21 December 2015

Mr. Harry Burrowes
City of San Bruno
567 El Camino Real
San Bruno, California 94066

Subject: Geotechnical Study
Glenview Neighborhood Pavement Repair
San Bruno, California
Langan Project No.: 770496906

Dear Mr. Burrowes:

This letter-report presents the results of our geotechnical study for the Glenview Neighborhood pavement repair project in San Bruno, California. The Glenview Neighborhood is bound by Sneath to the northwest, Skyline Boulevard on the southwest, San Bruno Avenue to the southeast and Crestmoor Canyon to northwest. The approximate limits of the Glenview Neighborhood are shown on Figure 1. The neighborhood was damaged by the PG&E gas main explosion in September 2010. Much of the infrastructure was damaged in the neighborhood. As part of the repairs the City of San Bruno replaced much of the underground utilities in the neighborhood including water and sewer lines.

Replacing the utilities required trenching through many of the neighborhood streets. The installation of the new utilities damaged and cracked the existing asphalt pavement from the excavation process and weight of construction equipment.

We understand the City of San Bruno intends to replace the asphalt pavement sections and regrade the streets and sidewalks to comply with ADA requirements. Our scope of services included reviewing available subsurface information and developing recommendations for flexible asphalt pavement sections and earthwork.

SUBSURFACE CONDITIONS

We used the results of a previous draft geotechnical investigation report[1], available geologic and geotechnical data and our observations during the replacement of utilities for the Glenview Neighborhood. As part of the previous geotechnical investigation, 18 borings were drilled in the streets. The approximate locations of the borings are shown on Figure 2 and logs of the test borings and pertinent test results are included in Appendix A.

[1] *Geotechnical Engineering Investigation, Glenview Neighborhood Reconstruction Project and Pavement Rehabilitation/Resurfacing, San Bruno California* by BAGG Engineers, dated 19 December 2011

Data from the previous report and our observations indicate the paved areas consist of asphaltic concrete (AC) over aggregate baserock (AB). The AC thickness varies from about 3 to 6.5 inches and the AB thickness varies from 3 to 12 inches. Table 1 presents the approximate thickness of the pavement section measured at the boring locations.

TABLE 1

Summary of Asphalt Pavement Section

Boring No.	Street	AC Thickness (inches)	AB Thickness (inches)	Subgrade Material
B-1	Claremont Drive	3.8	4.2	Sandstone
B-2	Claremont Drive	3.0	6.0	Clayey Sand
B-3	Concord Way	3.0	6.0	Clayey Sand
B-4	Claremont Drive	5.3	4.7	Clayey Sand
B-5	Plymouth Way	5.0	3.0	Clayey Sand
B-6	Fairmont Drive	3.0	5.0	Clayey Sand
B-7	Claremont Drive	6.5	3.0	Sandstone
B-8	Glenview Drive	6.5	3.0	Sandstone
B-9	Vermont Way	6.0	5.0	Sandstone
B-10	Glenview Drive	5.0	3.0	Clay
B-11	Plymouth Way	2.5	6.0	Sandstone
B-12	Claremont Drive	6.0	5.0	Clay with sand and gravel
B-13	Earl Avenue	3.3	12.0	Silty Gravel
B-14	Glenview Drive	4.0	8.0	Sandstone
B-15	Glenview Drive	5.8	3.0	Clay with sand and gravel
B-16	Claremont Drive	5.5	3.0	Clay with sand
B-17	Earl Avenue	3.0	9.5	Clayey sand with gravel
B-18	Earl Avenue	3.5	7.0	Clay with sand and gravel

Geologic maps show the neighborhood is blanketed by fill, the Merced formation or Franciscan complex bedrock as shown on Figure 2. The fill generally consists of clay and clayey sand. The Merced formation consists mostly of clayey sand and sandstone and the Franciscan complex bedrock appears to be sandstone.

CONCLUSIONS AND RECOMMENDATIONS

We understand two alternatives are being considered to repave the streets. The first alternative would be to strip the existing pavement components (both AC and AB), reuse the AC and AB as recycled AB and place a new AC layer. The second alternative would be cold in-place recycling (CIR), which consists of milling off the existing AC, appropriately sizing the reclaimed AC and mixing the reclaimed AC with selective additives, graded and compacted as a full depth AC section. CIR, if selected, should be performed by a qualified contractor with appropriate equipment and experience in this method of construction.

Because of the installation of the utilities, there are several feet of trench backfill consisting of AB, which likely creates hard or stiff spots relative to the adjacent soil. These hard spots should be considered when designing either option. Depending upon the alternative selected and the number of AC lifts, geotextile fabrics could be used either beneath the AC or sandwiched between the lifts to help reduce reflective cracks.

We understand CIR has several advantages and is the preferred alternative. However, we have provided recommendations for both methods. The following sections present our recommendations for earthwork and pavement designs.

Subgrade Preparation

Where the pavement section is to be replaced, the existing AC and AB should be removed and stockpiled. Demolished asphalt and any concrete at the site may be crushed to provide recycled Class 2 AB provided it is acceptable from an environmental standpoint. Where recycled Class 2 AB will be used beneath pavements, it should meet requirements of the Caltrans Standard Specifications. Recycled Class 2 AB that does not meet the Caltrans specifications should not be used beneath City streets, but it is acceptable for use beneath concrete flatwork such as sidewalks.

Prior to placing AB, the soil subgrade exposed after stripping and site clearing, should be scarified to a depth of at least six inches, moisture-conditioned to above the optimum moisture content, and compacted to at least 90 percent relative compaction[2] in sidewalk areas and 95 percent in street areas. If intact bedrock is encountered at the subgrade level, scarification and recompaction of the subgrade may be omitted. If areas of weak soil are encountered during subgrade preparation, we recommend the pavement areas be repaired by using one of the following subgrade repair options:

Subgrade Repair Option 1 – Moisture-Conditioning and Compaction

Scarifying the exposed subgrade to a depth of 8 to 12 inches, moisture-conditioning (wetting or drying) the soil to near the optimum moisture content, and compacting the soil to the compaction requirements discussed previously. Typically, this option is the least expensive to

[2] 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 ASTM D1557 laboratory compaction procedure.

implement, but it requires several days to weeks of dry, warm weather to facilitate the moisture-conditioning process.

