A Report Prepared for:

Boyle Engineering
1501 Quail Street
Newport Beach, CA 92660

PRELIMINARY MATERIALS REPORT
GROVE AVENUE CORRIDOR PROJECT
PROJECT NO. ST0302
ONTARIO, CALIFORNIA

Project No. 2008-007

by

for V.R.Nadeswaran

Jorge Sandoval
Civil Engineer C69876

V.R.Nadeswaran

V. R. Nadeswaran
Geotechnical Engineer 2390

REGISTERED PROFESSIONAL ENGINEER
V.R. NADESWARAN
No. GE002390
Exp. 9/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

Diaz•Yourman & Associates
1616 East 17th Street
Santa Ana, CA 92705-8509
(714) 245-2920

November 5, 2008

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This report presents the results of the preliminary geotechnical investigation performed by Diaz•Yourman & Associates (DYA) for the proposed widening of Grove Avenue for the Grove Avenue Corridor Project (Project) in Ontario, California.

The proposed Project is located in Ontario as shown on the Vicinity Map, Figure 1. Currently, Grove Avenue from Interstate (I)-10 to Holt Boulevard is a four-lane arterial and is divided by a striped median; the only access from Grove Avenue to the I-10 is the offset I-10 at the Fourth Street interchange. The existing Grove Avenue structure at I-10 is an undercrossing. Grove Avenue narrows at the I-10 undercrossing due to constraints from existing bridge abutments. The Project consists of preparing a Project Study Report (PSR) considering the following primary improvements:

- Construction of a new interchange on I-10 at Grove Avenue.
- Reconfigure/reconstruct the existing I-10 at the Fourth Street interchange.
- Widen Grove Avenue from four lanes to six lanes between I-10 and Holt Boulevard.
- Improve Fourth Street between Grove Avenue and I-10.

A preliminary geotechnical report was prepared by DYA to address the proposed bridge structures (DYA, 2008). This report provides preliminary pavement thickness recommendations for the proposed widening of Grove Avenue and improvement of Fourth Street between Grove Avenue and I-10.

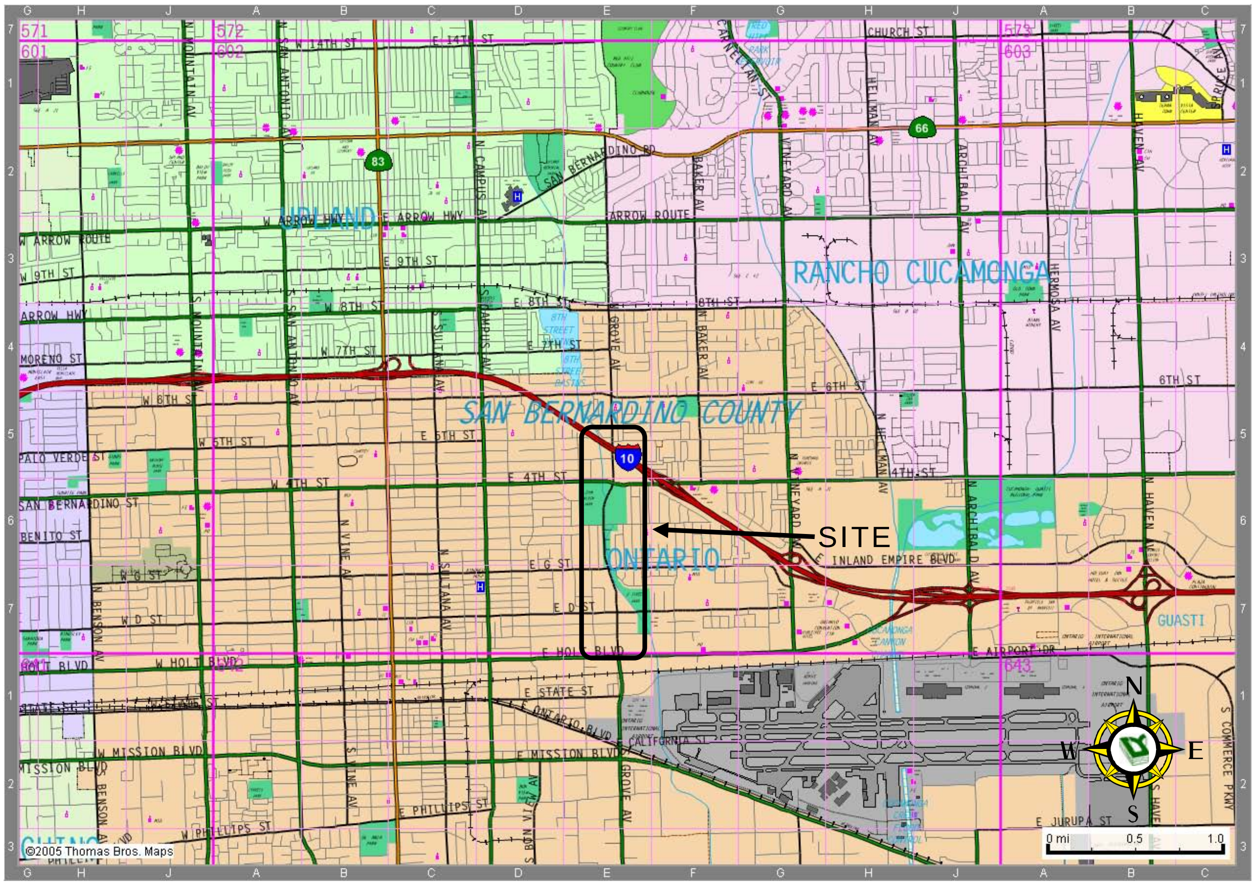


Figure 1 - VICINITY MAP

The purpose of DYA's investigation was to provide geotechnical input for the design of the proposed pavement widening. The scope of our services consisted of the following tasks:

- Reviewing data.
- Conducting a preliminary field investigation.
- Performing laboratory tests on selected soil samples.
- Performing preliminary engineering analyses to develop preliminary conclusions and recommendations regarding the following:
  - Site preparation and grading
  - Pavement thickness design
  - Corrosion potential
- Preparing this report.

2.0 EXISTING FACILITIES AND PROPOSED IMPROVEMENTS

2.1 EXISTING FACILITIES

Grove Avenue had four asphalt concrete (AC)-paved lanes and a striped median within the Project reach. Fourth Street generally had four AC-paved lanes with a striped median except underneath the bridge where there were only three lanes. The ground surface within the Project reach was generally level with a mild slope in a southeasterly direction.

