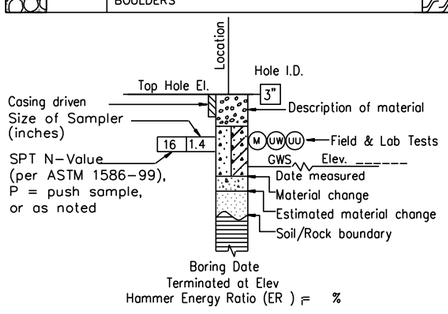
PLASTICITY OF FINE-GRAINED SOILS

Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

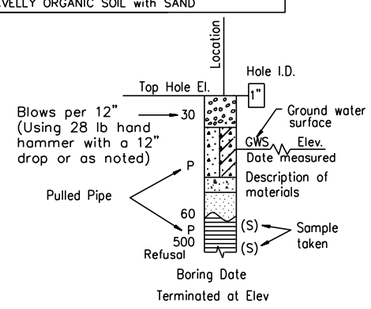
BOREHOLE IDENTIFICATION

Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
□	O	Other

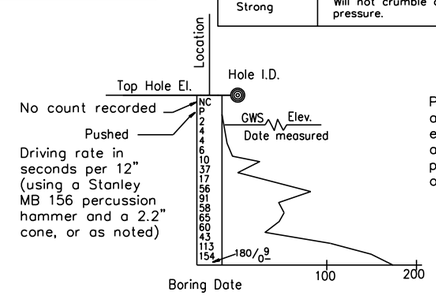
Note: Size in inches.



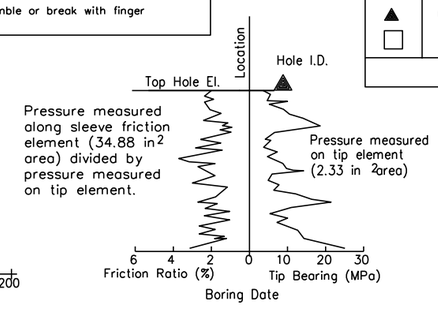
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES
PREPARED BY	L. Duddu
CHECKED BY	D. WANG

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. ---
POST MILE 12.8/13.2

SR-68/CORRAL DE TIERRA ROAD
SOIL LEGEND

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU -------
EA --------
FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET | OF

USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
05	MON	SR 68	12.8 TO 13.2	____	_____

REGISTERED ENGINEER-GEOTECHNICAL

PLANS APPROVAL DATE

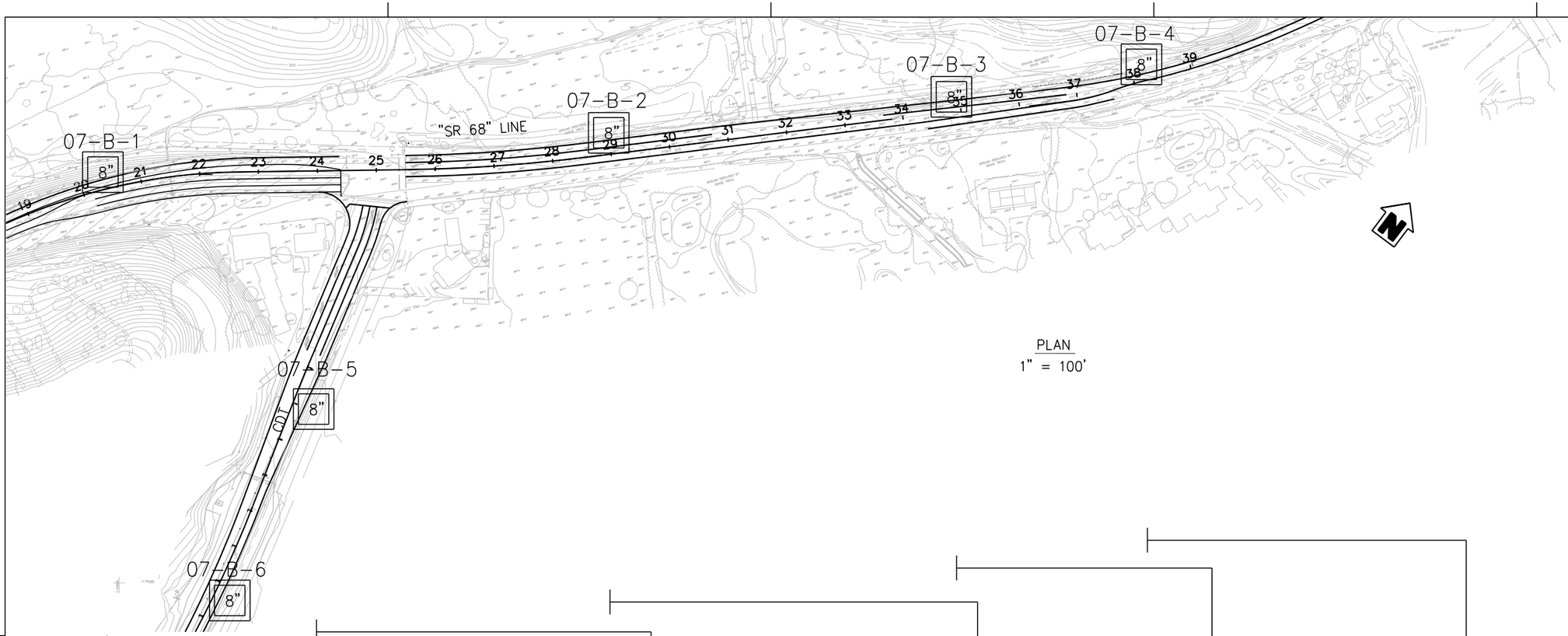
REGISTERED PROFESSIONAL ENGINEER
GARY PARIKH
No. G.E. 666
Exp. 12/31/13
GEOTECHNICAL
STATE OF CALIFORNIA