Subgrade Repair Option 2 – Lime or Cement Admixture

Thoroughly mixing a lime-based admixture into the subgrade at a concentration of 4 to 6 percent of the dry weight of the soil being treated; allowing the lime admixture to react with the wet soil for at least 12 hours, re-mixing and moisture-conditioning the soil to above the optimum moisture content, and compacting the lime-treated material to the compaction requirements discussed previously.

Subgrade Repair Option 3 – Overexcavation and Filling

Weak wet soil can be excavated and removed to expose firm subgrade or excavated to a depth of 18 to 24 inches bgs (or as recommended by our field engineer). A layer of geotextile tensile fabric (Mirafi 500X or equivalent) can then be placed over the sides and bottom of the excavation and the excavation backfilled with Caltrans Class 2 AB or other suitable granular material, if approved by the geotechnical engineer. The upper 12 inches of the Class 2 AB should be compacted to at least 95 percent relative compaction. Alternatively, the excavation can be backfilled with Controlled Density Fill (CDF), sand-cement slurry, or lean concrete with a 28-day unconfined compressive strength of at least 50 pounds per square inch (psi).

The most appropriate subgrade repair option will depend on the time of year site grading commences and the time available to allow drying of the soil. We will provide recommendations for subgrade stabilization on a case-by-case basis. We recommend a non-vibratory roller be used to compact weak and/or wet subgrade soil and any fill placed over wet subgrades.

Groundwater

If shallow or perched groundwater is encountered near the subgrade, sub-drains may be required to help collect the water. Water appears to have seeped through the pavement along Vermont Way. Also the previous report indicated that seepage was observed near the intersection of Claremont Drive and Concord Way. Where seepage occurs we recommend sub-drains be placed beneath the edge of pavement (below the curb and gutter). Sub-drain trenches should be a minimum of 12 inches wide and 36 inches below top of AC pavement. A 4-inch-diameter perforated pipe should be installed near the bottom of the trench. The pipe should be wrapped in a filter fabric such as Mirafi 140NC and surrounded by at least 4 inches of Class 2 permeable rock and should be sloped to drain into an appropriate outlet, such as a catch basin. The trench should be backfilled with Class 2 permeable rock to the top of the soil subgrade and be covered by the asphalt pavement section. Prior to construction we recommend a test pit be excavated in Vermont Way and near intersection of Claremont Drive and Concord Way to check if moisture or evidence of seepage is present in the AB or subgrade.

Pavement Design

The State of California flexible pavement design method was used to develop the recommended asphalt concrete pavement sections. On the basis of the R-value tests performed previously and the soil types present, we have delineated areas for three R-values of 15, 20 and 30 as shown on Figure 3. If the existing subgrade will be raised beneath the paved areas, the fill material should have the same or higher R-value than the subgrade of the area where the fill will be placed. The project specifications should include a minimum R-value for the various areas. During construction additional tests should be performed on the proposed fill to measure its R-value. If the R-value does not meet the project specifications then another source of import fill should be used.

Traffic data were not available at the time of this report. Therefore, we are presenting design pavement sections for three traffic indices (TIs) of 4.5, 5.5 and 6.5. For comparison, TIs of 4.5 and 5.5 assumes passenger car traffic with occasional trucks and a TI of 6.5 assumes moderate truck traffic. Recommended pavement sections for these traffic indices are presented in Table 2, if the existing AC and AB sections are replaced. Recommended full depth asphalt pavement sections are presented in Table 3 for the CIR option. If CIR is selected a coring or pothole program along the roadways on a grid pattern should be performed to evaluate the AC thickness and determine the depth of the existing AC that can be reclaimed.

TABLE 2

Pavement Section Design
Pavement Section Design Based on R-Value[3]

Traffic Index	R-Value = 15		R-Value = 20		R-Value = 30	
	AC Thickness (inches)	Class 2 AB, Thickness (inches)	AC Thickness (inches)	Class 2 AB, Thickness (inches)	Asphalt Concrete Thickness (inches)	Class 2 Aggregate Base, R = 78 (inches)
4.5	2.5	8	2.5	7	2.5	6
5.5	3	10	3	9	3	7
6.5	4	11.5	4	10.5	4	8

[3] See Figure 3 for approximate delineation of areas with R-value of 15, 20 and 30

TABLE 3

Full Depth Asphalt Pavement Section Design
Pavement Section Design Based on R-Value[3]

	R-Value = 15	R-Value = 20	R-Value = 30
Traffic Index	**Asphalt Concrete Thickness (inches)**	**Asphalt Concrete Thickness (inches)**	**Asphalt Concrete Thickness (inches)**
4.5	6	5.5	5
5.5	7.5	7	6.5
6.5	9	8.5	7.5

Pavement components should conform to the current Caltrans Standard Specifications. The upper six inches of the soil subgrade in pavement areas should be moisture-conditioned to above optimum and compacted to at least 95 percent relative compaction and rolled to provide a smooth non-yielding surface. Aggregate base should be compacted to at least 95 percent relative compaction.

Because most of the utility lines in the street have been replaced and backfilled with Class 2 AB, there is likely a difference in stiffness between the trench backfill and surrounding soil. The difference in stiffness may cause reflective cracks in the AC along the edge of the trenches. To help reduce the potential for reflective cracking of the AC, we recommend one of the following two options:

1. Place a geotextile fabric, such as Mirafi 600x or equivalent beneath the Class 2 AB, if the AC and AB are replaced or;

2. If the asphalt will be placed in two or more lifts for either option where the AC and AB are replaced or CIR is used, then a nonwoven paving geotextile such as PetroMat or equivalent could be placed between the two lifts.