In addition to the two bridge structures (I-10 at Grove Avenue and I-10 at Fourth Street), the concrete-lined West Cucamonga Channel is present in the Project vicinity west of Grove Avenue north of Fourth Street and east of Grove Avenue south of Fourth Street.

2.2 PROPOSED IMPROVEMENTS

The proposed Project will widen Grove Avenue from four lanes to six lanes within the Project reach. Widening is planned on both sides of the existing Grove Avenue. Proposed improvements along Fourth Street are not defined at this time.

3.0 PERTINENT REPORTS AND INVESTIGATION

Geotechnical data at the two undercrossings presented in previous logs of test borings (LOTB) were reviewed to supplement site data collected during this investigation. Pavement as-built data for Grove Avenue or Fourth Street were not available. A list of the documents reviewed is presented in the bibliography, Section 11.

4.0 PHYSICAL SETTING

4.1 CLIMATE

The range of average climatic conditions for the site area is shown in Table 1.

Table 1 - AVERAGE CLIMATIC CONDITIONS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (°F)	66.8	69.4	70.1	74.5	79.9	86.7	95.0	94.4	91.3	83.0	73.6	68.3	79.4
Average Min Temperature (°F).	44.0	45.0	46.3	48.4	52.6	56.6	62.2	62.9	61.3	55.4	48.5	44.4	52.3
Average Total Precipitation (mm)	3.65	2.85	2.80	1.13	0.26	0.04	0.01	0.11	0.34	0.34	1.72	2.07	15.3

Notes:
- Climatic conditions for reporting station at Fontana Kaiser (Station 043120), located approximately 8 miles from the site and obtained from Western Regional Climate Center.
- Period of Record – 3/1/1951 to 8/31/1984.

4.2 TOPOGRAPHY AND DRAINAGE

Grove Avenue had four AC-paved lanes and a striped median within the Project reach. Fourth Street generally had four AC-paved lanes with a striped median except underneath the bridge where there were only three lanes. Grove Avenue sloped mildly to the south within the Project reach, with elevations estimated to range from 980 feet to 1,080 feet above mean sea level (MSL). Fourth Street was generally level with a mild slope to the southeast, with the surface elevations ranging from approximately 1,070 feet to 1,060 feet MSL. The concrete-lined West Cucamonga Channel is present within the Project vicinity west of Grove Avenue north of Fourth Street and east of Grove Avenue south of Fourth Street.

4.3 GEOLOGY AND SEISMICITY

The Project site is underlain by fills and alluvial units. Three surface geologic units are mapped by Morton and Miller (2006, Sheet 3 of 4) in the area around the bridge abutments and along Grove Avenue south to Holt Boulevard. The bridge abutments are underlain with the older of the three "young" alluvial fan units designated as Qyf1. This early Holocene-late Pleistocene unit is typically a gravelly (pebbly) sand that is slightly to moderately consolidated and indistinctly stratified. Qyf1 and the two younger alluvial fan units, Qyf3 and Qyf5, underlie Grove Avenue with the late Holocene Qyf5 forming an alluvial channel deposit (consisting of unconsolidated to slightly consolidated coarse-sand to possible boulder-rich deposits), which alternately underlies, and lies to the east of, Grove Avenue. From north of D Street south to Holt Boulevard, Grove Avenue is underlain by Qyf3, a middle Holocene slightly to moderately consolidated silt, sand, and gravelly sand deposit. These deposits have their sources some 5 to 6 miles to the north at the San Gabriel Mountain front at Cucamonga Canyon.

No mapped surface faults are reported through the Project area. The site is not located within an Alquist-Priolo Earthquake fault zone.

The site is located within a seismically active region. The closest known active or potentially active fault is the Red Hills (Etiwanda Avenue) fault located approximately 1.5 miles from the Project site. The Red Hills (Etiwanda Avenue) fault can generate a maximum credible earthquake (MCE) of 7.0. The site can be subject to peak bedrock acceleration (PBA) of up to 0.7g during the design MCE event.

4.4 SOIL SURVEY MAPPING

Soil survey mapping was not performed by DYA for this Project.

5.0 EXPLORATION

5.1 DRILLING AND SAMPLES

The field exploration, conducted on April 8, 2008, consisted of drilling six soil borings at the locations shown on the Site Plan, Figure 2. The boring locations were chosen to provide areal coverage of the Project site for pavement thickness design. The borings were drilled to a depth 6.5 feet and extended to the depth of significant influence of the proposed pavement loads. Details of the field investigation, including sampling procedures and boring logs, are presented in Appendix A.

5.2 GEOLOGIC MAPPING

Geologic mapping was not performed by DYA for this Project.

5.3 GEOPHYSICAL STUDIES

Geophysical studies were not performed by DYA for this Project.

5.4 INSTRUMENTATION

Instruments were not installed during the field exploration by DYA.

5.5 EXPLORATION NOTES

No unusual conditions were observed or noted during the field investigation.

Legend

DYA Boring Location

Figure 2 - SITE PLAN

6.0 GEOTECHNICAL TESTING

6.1 INSITU TESTING

Insitu testing consisted of standard penetration tests (SPT) in the borings as discussed in Appendix A

6.2 LABORATORY TESTING

Soil samples collected from the borings were re-examined in the laboratory to substantiate field classifications. Selected soil samples were tested for moisture content, dry density, grain-size distribution, percent passing the No. 200 sieve, Atterberg limits, compaction characteristics, pavement-supporting capacity, and corrosion potential (pH, electrical resistivity, soluble chlorides, and soluble sulfates). The soil samples tested are identified on the boring logs.

Laboratory test data are summarized on the boring logs in Appendix A and presented on individual test reports in Appendix B.

7.0 GEOTECHNICAL CONDITIONS

7.1 SITE GEOLOGY

The site is composed of fills underlain by alluvial soils. See Section 4.3 for a brief discussion on the alluvial soils.

7.2 SUBSURFACE CONDITIONS

The soil borings within Grove Avenue encountered 7.5 to 9 inches of AC underlain by 2 to 7 inches of aggregate base. The subsurface soils encountered in the borings were sands with varying amounts of silts and gravel. The soils were generally medium dense with occasional very dense consistency. The insitu dry densities and moisture content of the soil samples tested ranged from 90 to 120 pounds per cubic foot (pcf) and 2 to 9 percent, respectively. Laboratory soil compaction tests on soils indicated that the maximum dry density and optimum moisture conditions ranged from 120 to 126 pcf and 5.5 to 8 percent, respectively. Based on the laboratory test results, the relative compaction[1] of the subgrade soils ranged from 75 to 100 percent with the majority of the tests indicating a value of approximately 90 percent. The subsurface soils had moisture contents near or below laboratory optimum moisture content. The subsurface soils had excellent pavement supporting characteristics indicated by laboratory R-values ranging from 68 to 71.