PARIKH CONSULTANTS, INC.
2360 QUME DRIVE, SUITE A
SAN JOSE, CALIFORNIA 95131

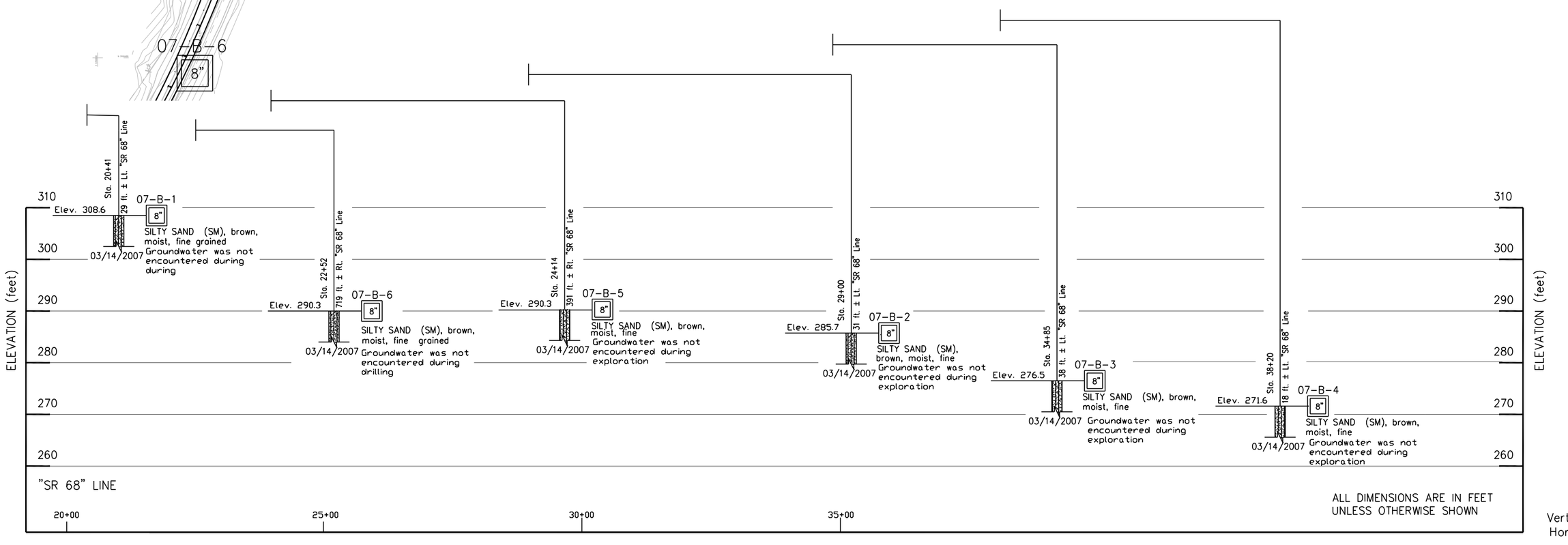
WOOD RODGERS, INC.
3301 C STREET, BLDG 100-B
SACRAMENTO, CALIFORNIA

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



PLAN
1" = 100'



ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SHOWN

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 100'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-68/CORRAL DE TIERRA ROAD
FUNCTIONAL SUPERVISOR	DRAWN BY: L. Duddu	FIELD INVESTIGATION BY:		DESIGN BRANCH	POST MILES 12.8/13.2	LOG OF TEST BORINGS
NAME: Gary Parikh	CHECKED BY: David Wang	G. Tripathi				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU _____
EA _____

DISREGARD PRINTS BEARING EARLIER REVISION DATES → 06/08/07 07/21/09

REVISION DATES | SHEET ___ | OF ___

FILE => $REQUEST

July 21, 2009 - 9:59am S:\VCAD\206148.10\LOTB (072109).dwg

lduddu

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented in "Log of Test Borings", Appendix A.

R-value Tests

R-value tests were performed on representative bulk samples for pavement design. The tests were performed according to California Test Method 301. The test results are presented on Plates B-2A, B-2B and B-2C.