Either of the geotextiles should be installed per the manufacture's recommendations, including minimum for overlaps and the need for a primer. An added benefit of using a paving geotextile is that it will reduce reflective cracking, act as a moisture barrier, if a crack were to develop, and increase the design pavement life, when installed properly.

Light Pole Foundations

Light pole foundations may be designed in accordance with the Section 1806.3 of the 2013 California Building Code (CBC) using allowable vertical and lateral soil bearing pressures of

1,500 pounds per square foot (psf) and 100 pounds per cubic foot (pcf), respectively, as designated for Class 5 materials.

ADDITIONAL GEOTECHNICAL SERVICES

Prior to construction, we should review the project plans and specifications to check their conformance with the intent of our recommendations. During construction, we should observe the preparation of pavement subgrades and any fill placement including Class 2 AB and perform field density tests to check that adequate compaction has been achieved beneath proposed pavement and sidewalk areas. These observations will allow us to compare the actual with the anticipated soil conditions and to check that the contractor's work conforms with the geotechnical aspects of the plans and specifications.

We appreciate the opportunity to be of service to you and look forward to working with you on the final design and construction phases of the project.

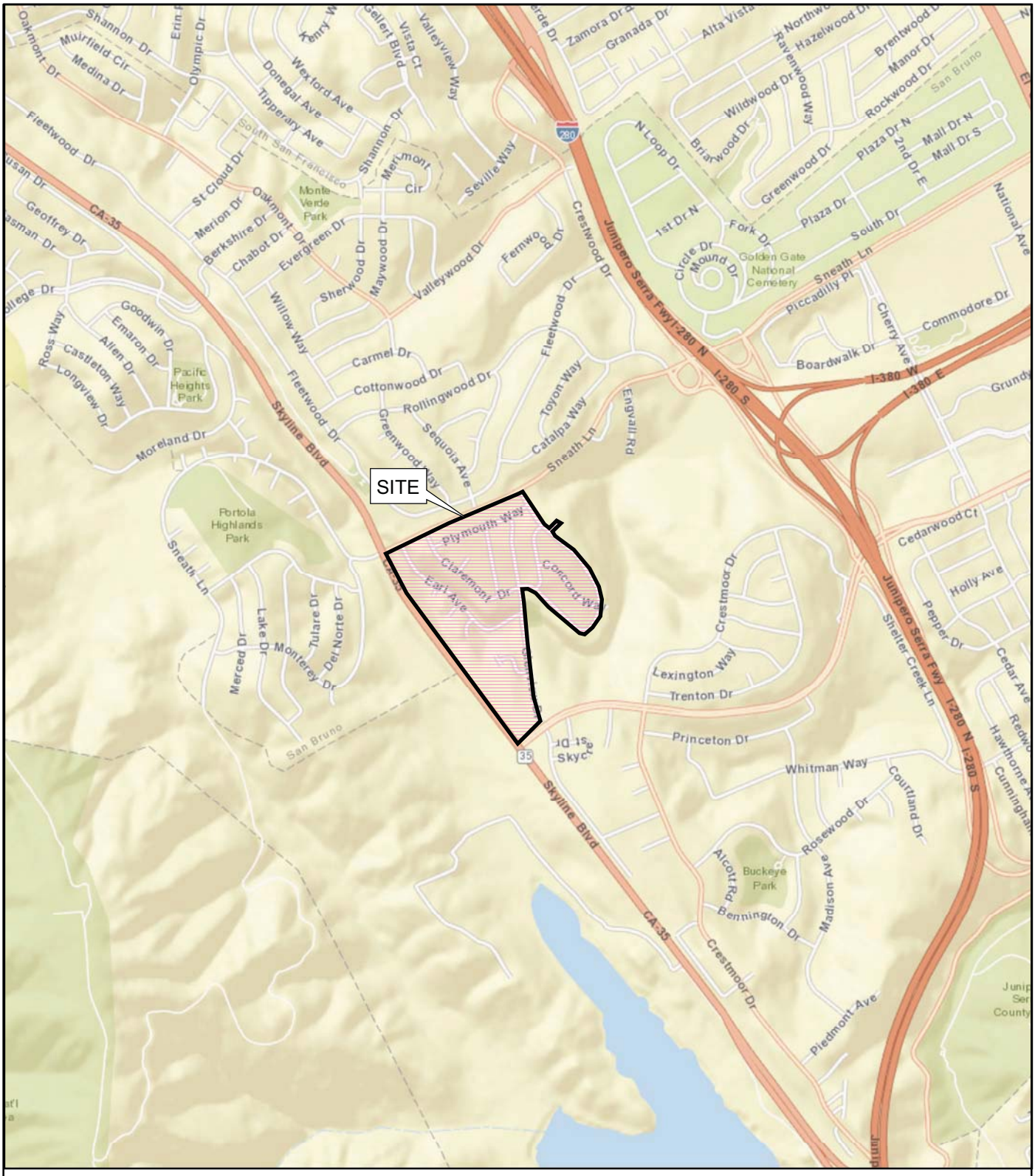
Sincerely yours,
Langan Treadwell Rollo

John Gouchon, GE
Principal/Vice President

Attachments: Figure 1 – Site Location Map
Figure 2 – Site Plan
Figure 3 – Geologic Map and Delineation of Pavement Zones
Appendix A – Log of Test Borings and Pertinent Laboratory Test Results by Others

770496906.01 JG

FIGURES



NOTES:

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

0 1,000 2,000
Feet

N
W E
S

GLENVIEW NEIGHBORHOOD PAVEMENT REPAIR
San Bruno, California

SITE LOCATION MAP

LANGAN TREADWELL ROLLO

Date 02/10/15	Project No. 770496906	Figure 1

Path: \\langan.com\data\SJ\data9\770496906\ArcGIS\ArcMap_Documents\Site Location Map.mxd User: cyoung

Reference: Esri, Digital Globe, GeoEye, i-cubed, USDA, USGS AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and GIS User Community .