7.3 GROUNDWATER

Groundwater was not encountered in our borings during the field investigation at a depth of approximately 6.5 feet below the ground surface (bgs). Groundwater was not detected to depths of 60 feet bgs in previous borings in the Project vicinity.

7.4 EARTHWORK, CUTS AND EXCAVATIONS

Earthwork should be performed in accordance with Section 19 of Caltrans Standard Specifications (Caltrans, 2006b). Generic guidelines for earthwork are also provided in Sections 7.4.1 and 7.4.2.

---

[1] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the American Society for Testing Materials (ASTM) D1557-91 test method. Optimum moisture content is the moisture content corresponding to the maximum dry density, as determined by the ASTM D1557-91 test method.

7.4.1 Earthwork

Prior to the start of construction, all utilities should be located in the field and rerouted, removed, abandoned, or protected. Unpaved areas to be graded and paved areas should initially be stripped of all vegetation and debris, and the material removed from the site. The areas should be excavated to the planned subgrade elevation. In areas where fill is required to achieve subgrade elevations, the stripped area should be:

- Scarified to a depth of 8 inches.
- Moisture-conditioned to above-optimum moisture content.
- Compacted to at least 90 percent relative compaction.

Fill and backfill should be compacted by:

- Placing in loose layers less than 8 inches thick.
- Moisture-conditioning to above-optimum moisture content.
- Compacting to at least 95 percent relative compaction.

The basement soil (soils below 1 foot) of the pavement section (AC and base) and aggregate base (AB) should be compacted to at least 95 percent relative compaction. Generally, the basement soils may be compacted in-place to achieve the desired compaction. As insitu moisture contents were generally less than the optimum moisture content, significant water will be required for proper moisture conditioning.

If any unanticipated, unsuitable subgrade soils that preclude compaction are encountered, they should be overexcavated to a sufficient depth such that a firm and unyielding surface is achieved at the planned bottom of the excavation. Overexcavation limits, if required, are best and most accurately determined in the field after the subgrade is exposed and proofrolled.

Import materials for fill should meet the criteria in Table 2.

Table 2 - IMPORT FILL CRITERIA

CRITERIA	IMPORT FILL
Maximum particle size (inches)	3
Maximum liquid limit (%)	30
Maximum plasticity index (%)	15
Maximum percentage passing the #200 sieve (%)	30
R-value	50
Minimum sand equivalent	20

7.4.2 Grading Factors

Based on the existing average insitu dry densities and a relative compaction of 95 percent for fill and backfill, we estimate that the shrinkage from cut to fill for the existing onsite soils will be approximately 5 to 10 percent (e.g., 1 cubic foot [cu.ft] of existing soil will be replaced with 0.9 to 0.95 cu.ft of fill). This estimate does not include any material loss during earthwork activities.

7.4.3 Rippability

The site grading may be accomplished using conventional heavy-duty excavation equipment. Blasting is not required for earthwork.

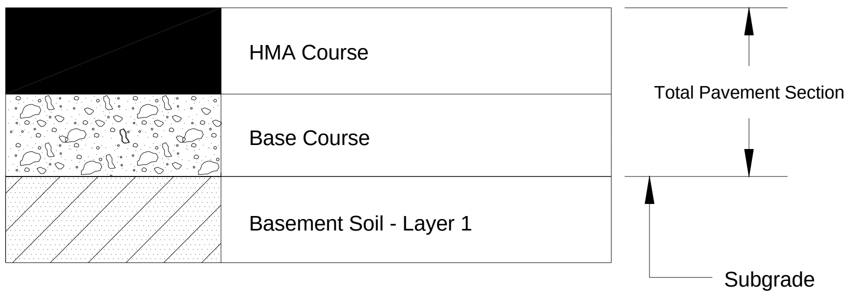
7.4.3 Dewatering

Dewatering is not anticipated because the depth to groundwater is greater than 60 feet bgs.

7.5 PAVEMENT THICKNESS DESIGN

Preliminary minimum hot mix asphalt (HMA) pavement sections are presented on Figure 3. Additional field and laboratory investigation will be required for final design of pavement. The preliminary minimum pavement sections are based on the following:

- R-value 50 for site soils.
- Caltrans design method.
- Traffic indices (TI) of 12 for Grove Avenue and 10 for Fourth Street.



COURSE	MINIMUM THICKNESS (feet)			
	Hot Mix Asphalt Over Base		**Full Depth Hot Mix Asphalt**	
	TI[1]=12	**TI=10**	**TI=12**	**TI=10**
HMA[2]	0.65	0.5	1.0	0.8
Base[3]	0.7	0.65	--	--
Subgrade Layer 1[4]	1	1	1	1

Notes:
1. TI = Traffic index. For Grove Avenue TI=12, Fourth Street TI =10.
2. Hot Mix Asphalt (HMA) should satisfy the requirements of Caltrans Standard Specifications Section 39.
3. Base course = Crushed aggregate base or crushed miscellaneous base, in accordance with Caltrans Standard Specifications Section 26. The minimum relative compaction is 95 percent.
4. Compacted in-place natural soil or fill; the minimum is 95 percent relative.

Figure 3 - PAVEMENT THICKNESS

Requirements and specifications for AB are outlined on Figure 3. The basement soil (subgrade) and AB should be compacted to at least 95 percent relative compaction as shown on Figure 3. If the basement soil cannot be compacted to at least 95 percent relative compaction, the subgrade should be overexcavated as recommended in Section 7.4.1.

The actual basement soil should be tested for its R-value after rough grading to check the pavement-supporting capacity of the exposed subgrade soils.

7.6 SOIL CORROSION POTENTIAL

Corrosion test results are presented in Appendix B and the range of test results is summarized in Table 3. Also presented in Table 3 are Caltrans (2003) corrosion criteria. Based on Caltrans correlations, a corrosive environment was not present to concrete substructures (Caltrans, 2003).

Table 3 - CORROSION POTENTIAL

	CALTRANS CRITERIA FOR CORROSIVE MATERIALS	RANGE OF VALUES
Water pH	<5.5	7.1 to 7.5
Water Soluble sulfate content (ppm)	>2,000	5 to 8
Water Soluble chloride content (ppm)	>500	61 to 65
Minimum Electrical resistivity (ohm-cm)	<1,000	4,000 to 5,500

8.0 MATERIAL SOURCES

The identification and location of potential material sources was outside the scope of our work. The proposed roadway widening will require only minor cuts and fills. However, import fill should satisfy the criteria in Section 7.4.1. AB should satisfy criteria specified in Section 7.5.