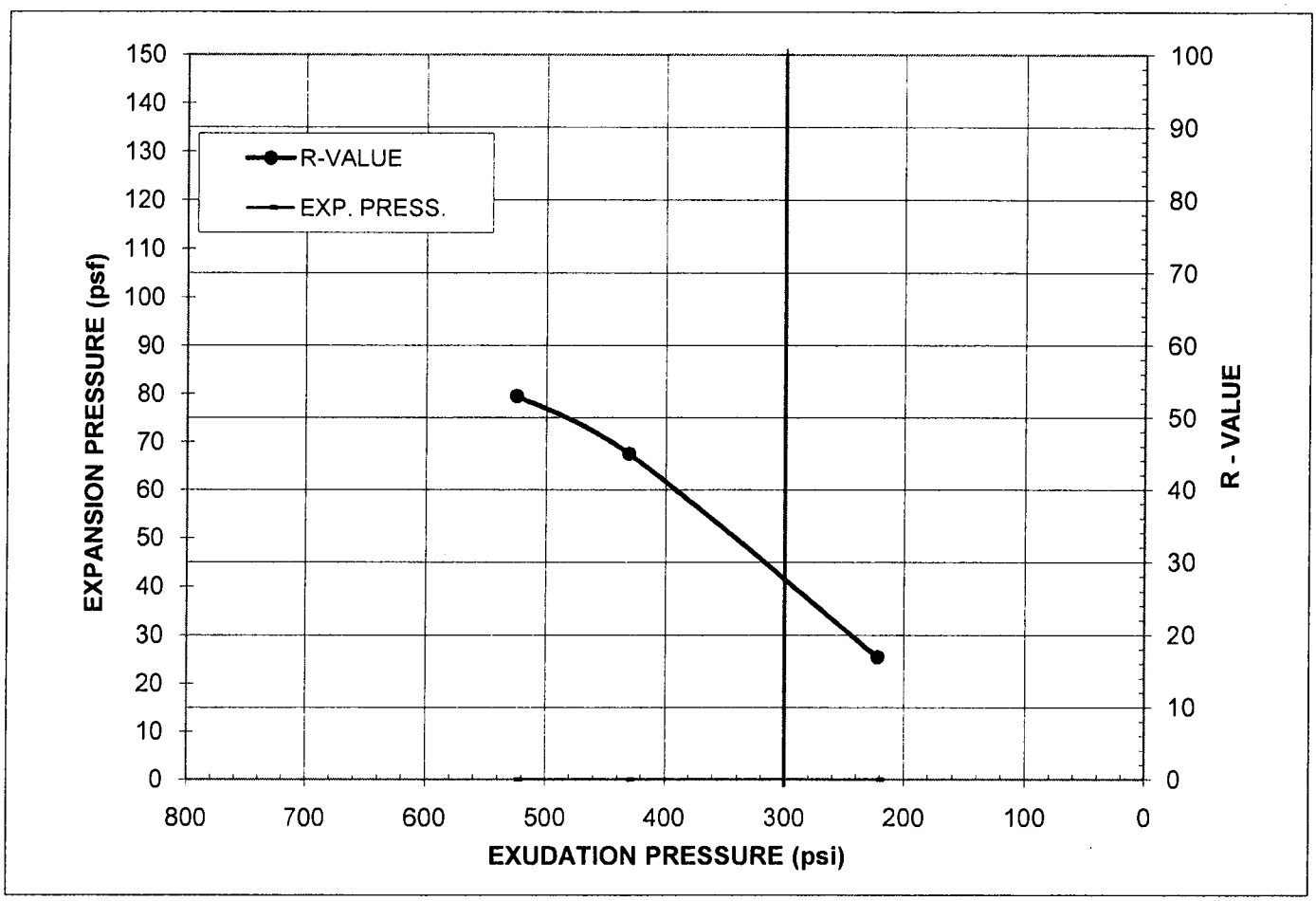
Corrosion Tests

Corrosion tests were performed on a selected sample to determine the corrosion potential of the soils. The pH and minimum resistively tests were performed according to California Test Method 643. The tests were performed by Sunland Analytical. The test results are presented on Plates B-3A and B-3B.

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 945-1011

Project Name:	SR 68 / Corral De Tierra Intersection Improvements	Date:	3/20/07
Client:	Wood Rodgers	Project #:	206148.10
Sample #: B2	Depth: 0' - 5'	Lab #:	M613
Location / Source:	Hiway 68 / Salinas	Sample Date:	
Material :	Silty sand with clay lumps, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	222	431	525
Expansion Pressure, psf	0	0	0
R-Value	17	45	53
Moisture Content at Test, %	13.8	13.4	12.9
Dry Density at Test, pcf	114.8	115.3	116.9

R-Value @ 300 psi Exudation Pressure = 28

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

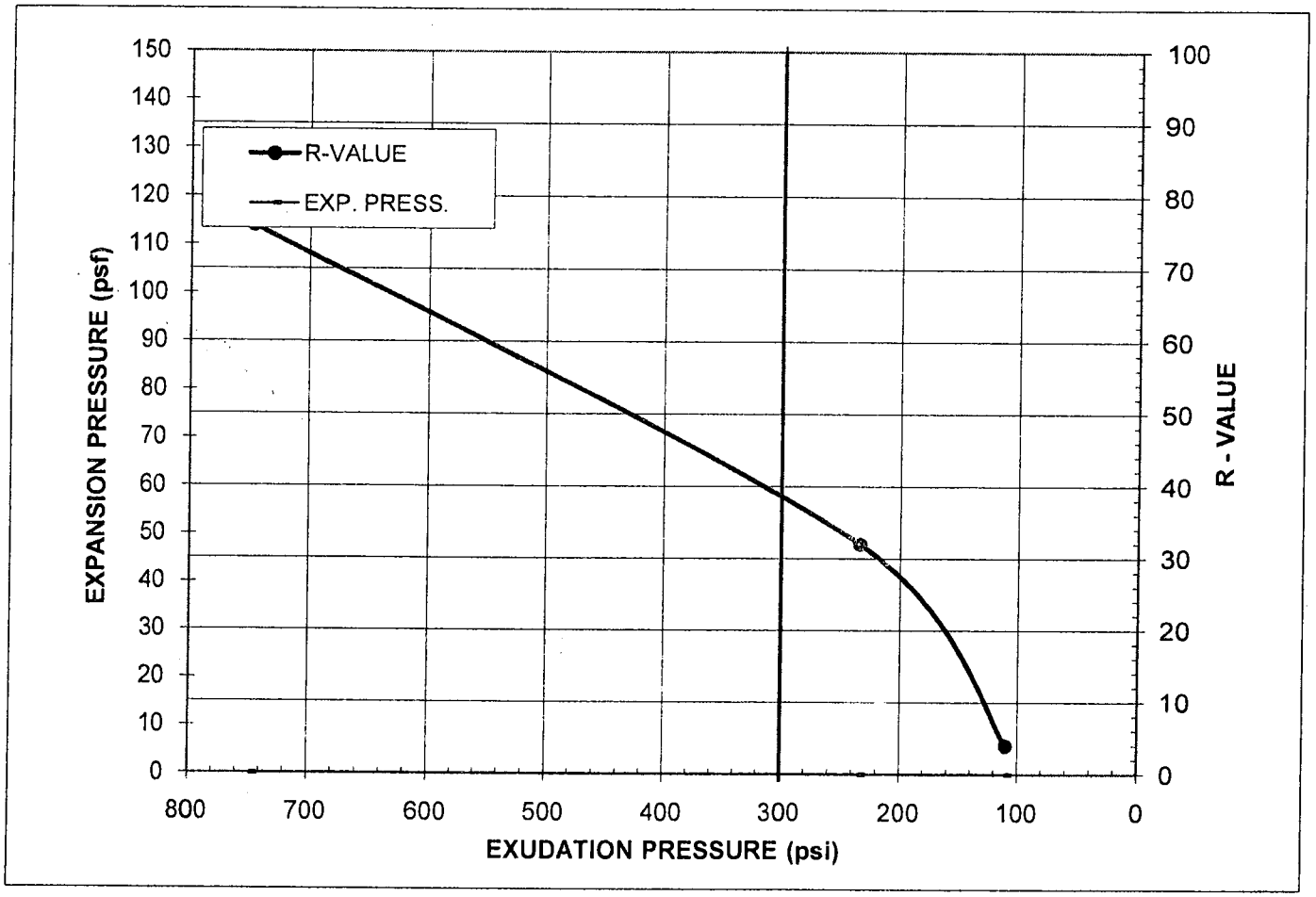
RVALUE with calcs pdp

PLATE NO: B-2A

R-VALUE REPORT

Parikh Consultants, Inc. ASTM D2844 or CTM 301 (408) 945-1011

Project Name:	SR 68 / Corral De Tierra Intersection Improvements	Date:	3/21/07
Client:	Wood Rodgers	Project #:	206148.10
Sample #: B4	Depth: 0' - 5'	Lab #:	M613
Location / Source:	Hiway 68 / Salinas	Sample Date:	
Material :	Silty sand with gravel and some clay lumps, brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	110	234	747
Expansion Pressure, psf	0	0	0
R-Value	4	32	76
Moisture Content at Test, %	14.1	12.2	10.8
Dry Density at Test, pcf	114.5	118.2	120.0