EXPLANATION

B-1 Approximate location of boring by BAGG Engineers, 2011

N

0 250 Feet

Approximate scale

GLENVIEW NEIGHBORHOOD PAVEMENT REPAIR

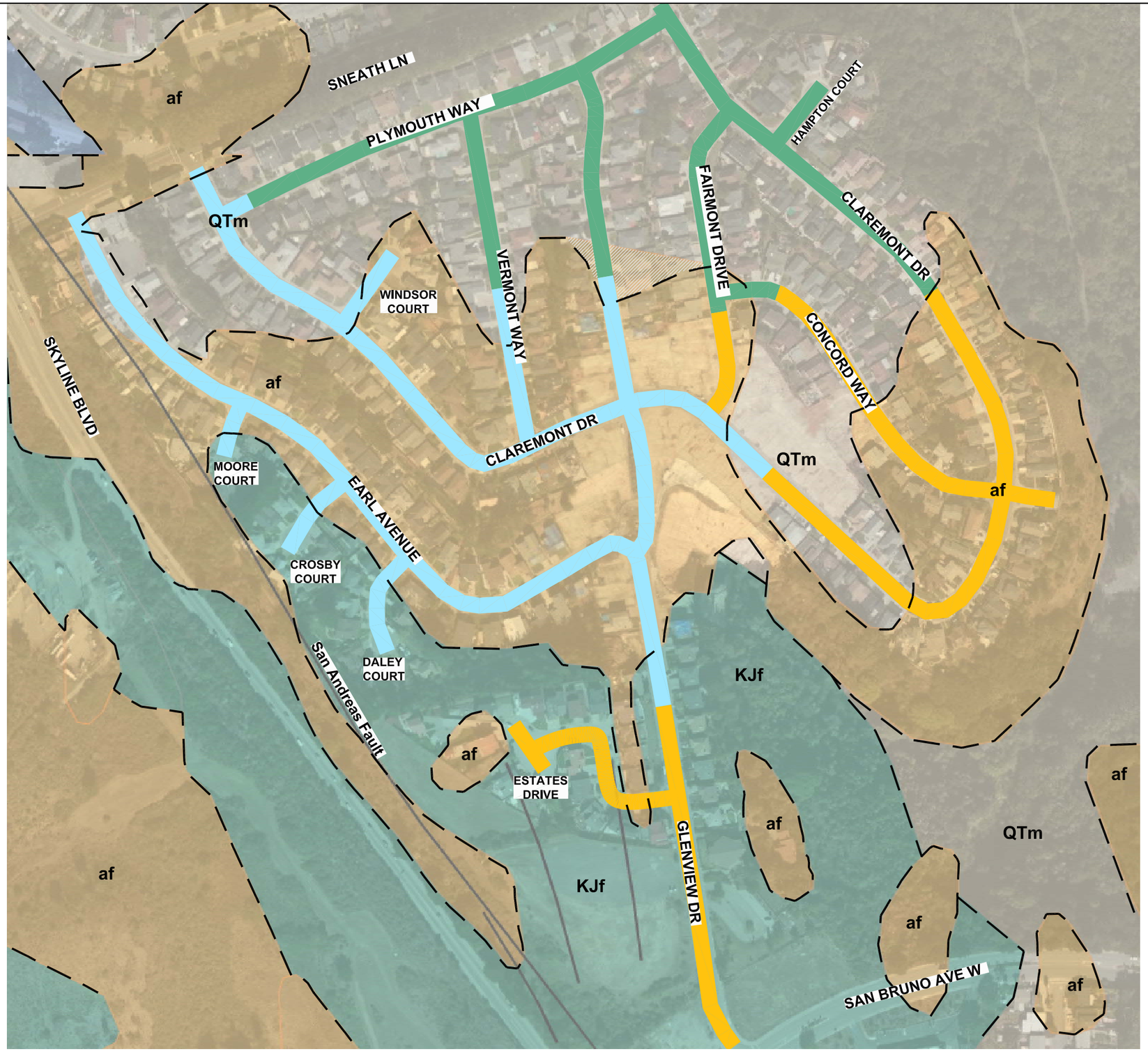
San Bruno, California

SITE PLAN

Date 01/20/15	Project No. 770496906	Figure 2

LANGAN TREADWELL ROLLO

\\langan.com\data\SJ\data9\770496906\Cadd Data – 770496906\2D-DesignFiles\Geotech\770496906-B-SP0101.dwg 2/11/15



EXPLANATION

af	Artificial Fill
QTm	Merced Formation
KJf	Franciscan Complex Bedrock
— —	Geologic Contact
———	Fault
———	Design Subgrade R-Value 30
———	Design Subgrade R-Value 20
———	Design Subgrade R-Value 15

N

0 250 Feet

Approximate scale

GLENVIEW NEIGHBORHOOD PAVEMENT REPAIR
San Bruno, California

GEOLOGIC MAP AND DELINEATION OF PAVEMENT ZONES

Date 01/20/15	Project No. 770496906	Figure 3

LANGAN TREADWELL ROLLO

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APPENDIX A

Log of Test Borings and Pertinent Laboratory Test Results by Others

BVGG ENGINEERS

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	Paving
	Aggregate Base
	Sandstone
	Clayey sand
	Fill
	Lean Clay
	Poorly graded gravel
Misc. Symbols	
	Water level at completion of boring
Soil Samplers	
	Modified California Sampler: 2.375" ID by 3" OD, split-barrel sampler driven w/ 140-pound hammer falling 30 inches
	Bulk/Grab sample
	Bulk sample taken from auger
	Standard Penetration Test: 1 3/8" ID by 2" OD, split-spoon sampler driven with 140-pound hammer falling 30" (ASTM D 1586-99)