9.0 MATERIAL DISPOSAL

Based on our investigation, there were no obvious signs of hydrocarbon contamination. The soils may, however, contain aerially deposited lead (ADL). Testing for ADL, permitting, handling, and disposal of material was outside DYA's scope of work.

10.0 LIMITATIONS

This report has been prepared for this Project in accordance with generally accepted geotechnical engineering practices common to the local area. No other warranty, expressed or implied, is made.

The analyses and recommendations contained in this report are based on the literature review, field investigation, and laboratory testing conducted in the area. The results of the field investigation indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. Although subsurface conditions have been explored as part of the investigation, we have not conducted chemical laboratory testing on samples obtained or evaluated the site with respect to the presence or potential presence of contaminated soil or groundwater conditions.

The validity of our recommendations is based in part on assumptions about the stratigraphy. Observations during construction can help confirm such assumptions. If subsurface conditions different from those described are noted during construction, recommendations in this report must be re-evaluated. DYA should be retained to observe earthwork construction in order to help confirm that our assumptions and recommendations are valid or to modify them accordingly. In accordance with California Building Code (CBC) Chapter 17 Section 1704, DYA cannot assume responsibility or liability for the adequacy of recommendations if we do not observe construction.

This report is intended for use only for the project described. In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by DYA. We are not responsible for any claims, damages, or liability associated with the interpretation of subsurface data or reuse of the subsurface data or engineering analyses without our express written authorization.

11.0 BIBLIOGRAPHY

ASTM, 2006, Annual Book of Standards, Volumes 4.08 and 4.09, Soil and Rock.

Blake, T.F., 2004, Updated CGS 2002 Fault Database for EQFAULT computer program.

Bortugno, E.J., and Spittler, T.E., (Compilers), 1986, Geologic map of the San Bernardino Quadrangle: California Division of Mines and Geology, Regional Geologic Map Series, Map No. 3A, Scale 1:250,000.

Boyle Engineering, 2008, Electronic conceptual plans, I-10 at Grove Avenue and Fourth Street Interchange and Grove Avenue Corridor Project, March 2008.

California Department of Transportation, 1952, As-Built Plans, Grove Avenue Undercrossing, Drawings C-2802-1-9, May 19, 1952.

California Department of Transportation, 1970, As-Built Plans, Grove Avenue Undercrossing (Widen), Drawings 54441-1-6, April 6, 1970.

California Department of Transportation, 1970, As-Built Plans, Fourth Street Undercrossing (Widen), Drawings 54440-1 & 2, April 6, 1970.

California Department of Transportation, 1970, Log of Test Boring, Campus Street Overcrossing, Drawing 59443, April 6, 1970.

California Department of Transportation, 1970, Log of Test Boring, Sixth Street Overcrossing (replace), Drawings 59442, April 6, 1970.

California Department of Transportation, 1996, California Seismic Hazard Map.

California Department of Transportation, 2003, Corrosion Guidelines, Materials Engineering and Testing Service, Corrosion Technology Branch, September 2003.

California Department of Transportation, 2006a Standard Plans.

California Department of Transportation, 2006b, Standard Specifications.

California Department of Transportation, 2006c, Highway Design Manual, Sixth Edition.

California Department of Water Resources (CDWR), 2008, Groundwater Level Data, CDWR website – http://wdl.water.ca.gov/gw/admin/main_menu_gw.asp.

California Geological Survey, 1994a, Fault Activity Map of California and Adjacent Areas, Scale 1:750,000, Geologic Data Map No. 6.

California Geological Survey, 1994b, Fault Rupture Hazard Zones in California, Special Publication No. 42.

California Geological Survey, 2001, Alquist-Priolo Earthquake Fault Zone (APEFZ) maps, Geographic Information System (GIS) data files.

Cao, T., W.A. Bryant, B. Rowshandel, D. Branum, and C.J. Willis, 2003, the revised 2002 California Probabilistic Seismic Hazard Maps, June 2003.

Caterpillar Performance Handbook, 1998, Caterpillar, Inc., Edition 29.

Chino Basin Watermaster, 2003 and 2006, http://www.cbwm.org/rep_eng_maps.htm.

City of Fontana (Fontana), 2003, General Plan, Chapter 11 - Safety Element, adopted October 21, 2003.

Morton, D. M., and F. K. Miller, 2006, Geologic Map of the San Bernardino and Santa Ana 30' X 60' Quadrangles, USGS OFR-2006-1217, Sheet 3 of 4.

Western Regional Climate Center, 2001, Web Page, http://www.wrcc.dri.edu.

Topozone, 2008, Internet web page, www.topozone.com.

United States Geological Survey (USGS), 1981, Ontario topographic quadrangle map, scale 1:24000.

United States Geological Survey (USGS), Ground-Water Data for the Nation Website, http://waterdata.usgs.gov/nwis/gw.

APPENDIX A

FIELD INVESTIGATION

APPENDIX A - FIELD INVESTIGATION

The field investigation for the proposed project consisted of drilling six borings (B-1 through B-6) to depths of approximately 6.5 feet. The approximate boring locations are shown on Figure 2.

Borings were drilled by Layne Christensen Company on April 8, 2008, with a truck-mounted, CME-75 drill rig using hollow-stem auger drilling techniques. Our field engineer observed the drilling operations and collected drive samples for visual examination and subsequent laboratory testing. Drive samples were collected with a 2.4-inch-inside-diameter (3-inch-outside-diameter) modified California split-barrel sample lined with brass tubes and a standard split-spoon penetrometer sampler (SPT) with dimensions in accordance with ASTM 3550 and 1586, respectively. Both samplers were driven with a 140 pound hammer falling 30 inches. An automatic trip hammer was used. Blow counts were recorded for each 6-inch increment. The blows required to drive the modified California sampler were converted to equivalent standard penetration test (SPT) N-values by multiplying by 0.65 (N=0.65 x modified California blows per foot).

Soils encountered in the test borings were classified in general accordance with the ASTM Soil Classification System (ASTM D2487 and 2488), summarized on Plate A1. Boring logs presented on Plates A2 through A7 were prepared from visual examination of the samples, cuttings obtained during drilling operations, and results of laboratory tests.

Groundwater was not encountered during the field investigation. Borings were backfilled with soil cuttings.