R-Value @ 300 psi Exudation Pressure = **38**

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

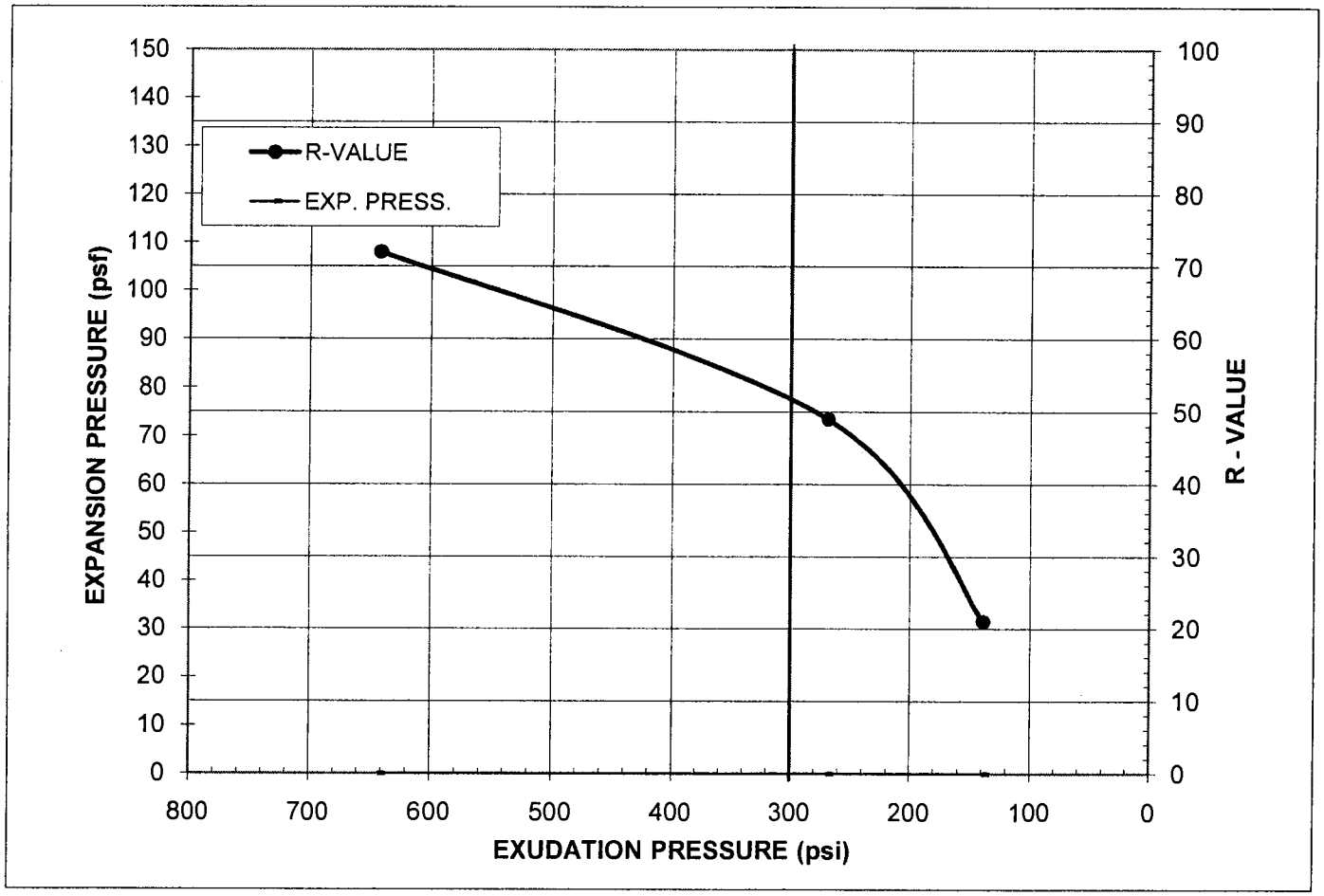
RVALUE with calcs pdp

PLATE NO: B-2B

R-VALUE REPORT

Parikh Consultants, Inc. **ASTM D2844 or CTM 301** (408) 945-1011

Project Name:	SR 68 / Corral De Tierra Intersection Improvements	Date:	3/20/07
Client:	Wood Rodgers	Project #:	206148.10
Sample #: B6	Depth: 0' - 5'	Lab #:	M613
Location / Source:	Hiway 68 / Salinas	Sample Date:	
Material :	Silty sand with gravel, dark grayish brown	Sampled By:	



Specimen No.	A	B	C
Exudation Pressure, psi	139	269	642
Expansion Pressure, psf	0	0	0
R-Value	21	49	72
Moisture Content at Test, %	12.8	11.9	11.0
Dry Density at Test, pcf	117.0	119.5	121.4

R-Value @ 300 psi Exudation Pressure = 52

Expansion Pressure @300 psi Exudation, psf = **0**

Minimum R-Value Requirement:

Comments:

Report By: Prav Dayah

RVALUE with calcs pdp

PLATE NO: B-2C

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/04/2007
Date Submitted 03/30/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206148.10/SR68 Site ID : B3 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 50187-99965.

EVALUATION FOR SOIL CORROSION

Soil pH	7.71		
Minimum Resistivity	6.70	ohm-cm (x1000)	
Chloride	5.9 ppm	00.00059	%
Sulfate	12.5 ppm	00.00125	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO: B-3A

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/04/2007
Date Submitted 03/30/2007

To: Prav Dayah
Parikh Consultants, Inc.
356 S. Milpitas Blvd.
Milpitas, Ca 95035

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 206148.10/SR68 Site ID : B6 @ 0-5'.
Thank you for your business.

* For future reference to this analysis please use SUN # 50187-99966.