Symbol	Description
Line Types	
_____	Denotes a sudden, or well identified strata change
- - -	Denotes a gradual, or poorly identified strata change
Laboratory Tests	
PI	Plasticity Index established per ASTM D4318 laboratory test method
LL	Liquid Limit established per ASTM D4318 laboratory test method
DSX	Direct Shear test run under saturated conditions per ASTM D3080 laboratory test method
DS	Direct Shear test run at natural water content per ASTM D3080 laboratory test method
NAT	Natural Water Content

BORING LOG

Boring No. B-1

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 422±feet
LOGGED BY:
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			5-inch asphaltic concrete	
									6-inches aggregate base	
				16.9	107	2	19 50	rock	SANDSTONE, olive brown, highly weathered, poorly indurated, medium to fine grained with oxidation stains	
						4				
						6			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						8				
						10				
						12				

BORING LOG

Boring No. B-2

BYGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 358±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			3-inch asphaltic concrete	
									6-inches aggregate base	
								SC	CLAYEY SAND, yellow brown, moist, medium dense, some oxidation stains (native)	
				21.4	100	2	13, 15, 19			
						4				
						6			Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						8				
						10				
						12				

BORING LOG

Boring No. B-3

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 355±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			3-inches asphaltic concrete 6-inches aggregate baserock	
				18.7	102	2	6 7 9	FILL	CLAYEY SAND, olive gray, moist, medium dense, with black and tan mottling	
						4			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-4

BYGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 345±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$5\frac{1}{4}$-inches asphaltic concrete	
									$4\frac{3}{4}$-inches aggregate baserock	
								FILL	CLAYEY SAND, gray, moist, medium dense, medium to fine grained	
				20.2	99	2	4 5 5			
						4				
						6			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						8				
						10				
						12				

BORING LOG

Boring No. B-5

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 436±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			5-inches asphaltic concrete	
				15.1	115	2	17, 14, 19		CLAYEY SAND, olive brown, moist, medium dense, sith oxidation stains (decomposed sandstone?)	
						4				
						6			Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						8				
						10				
						12				

BORING LOG

Boring No. B-6

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 406±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			3-inches asphaltic concrete	
									5-inches aggregate baserock	
								SC	CLAYEY SAND, olive brown, medium dense, very moist, some oxidation stains (native)	
				20.2	103	2	12, 13, 16			
						4				
									Boring was terminated at $4\frac{1}{2}$ feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-7

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 371±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$6\frac{1}{2}$-inches asphaltic concrete	
									3-inches aggregate baserock	
								rock	SANDSTONE, olive brown, intensely weathered, poorly indurated, moist, heavily oxidized	
						2				
				13.9	116.5		15 / 23 / 26			
						4			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-8

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 423±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			6-inches asphaltic concrete	
									3-inches aggregate baserock	
								rock	SANDSTONE, light gray, highly weathered, poorly indurated, moist, with oxidation stains	
				18.8	104	2	11, 15, 25			
						4			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-9

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 429±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$3\frac{1}{2}$-inches asphaltic concrete	
									5-inches aggregate baserock	
							13	rock	SANDSTONE, pale yellow brown, highly weathered, poorly indurated	
						2	22			
							29			
							22		...less weathered, better indurated	
						4	50			
									Boring was terminated at $4\frac{1}{2}$feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-10

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 372±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			5-inches asphaltic concrete	
									3-inches aggregate baserock	
							13 15 17	FILL	LEAN CLAY, yellow brown, moist, very stiff, some sand, trace gravel, trace dark mottling, trace rootlets	
				10.9	122	2				
							9 9 9		...color change to dark olive gray	
				13.0	119	4				
									Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-11

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 11/8/11
ELEVATION: 446±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$2\frac{1}{2}$-inches asphaltic concrete	
									6-inches aggregate baserock	
								rock	SANDSTONE, olive gray, intensely weathered, poorly indurated, medium to fine grained with oxidation stains	
				12.9	113	2	14, 21, 26			
						4				
									Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-12

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 415±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			6-inches asphaltic concrete	
									5-inches aggregate baserock	
				15.0	120	2	11, 21, 30	FILL	LEAN CLAY, olive to blue gray, moist, hard, some sand and gravel, with orange and black mottling	
				18.1	104	4	12, 17, 22			
						6			Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						8				
						10				
						12				

BORING LOG

Boring No. B-13

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION:
DRILLER:
DRILL METHOD:

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 379±feet
LOGGED BY:
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$3\frac{1}{4}$-inch asphaltic concrete 12-inches aggregate baserock	
						2	14 16 8	FILL	SILTY GRAVEL, brown, moist, medium dense, medium to fine gravel with sand, and trace clay	
				5.1				FILL	POORLY GRADED SAND, yellow brown, moist, medium dense, trace gravel	
						4			Boring was terminated at 4 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-14

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 429±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			4-inches asphaltic concrete	
									8-inches aggregate baserock	
							50	rock	SANDSTONE, gray to light olive gray, moderately weathered	
				3.5		2				
				5.2	90.4		50			
						4			Boring was terminated at $3\frac{1}{4}$-feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-15

BAGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 476±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$5\frac{3}{4}$-inches asphaltic concrete	
									3-inches aggregate baserock	
							6, 6, 8	FILL	LEAN CLAY, dark gray brown, moist, stiff, with sand and trace gravel up to 2-inch size; trace fine wood fragments	
				10.6	122	2				
							4, 4, 6			
				20.7	94	4				
									Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-16

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 444±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$5\frac{1}{2}$-inches asphaltic concrete	
									3-inches aggregate baserock	
							10, 16, 20	FILL	LEAN CLAY, black, moist, hard, with sand and trace gravel, light gray mottling	
				14.0	111	2				
							13, 20, 20	CL	LEAN CLAY, yellow brown, moist, hard, with silt and sand (native)	
				12.0	115	4				
									Boring was terminated at 5 feet. Grounddwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-17