SOIL CLASSIFICATION SYSTEM-ASTM D2487

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE-GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

"Push" Sampler

Split Barrel "Drive" Sampler With Liner

Standard Penetration Test (SPT) Sampler

Bag Sample

Concrete/Rock Core

Groundwater Surface

SPT **"N"** = 0.65 x modified California blows per foot

NP = Nonplastic
EI = Expansion Index Test
SG = Specific Gravity
SE = Sand Equivalent
UC = Unconfined Comp.
CD = Consol. Drained Triaxial.
CU = Consol. Undrained Triaxial.
UU = Undrained, Unconsol. Triaxial.
RV = R-Value
CA = Chemical Analysis
DS = Direct Shear
CN = Consolidation
CP = Collapse Potential
SA = Grain size; HD = Hydrometer
MD = Compaction Test
HC = Hydraulic Conductivity Test
[PID] Reading in ppm above background

Ontario I-10/Grove Ave Interchange
Project No. 2008-007

PLATE

A1

Template: DYLG1-2006; Prj ID: 2008-007.GPJ

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	986 MSL
LATITUDE:	34° 3' 50.8" N	**LONGITUDE:**	117° 37' 42.6" W
DRILLING EQUIPMENT:	CME-75	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	6.5
DATE STARTED:	4/8/08	**DATE COMPLETED:**	4/8/08
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
985							SILTY SAND (SM): gray, moist, medium dense, fine-grained sand, fine to coarse gravel						
				8 7 12	12			96	4	NP	NP	39	MD CA
980	5			6 9 8	17		grayish brown, fine- to coarse-grained sand, micaceous, trace fine gravel						
							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
975	10												
970	15												
965	20												
960	25												

LOG OF BORING B-1

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A2

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1003 MSL
LATITUDE:	34° 4' 0.8" N	**LONGITUDE:**	117° 37' 43.2" W
DRILLING EQUIPMENT:	CME-75	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	6.5
DATE STARTED:	4/8/08	**DATE COMPLETED:**	4/8/08
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 8 inches						
							BASE (AB): 2 inches						
1000				9 12 12	16		SILTY SAND (SM): grayish brown, slightly moist, medium dense, fine- to medium-grained sand, few fine gravel, micaceous	109	3			16	RV SA
	5			2 5 6	11		moist, fine- to coarse-grained sand						
995							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
	10												
990													
	15												
985													
	20												
980													
	25												
975													

LOG OF BORING B-2

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A3

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1017 MSL
LATITUDE:	34° 4' 9.4" N	**LONGITUDE:**	117° 37' 43.5" W
DRILLING EQUIPMENT:	CME-75	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	6.5
DATE STARTED:	4/8/08	**DATE COMPLETED:**	4/8/08
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							SILTY SAND (SM): gray, moist, medium dense, fine- to coarse-grained sand, trace coarse gravel						
1015				7 15 24	25			120	2				
	5			4 5 5	10		increased coarse grained sand						
							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
1010													
	10												
1005													
	15												
1000													
	20												
995													
	25												
990													

LOG OF BORING B-3

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A4

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1026 MSL
LATITUDE:	34° 4' 16.0" N	**LONGITUDE:**	117° 37' 45.8" W
DRILLING EQUIPMENT:	CME-75	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	6.5
DATE STARTED:	4/8/08	**DATE COMPLETED:**	4/8/08
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
1025							ASPHALT CONCRETE (AC): 7.5 inches BASE (AB): 3 inches						
				14 20 26	30		POORLY GRADED SAND with GRAVEL (SP): grayish brown, moist, medium dense, fine- to coarse-grained sand, fine gravel	115	3			4	SA MD
1020	5			32 17 10	27		POORLY GRADED SAND (SP): white, moist, medium dense, fine- to coarse-grained sand, decomposed granite						
							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
1015	10												
1010	15												
1005	20												
1000	25												

LOG OF BORING B-4

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A5

BORING LOCATION: See Figure 2		**ELEVATION AND DATUM (feet):** 1043 MSL	
LATITUDE: 34° 4' 25.6" N		**LONGITUDE:** 117° 37' 46.8" W	
DRILLING EQUIPMENT: CME-75		**DRILLING METHOD:** Hollow Stem Auger	
BORING DIAMETER (inches): 6		**BORING DEPTH (feet):** 6.5	
DATE STARTED: 4/8/08		**DATE COMPLETED:** 4/8/08	
SPT HAMMER DROP: 30 inches	**WT:** 140 lbs	**DRIVE HAMMER DROP:** 30 inches	**WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 9 inches BASE (AB): 7 inches						
1040				6 20 14	22		SILTY SAND (SM): brown, moist, medium dense, fine- to coarse-grained sand, fine gravel, trace fill material Fill (brick, plusfer, grout, welding foam fragments)	90	9	NP	NP	23	RV CA
	5			8 10 9	19		decomposed granite, no fill						
1035							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
	10												
1030													
	15												
1025													
	20												
1020													
	25												
1015													

LOG OF BORING B-5

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A6

BORING LOCATION:	See Figure 2	**ELEVATION AND DATUM (feet):**	1060 MSL
LATITUDE:	34° 4' 35.3" N	**LONGITUDE:**	117° 37' 45.7" W
DRILLING EQUIPMENT:	CME-75	**DRILLING METHOD:**	Hollow Stem Auger
BORING DIAMETER (inches):	6	**BORING DEPTH (feet):**	6.5
DATE STARTED:	4/8/08	**DATE COMPLETED:**	4/8/08
SPT HAMMER DROP:	30 inches **WT:** 140 lbs	**DRIVE HAMMER DROP:**	30 inches **WT:** 140 lbs
LOGGED BY: JS	**CHECKED BY:** SS	**DRIVE SAMPLER DIAMETER (inches)**	**ID:** 2.4 **OD:** 3

Elevation (feet)	Depth (feet)	Sampler	Symbol	Blows per 6 Inches	SPT N Blows per Foot	Field Unc. Comp. Str. (tsf)	DESCRIPTION	Dry Density (pcf)	Moisture Content (%)	Liquid Limit (%)	Plasticity Index (%)	Percent Passing #200 Sieve	Other Tests [PID]
							ASPHALT CONCRETE (AC): 7.5 inches BASE (AB): 6 inches						
				24 11 27	25		SILTY SAND with GRAVEL (SM): grayish brown, moist, medium dense, fine- to coarse-grained sand, fine to coarse gravel	115	9			14	
1055	5			21 23 31	54		SILTY SAND (SM): light olive brown, moist, very dense, fine- to coarse-grained sand, coarse gravel						
							Bottom of boring at 6.5 feet. Groundwater not encountered during drilling. Boring backfilled with cuttings.						
1050	10												
1045	15												
1040	20												
1035	25												

LOG OF BORING B-6

Page 1 of 1

Ontario I-10/Grove Ave Interchange

Project No. 2008-007

PLATE

A7

APPENDIX B

LABORATORY TESTING

APPENDIX B - LABORATORY TESTING

Diaz•Yourman & Associates (DYA) selected soil samples to be tested and selected the tests to be performed on the selected samples. Laboratory testing was performed by AP Engineering & Testing, Inc. (a City of Los Angeles certified testing lab). Laboratory data are summarized on the boring logs and presented on Plates B1 through B5. We have reviewed and concur with the test results and accept full responsibility for their use in our analysis. A summary of the geotechnical laboratory testing is presented in Table B1. Corrosion potential test results are summarized in Table B2.