EVALUATION FOR SOIL CORROSION

Soil pH	7.05	
Minimum Resistivity	9.65 ohm-cm (x1000)	
Chloride	4.5 ppm	00.00045 %
Sulfate	0.2 ppm	00.00002 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

PLATE NO: B-3B

APPENDIX C

PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

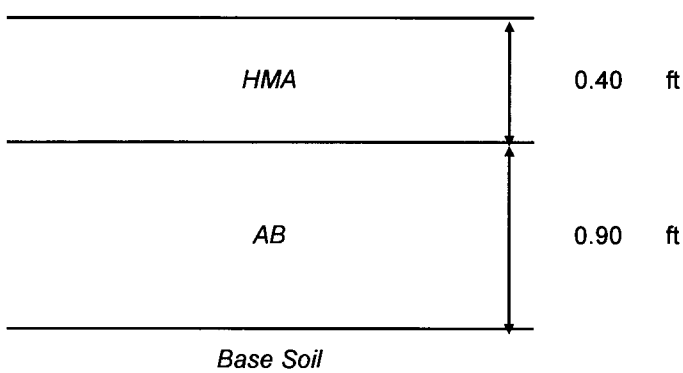
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***7.5***	input	
R_{BS}=	***25***	input	
R_{AB}=	78		
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		1.80	
$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$		0.53	
=>	GE'_{HMA} =	0.73	(add 0.2 ft safety factor)
	AC Thickness =	0.35	ft
=>	AC Thickness =	**0.40**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ HMA}$ =	2.07	
	GE_{HMA} =	0.83	
$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$		0.97	
	AB thickness=	0.88	ft
=>	AB Thickness=	**0.90**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	0.99	$G_{f,\ AB}$=1.1

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***7.5***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 1.80

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.53

=> GE'_{HMA} = 0.73 (add 0.2 ft safety factor)

AC thickness = 0.35 ft

=> HMA Thickness= **0.40** ft (round up to the nearest 0.05 ft)

$G_{f,\,HMA}$= 2.07

GE_{HMA}= 0.83

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.20

=> GE_{HMA+AB}= 1.40 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.57

=> AB thickness= 0.52

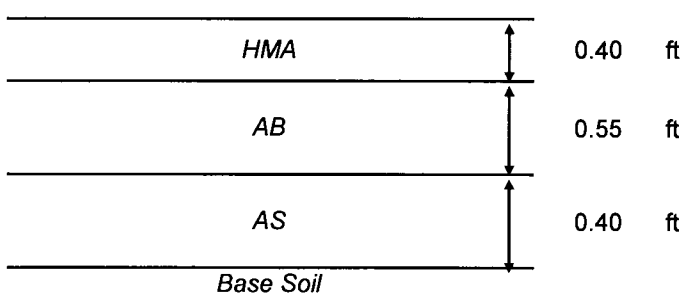
=> AB Thickness= **0.55** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.61 $G_{f,\,AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.37

=> AS Thickness= **0.40** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

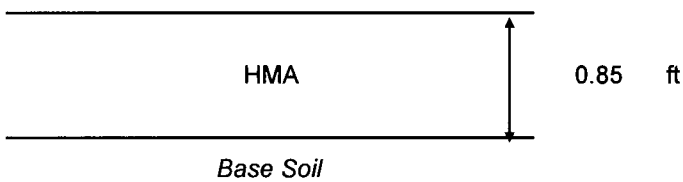
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***7.5***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		1.80	
=>	GE'_{HMA}=	1.90	(add 0.1 ft safety factor)
=>	HMA Thickness=	0.80	
=>	HMA Thickness=	**0.85**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***8***	input	
R_{BS}=	***25***	input	
R_{AB}=	78		

$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$ 1.92

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.56

=> GE'_{HMA} = 0.76 (add 0.2 ft safety factor)

AC Thickness = 0.38 ft

=> AC Thickness = **0.40** ft (round up to the nearest 0.05 ft)

$G_{f,\,HMA}$ = 2.00

GE_{HMA} = 0.80

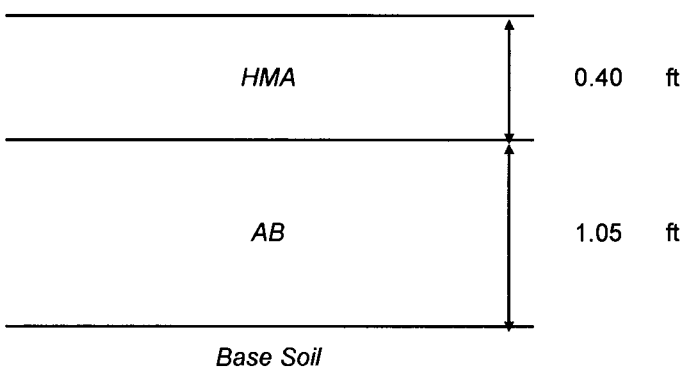
$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 1.12

AB thickness= 1.02 ft

=> AB Thickness= **1.05** ft (round up to the nearest 0.05 ft)

GE_{AB}= 1.16 $G_{f,\,AB}$=1.1

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***8***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 1.92

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.56

=> GE'_{HMA} = 0.76 (add 0.2 ft safety factor)

AC thickness = 0.38 ft

=> HMA Thickness= **0.40** ft (round up to the nearest 0.05 ft)

$G_{f,\ HMA}$= 2.00

GE_{HMA}= 0.80

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.28

=> GE_{HMA+AB}= 1.48 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.68

=> AB thickness= 0.62

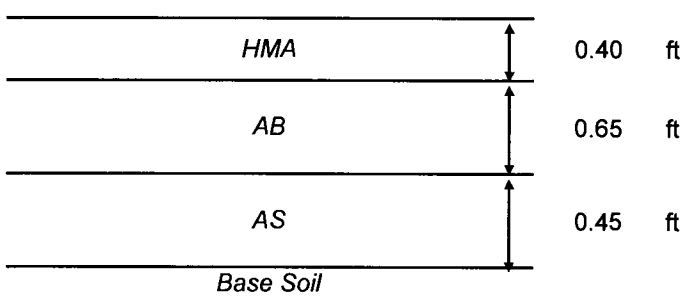
=> AB Thickness= **0.65** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.72 $G_{f,\ AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.40