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 402±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$4\frac{1}{2}$-inches asphaltic concrete	
									8-inches aggregate baserock	
							11	FILL	CLAYEY SAND, dark gray brown, very moist, medium dense, with gravel up to 2-inch size, some yellow mottling, trace fine wood fragments	
				9.2	127	2	7			
							5			
							8			
						4	14			
				9.8	132		12			
									Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

BORING LOG

Boring No. B-18

BVGG ENGINEERS

JOB NAME: Glenview Neighborhood Reconstruction Project
CLIENT: BKF Engineers, Surveyors, Planners
LOCATION: Glenview Neighborhood, San Bruno, California
DRILLER: West Coast Exploration
DRILL METHOD: $4\frac{1}{2}$-inch diameter solid flight auger

JOB NO.: BKFEN-13-00
DATE DRILLED: 10/24/11
ELEVATION: 423±feet
LOGGED BY: MM
CHECKED BY:

Type of Strength Test	Test Surcharge Pressure, psf	Test Water Content, %	Shear Strength, psf	In-Situ Water Content, %	In-Situ Dry Unit Weight, pcf	Depth, ft.	Soil Symbols, Samplers and Blow Counts	USCS	Description	Remarks
						0			$3\frac{1}{2}$-inches asphaltic concrete	
									7-inches aggregate baserock	
							12	FILL	LEAN CLAY, dark gray, moist, hard, with silt and sand, trace gravel up to 2-inch size, trace fine wood fragments, trace tan mottling	
						2	28			
							30			
							18			
						4	32			
				7.2			22			
									Boring was terminated at 5 feet. Groundwater was not encountered. Boring was backfilled with neat cement grout.	
						6				
						8				
						10				
						12				

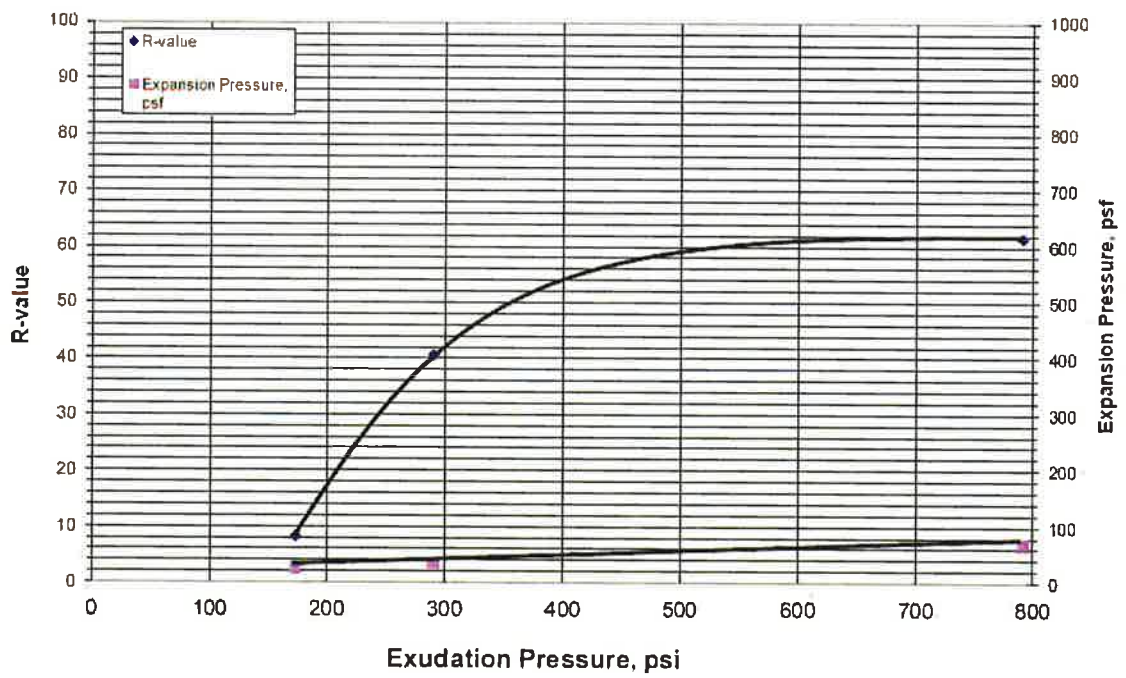
COOPER

R-value Test Report (Caltrans 301)

Job No.:	011-472	Date:	11/11/11	Initial Moisture,	11.6%
Client:	BAGG	Tested	MD	R-value by Stabilometer	42
Project:	Glenview - BKFEN-13-00	Reduced	RU		
Sample	Bulk 1	Checked	DC	Expansion Pressure	40 psf
Soil Type:	Olive Brown Clayey SAND w/ Gravel				

Specimen Number	A	B	C	D
Exudation Pressure, psi	173	290	791	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	65	22	5	
Weight of Soil & Mold, grams	3244	3106	3124	
Weight of Mold, grams	2118	2088	2086	
Height After Compaction, in.	2.65	2.32	2.3	
Moisture Content, %	17.6	13.6	12.1	
Dry Density, pcf	109.4	116.9	121.9	
Expansion Pressure, psf	25.8	34.4	68.8	
Stabilometer @ 1000				
Stabilometer @ 2000	141	79	50	
Turns Displacement	4.04	3.08	2.83	
R-value	8	41	62	

Remarks:



GLENVIEW NEIGHBORHOOD
RECONSTRUCTION PROJECT
SAN BRUNO, CALIFORNIA

R-VALUE TEST RESULTS

DATE:	JOB NUMBER:	PLATE
DEC. 2011	BKFEN-13-00	33

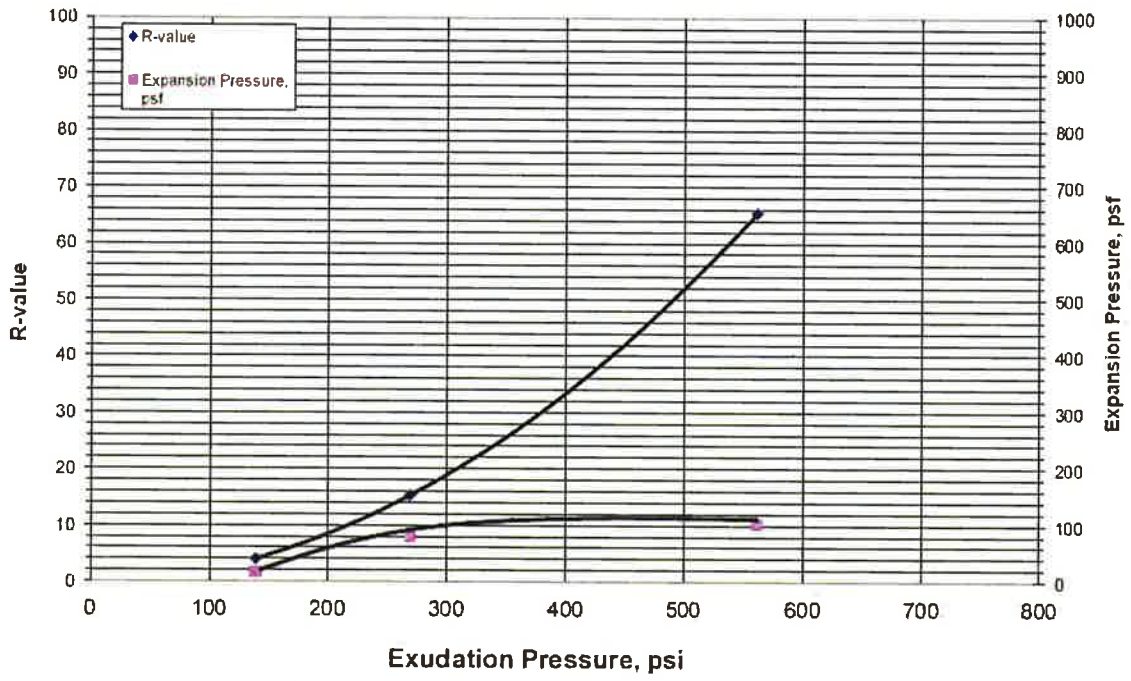
BAGG ENGINEERS

R-value Test Report (Caltrans 301)

Job No.:	011-472	Date:	11/11/11	Initial Moisture,	7.0%
Client:	BAGG	Tested	MD	R-value by Stabilometer	18
Project:	Glenview - BKFEN-13-00	Reduced	RU		
Sample	Bulk 2	Checked	DC	Expansion Pressure	100 psf
Soil Type: Dark Brown Clayey SAND					

Specimen Number	A	B	C	D
Exudation Pressure, psi	139	269	562	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	67	25	14	
Weight of Soil & Mold, grams	3288	3256	3198	
Weight of Mold, grams	2099	2104	2107	
Height After Compaction, in.	2.61	2.43	2.3	
Moisture Content, %	12.9	9.2	8.2	
Dry Density, pcf	122.1	131.5	132.7	
Expansion Pressure, psf	17.2	81.7	103.2	
Stabilometer @ 1000				
Stabilometer @ 2000	150	130	45	
Turns Displacement	4.14	3.08	2.81	
R-value	4	15	65	

Remarks:



GLENVIEW NEIGHBORHOOD
RECONSTRUCTION PROJECT
SAN BRUNO, CALIFORNIA

R-VALUE TEST RESULTS

DATE:	JOB NUMBER:	PLATE
DEC. 2011	BKFEN-13-00	34

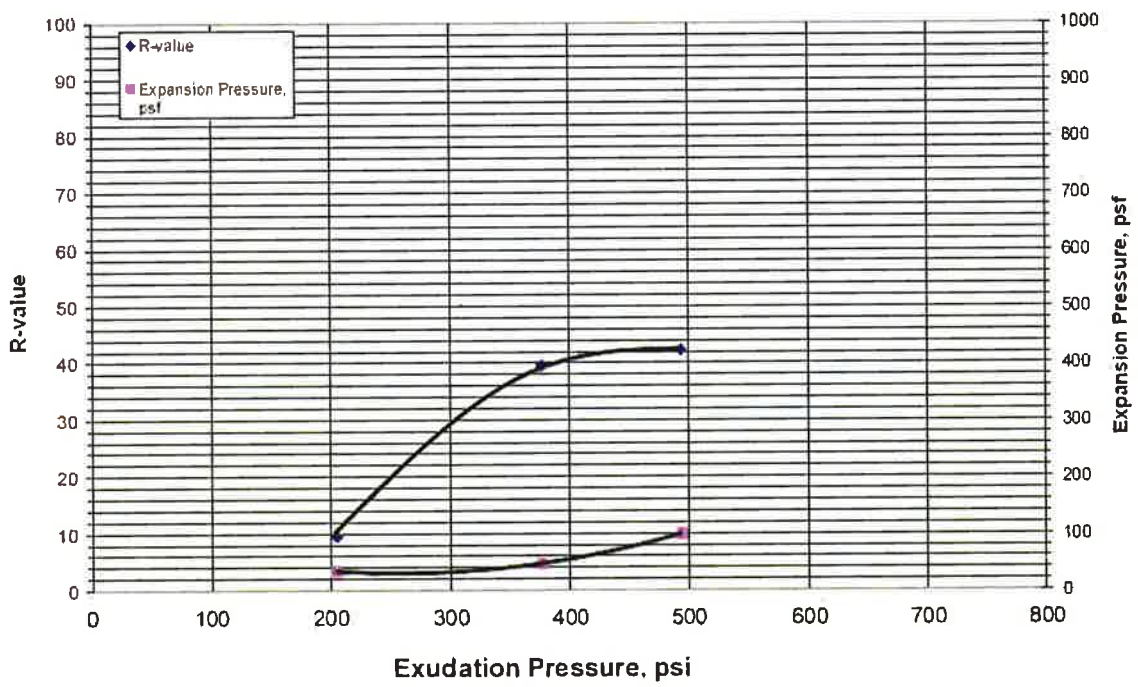
BAGG ENGINEERS

R-value Test Report (Caltrans 301)