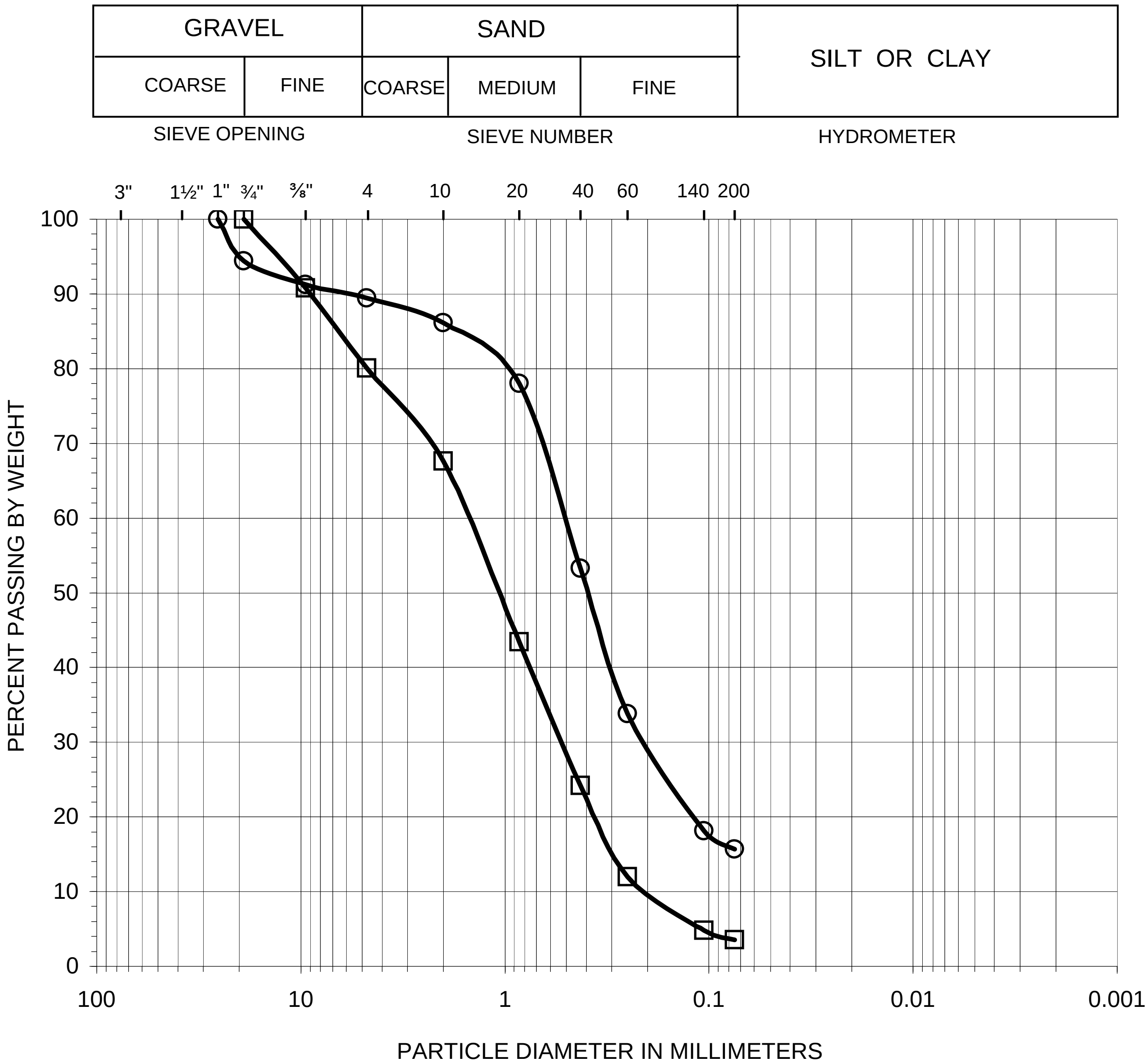
Table B1 - LABORATORY TESTING SUMMARY

TEST NAME	PROCEDURE	PURPOSE	LOCATION
Percent Passing the No. 200 Sieve	ASTM D1140-92	Classification, index properties	Boring Logs
Moisture Content, Dry Density	ASTM D2216-92	Classification, index properties	Boring Logs
Atterberg Limits	ASTM D-4318-93	Expansion potential, classification, index properties	Boring Logs
Grain-Size Distribution	ASTM D422-63	Classification, index properties	Plate B1
Compaction	ASTM D1557-91	Earthwork	Plates B2 and B3
Resistance (R-) Value	ASTM D2844-69 CTM 301	Pavement thickness design	Plates B4 and B5
pH	CTM 532	Corrosion potential	Table B2
Resistivity	CTM 532	Corrosion potential	Table B2
Soluble Sulfates	CTM 417-B	Corrosion potential	Table B2
Soluble Chlorides	CTM 422	Corrosion potential	Table B2

Notes:
- ASTM = American Society for Testing and Materials
- CTM = Caltrans Test Method

Table B2 - CORROSION POTENTIAL TEST RESULTS

Boring No.	B-1	B-5
Depth (feet)	0-5	0-5
pH	7.5	7.1
Water Soluble Sulfate Content (ppm)	5	8
Water Soluble Chloride Content (ppm)	61	65
Minimum Resistivity/Moisture Content (ohms-cm / %)	5,500	4,000



Symbol	Boring No.	Sample No.	Depth (ft)	Percent			Atterberg Limits LL:PL:PI	Soil Type
				Gravel	Sand	Fines		
○	B-2	Bulk	0-5	10.6	73.8	15.7	NP	SM
□	B-4	1	2	19.9	76.5	3.6	NP	SP

* NP = NonPlastic

GRAIN SIZE DISTRIBUTION CURVE

ASTM D 422

Project Name: Ontario I-10/Grove Ave Interchange
Project No.: 2008-007
Date: 4/11/2008
AP No: 28-0425

PLATE
B1

AP Engineering & Testing, Inc.