=> AS Thickness= **0.45** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

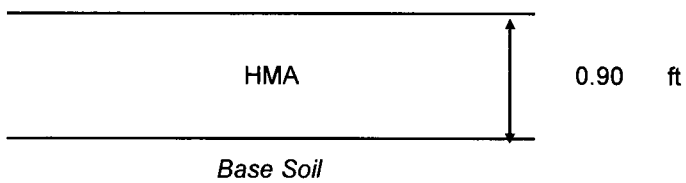
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***8***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		1.92	
=>	GE'_{HMA}=	2.02	(add 0.1 ft safety factor)
=>	HMA Thickness=	0.86	
=>	HMA Thickness=	**0.90**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

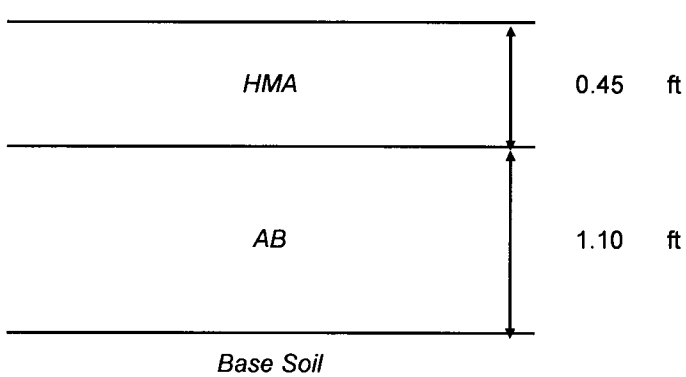
PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***8.5***	input	
R_{BS}=	***25***	input	
R_{AB}=	78		
$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		2.04	
$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$		0.60	
=>	GE'_{HMA} =	0.80	(add 0.2 ft safety factor)
	AC Thickness =	0.41	ft
=>	AC Thickness =	**0.45**	ft (round up to the nearest 0.05 ft)
	$G_{f, HMA}$ =	1.94	
	GE_{HMA} =	0.88	
$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$		1.16	
	AB thickness=	1.06	ft
=>	AB Thickness=	**1.10**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.21	$G_{f, AB}$=1.1

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***8.5***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.04

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.60

=> GE'_{HMA} = 0.80 (add 0.2 ft safety factor)

AC thickness = 0.41 ft

=> HMA Thickness= **0.45** ft (round up to the nearest 0.05 ft)

$G_{f,\,HMA}$= 1.94

GE_{HMA}= 0.88

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.36

=> GE_{HMA+AB}= 1.56 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.68

=> AB thickness= 0.62

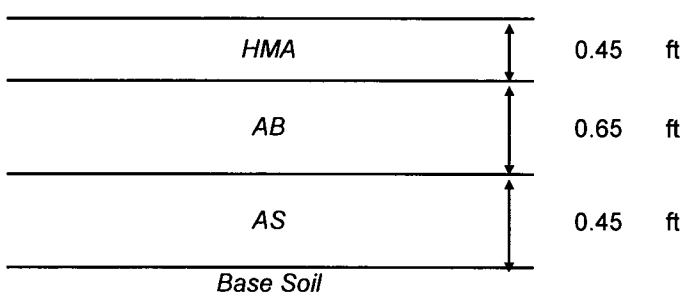
=> AB Thickness= **0.65** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.72 $G_{f,\,AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.45

=> AS Thickness= **0.45** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (CORRAL DE TIERRA ROAD)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

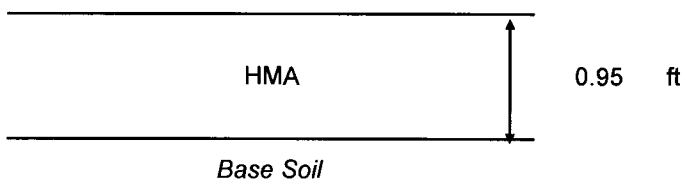
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***8.5***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		2.04	
=>	GE'_{HMA}=	2.14	(add 0.1 ft safety factor)
=>	HMA Thickness=	0.92	
=>	HMA Thickness=	**0.95**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

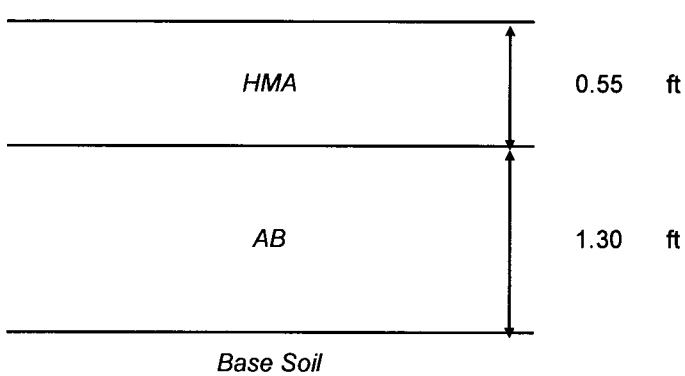
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***10***	input
R_{BS}=	***25***	input
R_{AB}=	78	

$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$		2.40	
$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$		0.70	
=>	GE'_{HMA} =	0.90	(add 0.2 ft safety factor)
	AC Thickness =	0.51	ft
=>	AC Thickness =	**0.55**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ HMA}$ =	1.81	
	GE_{HMA} =	1.00	
$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$		1.40	
	AB thickness=	1.27	ft
=>	AB Thickness=	**1.30**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.43	$G_{f,\ AB}$=1.1

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***10***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.40

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.70

=> GE'_{HMA} = 0.90 (add 0.2 ft safety factor)

AC thickness = 0.51 ft

=> HMA Thickness= **0.55** ft (round up to the nearest 0.05 ft)

$G_{f,\ HMA}$= 1.81

GE_{HMA}= 1.00

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.60

=> GE_{HMA+AB}= 1.80 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.80

=> AB thickness= 0.73

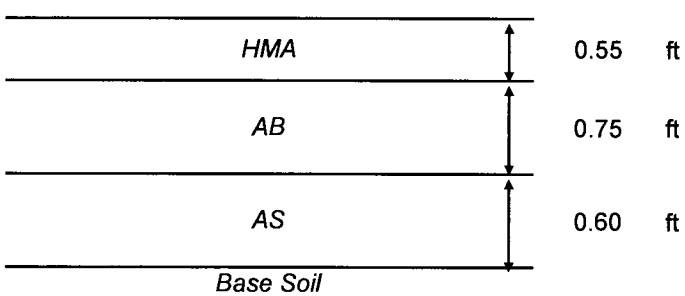
=> AB Thickness= **0.75** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.83 $G_{f,\ AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.58