Job No.:	011-473	Date:	11/14/11	Initial Moisture,	10.6%
Client:	BAGG	Tested	MD	R-value by Stabilometer	30
Project:	Glenview Neighborhood Reconstruction - BKFEN-13-00	Reduced	RU		
Sample	B-2,3,4,7 @ 1-2'	Checked	DC	Expansion Pressure	35 psf
Soil Type: Olive Brown Sandy CLAY					

Specimen Number	A	B	C	D
Exudation Pressure, psi	205	376	494	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	50	30	14	
Weight of Soil & Mold, grams	3146	3087	3063	
Weight of Mold, grams	2088	2085	2102	
Height After Compaction, in.	2.5	2.35	2.3	
Moisture Content, %	15.2	13.4	11.9	
Dry Density, pcf	111.2	113.9	113.0	
Expansion Pressure, psf	34.4	47.3	98.9	
Stabilometer @ 1000				
Stabilometer @ 2000	140	84	81	
Turns Displacement	3.41	2.93	2.67	
R-value	9	40	42	

Remarks:



GLENVIEW NEIGHBORHOOD RECONSTRUCTION PROJECT
SAN BRUNO, CALIFORNIA

R-VALUE TEST RESULTS

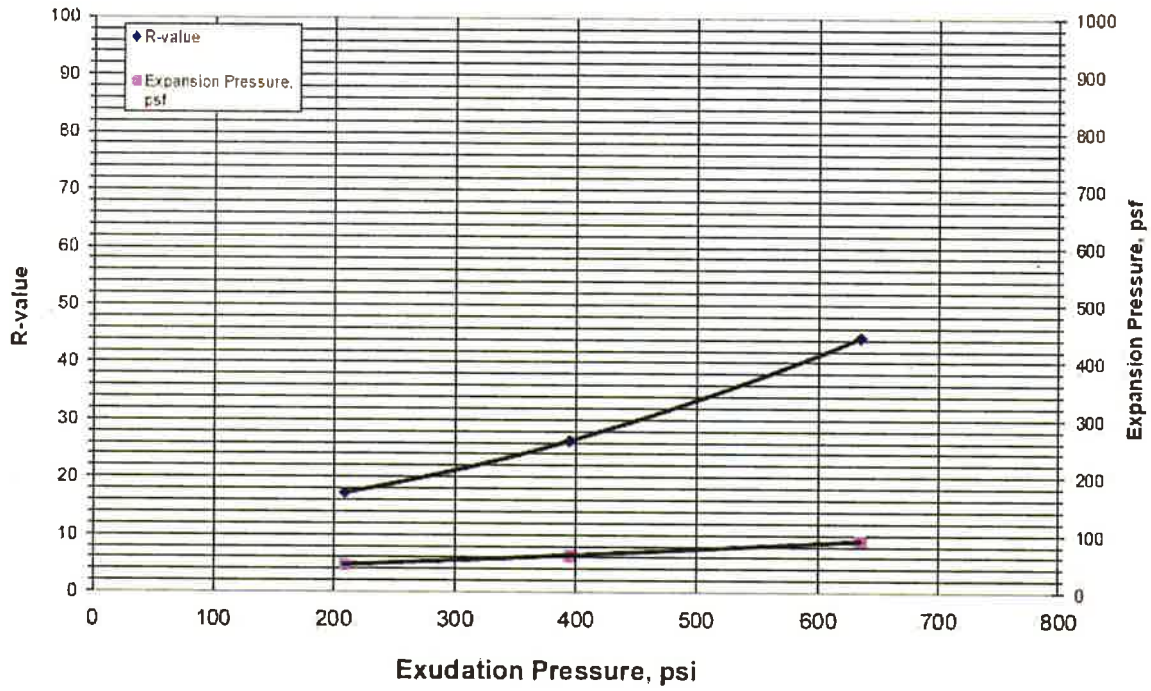
DATE:	JOB NUMBER:	PLATE
DEC. 2011	BKFEN-13-00	35

R-value Test Report (Caltrans 301)

Job No.:	011-473	Date:	11/14/11	Initial Moisture,	9.9%
Client:	BAGG	Tested	MD	R-value by Stabilometer	21
Project:	Glenview Neighborhood Reconstruction - BKFEN - 13-00	Reduced	RU		
Sample	B-11,8,6,5,1 @ 1-2'	Checked	DC	Expansion Pressure	60 psf
Soil Type: Yellowish Brown Clayey SAND					

Specimen Number	A	B	C	D
Exudation Pressure, psi	209	394	635	
Prepared Weight, grams	1200	1200	1200	
Final Water Added, grams/cc	66	44	30	
Weight of Soil & Mold, grams	3105	3140	3094	
Weight of Mold, grams	2086	2099	2100	
Height After Compaction, in.	2.39	2.38	2.31	
Moisture Content, %	16.0	14.0	12.7	
Dry Density, pcf	111.3	116.2	115.6	
Expansion Pressure, psf	47.3	64.5	90.3	
Stabilometer @ 1000				
Stabilometer @ 2000	122	108	78	
Turns Displacement	3.48	3.02	2.67	
R-value	17	26	44	

Remarks:



GLENVIEW NEIGHBORHOOD
RECONSTRUCTION PROJECT
SAN BRUNO, CALIFORNIA

R-VALUE TEST RESULTS

DATE:	JOB NUMBER:	PLATE
DEC. 2011	BKFEN-13-00	36