COMPACTION TEST

Client:	Diaz Yourman			AP Number:	28-0425
Project Name:	Ontario I-10/Grove Ave Interchange	Tested By:	JT	Date:	04/16/08
Project No. :	2008-007	Calculated By:	KM	Date:	04/17/08
Location:	B-1	Checked By:	AP	Date:	04/17/08
Sample No. :	Bulk	Depth (ft):	0-5		

Visual Sample Description: Silty Sand

Compaction Method: [X] ASTM D1557 [ ] ASTM D698

Preparation Method: [ ] Moist [X] Dry

METHOD: A

MOLD VOLUME (CU.FT): 0.0333

Trial No.	1	2	3	4	5	6
Wt. Comp. Soil + Mold (gm.)	3525	3641	3749	3711		
Wt. of Mold (gm.)	1790	1790	1790	1790		
Net Wt. of Soil (gm.)	1735	1851	1959	1921		
Container No.						
Wt. of Container (gm.)	190.41	190.15	194.03	195.15		
Wet Wt. of Soil + Cont. (gm.)	705.63	781.70	971.48	1085.45		
Dry Wt. of Soil + Cont. (gm.)	689.03	749.15	911.69	1005.95		
Moisture Content (%)	3.33	5.82	8.33	9.81		
Wet Density (pcf)	114.75	122.42	129.56	127.05		
Dry Density (pcf)	111.05	115.68	119.60	115.70		

Maximum Dry Density (pcf) **120.0**

Optimum Moisture Content (%) **8.0**

PROCEDURE USED

[X]
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained < 20%

[ ]
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if + No.4 > 20% and - 3/8 " < 20%

[ ]
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in >20% and + in <30%

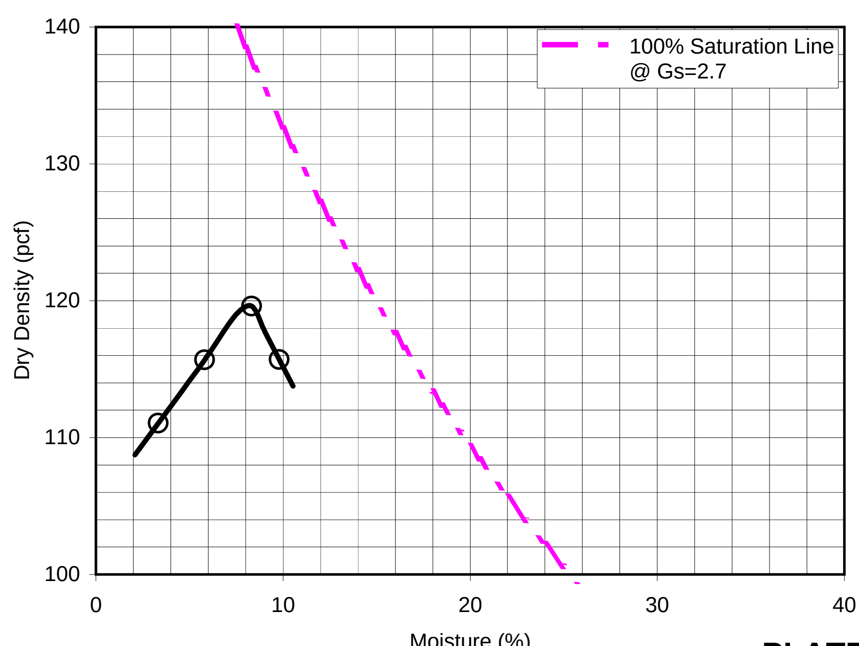


PLATE
B2

AP Engineering & Testing, Inc.

COMPACTION TEST

Client:	Diaz Yourman			AP Number:	28-0425
Project Name:	Ontario I-10/Grove Ave Interchange	Tested By:	JT	Date:	04/15/08
Project No. :	2008-007	Calculated By:	KM	Date:	04/16/08
Location:	B-4	Checked By:	AP	Date:	04/16/08
Sample No. :	Bulk	Depth (ft):	0-5		
Visual Sample Description:	Sand with Gravel				

Compaction Method: [X] ASTM D1557 [ ] ASTM D698

METHOD: C

MOLD VOLUME (CU.FT): 0.0752

Preparation Method: [ ] Moist [X] Dry

Trial No.	1	2	3	4	5	6
Wt. Comp. Soil + Mold (gm.)	6993	7166	7185	7139		
Wt. of Mold (gm.)	2657	2657	2657	2657		
Net Wt. of Soil (gm.)	4336	4509	4528	4482		
Container No.						
Wt. of Container (gm.)	190.50	194.61	181.74	180.19		
Wet Wt. of Soil + Cont. (gm.)	765.21	1060.68	1046.84	1239.21		
Dry Wt. of Soil + Cont. (gm.)	749.73	1020.39	992.67	1160.04		
Moisture Content (%)	2.77	4.88	6.68	8.08		
Wet Density (pcf)	127.12	132.19	132.74	131.39		
Dry Density (pcf)	123.70	126.04	124.43	121.57		

Maximum Dry Density (pcf) **126.5**

Optimum Moisture Content (%) **5.5**

PROCEDURE USED

[ ] Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if No.4 retained < 20%

[ ] Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if + No.4 > 20% and - 3/8 " < 20%

[X] Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if + 3/8 in >20% and + in <30%

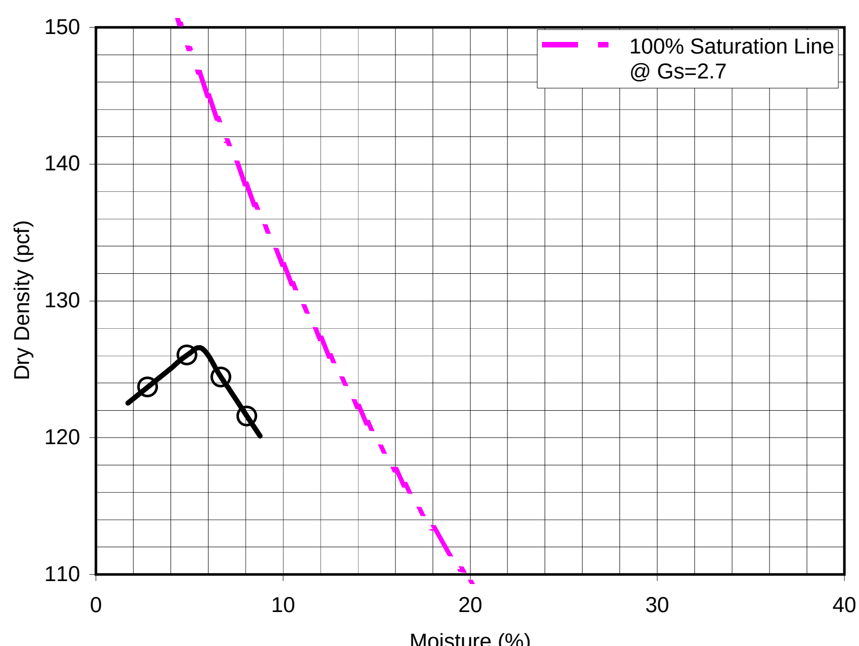


PLATE
B3

AP Engineering & Testing, Inc.