=> AS Thickness= **0.60** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

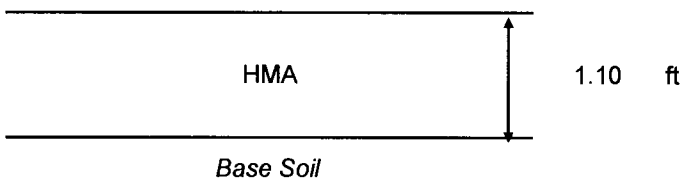
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***10***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		2.40	
=>	GE'_{HMA}=	2.50	(add 0.1 ft safety factor)
=>	HMA Thickness=	1.10	
=>	HMA Thickness=	**1.10**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***10.5***	input
R_{BS}=	***25***	input
R_{AB}=	78	

$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$ 2.52

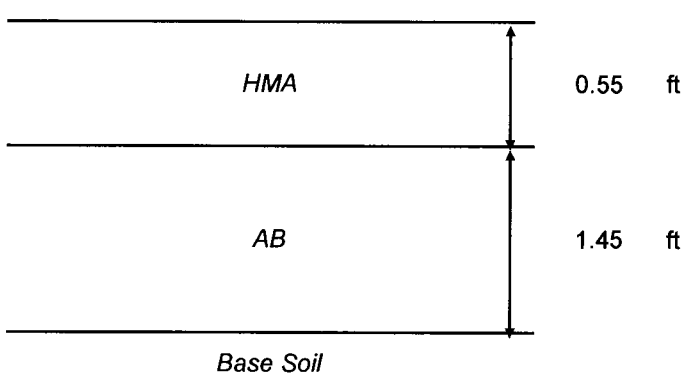
$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.74

=>	GE'_{HMA} =	0.94	(add 0.2 ft safety factor)
	AC Thickness =	0.54	ft
=>	AC Thickness =	**0.55**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ HMA}$ =	1.77	
	GE_{HMA} =	0.97	

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 1.55

	AB thickness=	1.41	ft
=>	AB Thickness=	**1.45**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.60	$G_{f,\ AB}$=1.1

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***10.5***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.52

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.74

=> GE'_{HMA} = 0.94 (add 0.2 ft safety factor)

AC thickness = 0.54 ft

=> HMA Thickness= **0.55** ft (round up to the nearest 0.05 ft)

$G_{f,\ HMA}$= 1.77

GE_{HMA}= 0.97

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.68

=> GE_{HMA+AB}= 1.88 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.91

=> AB thickness= 0.82

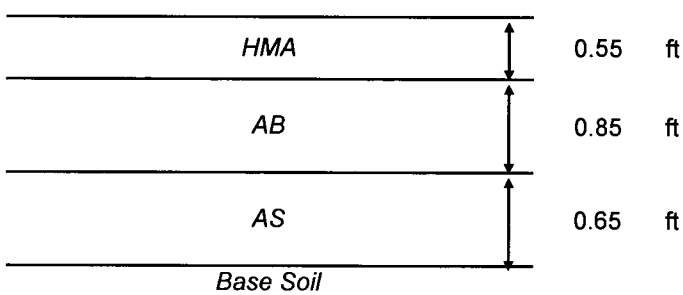
=> AB Thickness= **0.85** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.94 $G_{f,\ AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.61

=> AS Thickness= **0.65** ft (round up to the nearest 0.05 ft)

Design Section:



0.55 ft

0.85 ft

0.65 ft

PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

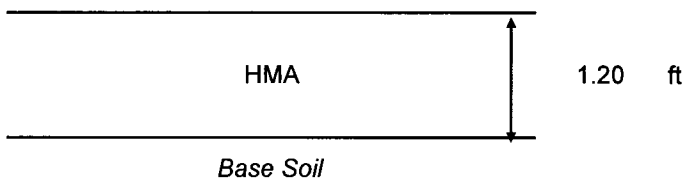
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***10.5***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		2.52	
=>	GE'_{HMA}=	2.62	(add 0.1 ft safety factor)
=>	HMA Thickness=	1.16	
=>	HMA Thickness=	**1.20**	ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 206148.10

Design Case: AC over AB

Design TI=	***11***	input
R_{BS}=	***25***	input
R_{AB}=	78	

$GE_{AC+AB} = 0.0032*TI*(100-R_{BS}) =$ 2.64

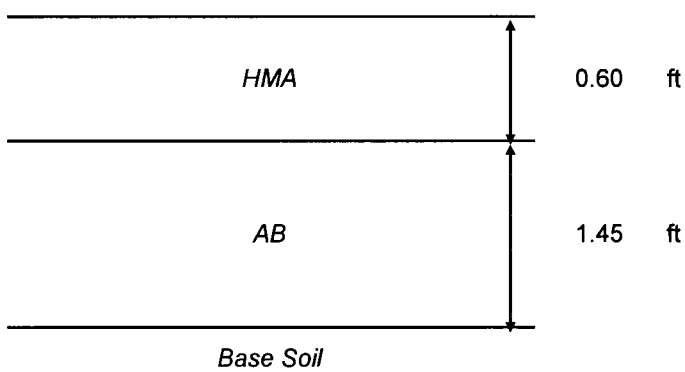
$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.77

=>	GE'_{HMA} =	0.97	(add 0.2 ft safety factor)
	AC Thickness =	0.56	ft
=>	AC Thickness =	**0.60**	ft (round up to the nearest 0.05 ft)
	$G_{f,\ HMA}$ =	1.78	
	GE_{HMA} =	1.07	

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 1.57

	AB thickness=	1.43	ft
=>	AB Thickness=	**1.45**	ft (round up to the nearest 0.05 ft)
	GE_{AB}=	1.60	$G_{f,\ AB}$=1.1

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: AC over AB over AS

Design TI=	***11***	input
R_{BS}=	***25***	input
R_{AB}=	78	
R_{AS}=	50	check

$GE_{TOTAL} = 0..0032*TI*(100-R_{BS}) =$ 2.64

$GE_{HMA} = 0.0032*TI*(100-R_{AB}) =$ 0.77

=> GE'_{HMA}= 0.97 (add 0.2 ft safety factor)