R-VALUE TEST DATA
ASTM D2844

Project Name:	Ontario I-10/Grove Ave Interchange	Tested By:	ST/KM	Date:	04/12/08
Project Number:	2008-007	Checked By:	AP	Date:	04/17/08
Boring No.:	B-2				
Sample No.:	Bulk	Depth (ft.):	0-5		
Location:	-				
Soil Description:	Silty Sand				

Mold Number	D	E	F		
Water Added, g	53	67	75		
Compact Moisture(%)	10.2	11.6	12.3		
Compaction Gage Pressure, psi	350	300	250		
Exudation Pressure, psi	798	548	101		
Sample Height, Inches	2.7	2.7	2.7		
Gross Weight Mold, g	3116	3108	3031		
Tare Weight Mold, g	1971	1957	1872		
Net Sample Weight, g	1145	1151	1160		
Expansion, inchesx10^{-4}	0	0	0		
Stability 2,000 (160 psi)	15/26	18/30	22/37		
Turns Displacement	3.91	3.92	4.10		
R-Value Uncorrected	77	73	67		
R-Value Corrected	78	74	69		
Dry Density, pcf	118.7	117.9	118.0		
Traffic Index	8.0	8.0	8.0		
G.E. by Stability	0.37	0.44	0.52		
G.E. by Expansion	0.00	0.00	0.00		

R-Value by Exudation = 71
R-Value by Expansion = N/A
Equilibrium R- Value = 71
(by Exudation)

Remarks: G_f = 1.5
6.7 % Retained on the ¾"

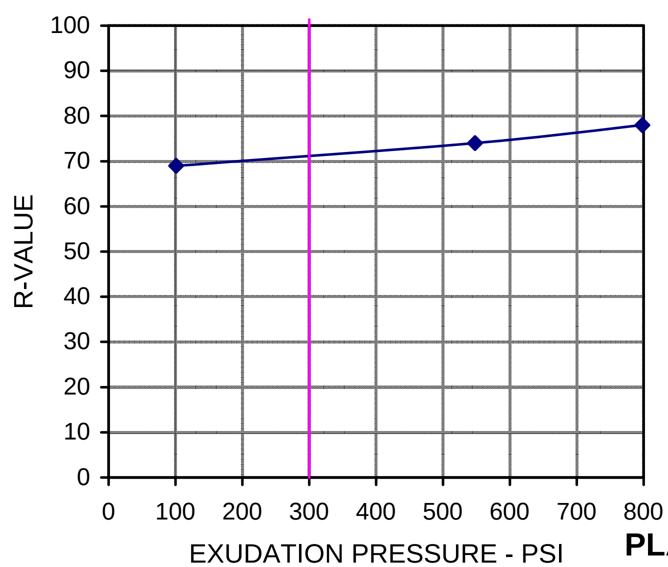


PLATE
B4

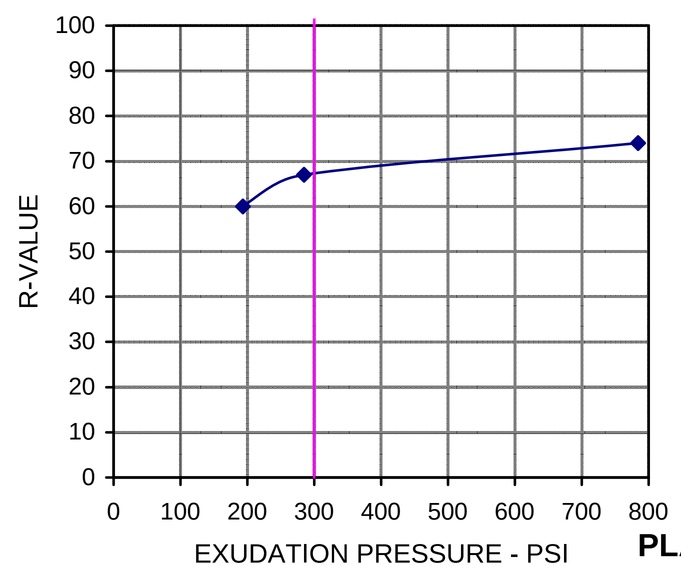
AP Engineering & Testing, Inc.

R-VALUE TEST DATA

ASTM D2844

Project Name:	Ontario I-10/Grove Ave Interchange	Tested By:	ST/KM	Date:	04/12/08
Project Number:	2008-007	Checked By:	AP	Date:	04/17/08
Boring No.:	B-5				
Sample No.:	Bulk	Depth (ft.):	0-5		
Location:	-				
Soil Description:	Silty Sand				

Mold Number	D	E	F		
Water Added, g	31	21	27		
Compact Moisture(%)	8.8	7.8	8.4		
Compaction Gage Pressure, psi	300	300	300		
Exudation Pressure, psi	194	784	285		
Sample Height, Inches	2.4	2.4	2.4		
Gross Weight Mold, g	3095	3089	3094		
Tare Weight Mold, g	1971	1969	1970		
Net Sample Weight, g	1124	1120	1124		
Expansion, inchesx10^{-4}	0	0	0		
Stability 2,000 (160 psi)	26/46	16/28	24/41		
Turns Displacement	3.73	3.75	3.29		
R-Value Uncorrected	62	76	69		
R-Value Corrected	60	74	67		
Dry Density, pcf	130.4	131.1	130.9		
Traffic Index	8.0	8.0	8.0		
G.E. by Stability	0.68	0.44	0.56		
G.E. by Expansion	0.00	0.00	0.00		



R-Value by Exudation = 68

R-Value by Expansion = N/A

Equilibrium R- Value = 68
(by Exudation)

Remarks: G_f = 1.5
6.1 % Retained on the ¾"

PLATE
B5

DISTRIBUTION

5 copies: Mr. Ed Kouzi
Boyle Engineering Corporation
1501 Quail Street
Newport Beach, CA 92660-2746

QUALITY CONTROL REVIEWER

Mr. Saroj Weeraratne, Ph.D., P.E., G.E.
Senior Engineer

SS/VRN:cfp