AC thickness = 0.56 ft

=> HMA Thickness= **0.60** ft (round up to the nearest 0.05 ft)

$G_{f,\,HMA}$= 1.78

GE_{HMA}= 1.07

$GE_{AB+HMA} = 0.0032*TI*(100-R_{AS}) =$ 1.76

=> GE_{HMA+AB}= 1.96 (add 0.2 ft safety factor)

$GE_{AB} = GE_{HMA+AB} - GE_{HMA} =$ 0.89

=> AB thickness= 0.81

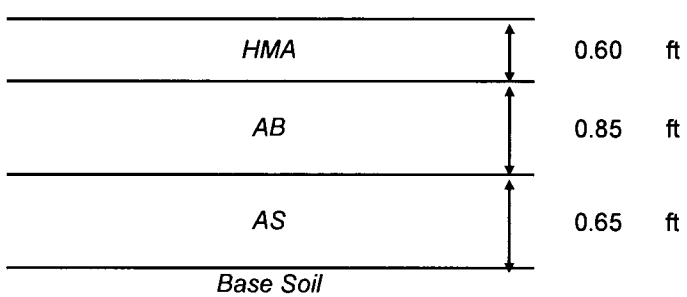
=> AB Thickness= **0.85** ft (round up to the nearest 0.05 ft)

GE_{AB}= 0.94 $G_{f,\,AB}$=1.1

$GE_{AS} = GE_{TOTAL} - GE_{AB} - GE_{HMA} =$ 0.64

=> AS Thickness= **0.65** ft (round up to the nearest 0.05 ft)

Design Section:



PAVEMENT DESIGN (SR-68)

PER HIGHWAY DESIGN MANUAL, CHAP. 600

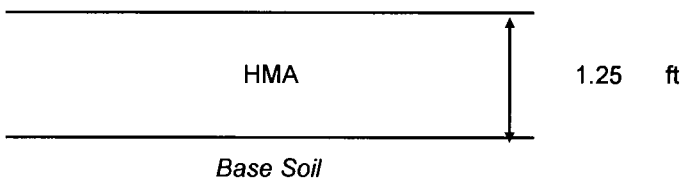
PROJECT NAME: SR-68/CORRAL DE TIERRA ROAD INTERSECTION IMPROVEMENT PROJECT
PROJECT NO.: 207132.10

Design Case: Full depth AC

Design TI=	***11***	input
R_{BS}=	***25***	input

$GE_{HMA} = 0.0032*TI*(100-R_{BS}) =$		2.64	
=>	GE'_{HMA}=	2.74	(add 0.1 ft safety factor)
=>	HMA Thickness=	1.22	
=>	HMA Thickness=	**1.25**	ft (round up to the nearest 0.05 ft)

Design Section:



APPENDIX D

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...206148-SR 68/Corral

PROJECT ACCOUNT NO.206148.10

SAMPLE LOCATION....B 3 @ 0-5'

TEST SAMPLE NO.....

OPERATOR.....Ganga

TEST DATE.....04-05-07

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.7 , WATER pH = 0.0 , SOIL pH = 7.7

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 6700 , WATER = 0 , SOIL = 6700

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& mm	GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	54	62	69	79	104
16	1.6	70	78	85	95	120
14	2.0	87	95	102	112	137
12	2.8	119	127	134	144	169
10	3.5	152	160	167	177	202
8	4.3	185	193	200	210	235

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.

MAINTENANCE-FREE SERVICE DESIGN ESTIMATES FOR DRAINAGE FACILITIES USING:
CALIFORNIA CULVERT CRITERIA AND CULVERT4.EXE, (RELEASE DATE 04-16-98)

PROJECT LOCATION...206148-SR 68/Corral

PROJECT ACCOUNT NO.206148.10

SAMPLE LOCATION....B 6 @ 0-5'

TEST SAMPLE NO.....

OPERATOR.....Ganga

TEST DATE.....04-05-07

********** A DATA VALUE OF ZERO INDICATES NO DATA INPUT **********

CSP SITE pH = 7.1 , WATER pH = 0.0 , SOIL pH = 7.1

MINIMUM RESISTIVITY, OHM-CM: CSP SITE = 9650 , WATER = 0 , SOIL = 9650

****

ESTIMATED SERVICE LIFE OF CSP CULVERTS, YEARS
SEE CALTRANS HIGHWAY DESIGN MANUAL CHAPTER 850

CSP THICK Gage	& mm	GALV. 57 g	GALV.+ BIT COAT. (WATER SIDE)	GALV.+ BIT COAT & PAVED INV. (ABRASION)	GALV.+ BIT COAT (SOIL SIDE)	GALV.+ POLYMER 90 DEG INVERT
18	1.3	31	39	46	56	81
16	1.6	41	49	56	66	91
14	2.0	50	58	65	75	100
12	2.8	69	77	84	94	119
10	3.5	88	96	103	113	138
8	4.3	107	115	122	132	157

FLOW VEL. <1.5 m/s WITH NON-ABRASIVE CONDITIONS, (DEFAULT VALUES)
CAP, 18 GAGE (1.3 mm) CSP AND CASP MAY BE USED WITH THESE FLOW VELOCITIES

STANDARD REINFORCED CONCRETE PIPE DESIGN SHOULD BE
SUITABLE FOR THIS USER DEFINED LEVEL OF CHLORIDES

CONCRETE AND RCP MITIGATION MEASURES FOR pH
TYPE IP (MS) MODIFIED CEMENT OR TYPE II MODIFIED CEMENT
MINIMUM REQUIRED BY CALTRANS STD. SPECS. 90-1.01

A CORRUGATED ALUMINUM PIPE, CAP, MAY BE USED
IF ABRASIVE CONDITIONS DO NOT EXIST
SITE CONDITIONS MEET CORROSION REQUIREMENTS

A CORRUGATED ALUMINIZED STEEL PIPE, CASP, MAY BE USED
SITE CONDITIONS MEET CORROSION REQUIREMENTS

PLASTIC PIPE IS APPROVED FOR 50 YEARS SERVICE LIFE FOR
CORROSIVE CONDITIONS. ABRASION MUST BE EVALUATED. ALSO,
CONSIDER CONCRETE HEADWALLS AND CONCRETE OR METAL END
TREATMENT WHERE HIGH FIRE POTENTIAL EXISTS.