Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

October 15, 2013

KA Project No. 012-13096

RE: PAVEMENT EVALUATION INVESTIGATION
AVOCADO HOA
Avocado Summit Drive
El Cajon, California

In accordance with your request, we have completed a Pavement Evaluation Investigation for the above-referenced project. The information presented herein is based upon professional interpretation and a degree of conservatism deemed proper as of this report date. It is not warranted that such information cannot be superseded by future geotechnical developments.

A site plan showing the approximate boring locations is presented following the text of this report. A description of the field investigation, boring logs, and the boring logs legend are presented following the text of this report. In addition, a description of the laboratory testing phase of this study, along with the laboratory test results are attached.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the asphaltic concrete pavement, subbase and subgrade conditions at the site and provide a soil profile utilizing exploratory soil borings.

Our scope of services included the following:

- A site reconnaissance by a member of our engineering staff to evaluate the surface conditions at the project site.
- A field investigation consisting of coring/drilling 15 borings to a depth of approximately 3 to 10 feet for evaluation of asphaltic concrete and subsurface conditions at the project site.

- Performing laboratory 5 R-Value tests on representative soil samples obtained from the borings to evaluate the physical and index properties of the subsurface soils.

- Evaluation of the data obtained from the investigation and an engineering analysis to provide a physical description of the soil properties.

- Preparation of this report summarizing the results, conclusions, and findings of our investigation.

SITE LOCATION AND SITE DESCRIPTION

The site is located on Avocado Summit Drive in El Cajon, California. The site is predominately surrounded by residential developments.

Presently, the site is located in a residential development. Areas of distressed pavement are located throughout the site. Areas not covered by the existing structures and pavement are covered by landscaping. Underground utilities are located throughout the site. The site is relatively level with no major changes in grade.

FIELD EXPLORATION AND LABORATORY TESTING

Subsurface soil conditions were explored by coring/drilling 15 borings within the project site to evaluate the asphaltic concrete sections. The exploratory soil borings were advanced to a depth of approximately 3 to 10 feet below existing site grade. The approximate boring and coring locations are shown on the site plan. Soil samples were retained for laboratory testing.

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory testing program was formulated with emphasis on the evaluation of gradation, expansion index, maximum density/optimum moisture content, and R-Values were retained for Analysis.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Based on our findings, the subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the pavement section consisted of approximately 2.8" to 3.0" inches of asphaltic concrete. No aggregate base was underlain the asphaltic concrete.

Below the existing asphaltic concrete and aggregate layer, approximately 2 to 5 feet of silty sand and silty sand with clay was found. Below this, clayey silty sand fill material was encountered. Laboratory tests suggest that these soils have low subgrade support characteristics. Representative soil samples had R-Values of 20-55.

The thickness of the existing pavement sections are as follows:

Core No.	Asphaltic Concrete (inches)	Aggregate Base (inches)	Petro-mat Inter-Layer	Subgrade Soil
1	3.0	--	--	Clay Silty Sand (SM)
2	3.0	--	--	Silty Sand (SM)
3	2.8	--	--	Silty Sand (SM)
4	3.0	--	--	Silty Sand (SM)
5	3.0	--	--	Silty Sand (SM)
6	2.8	--	--	Silty Sand (SM)
7	3.0	--	--	Clay Silty Sand (SM)
8	2.8	--	--	Silty Sand (SM)
9	3.0	--	--	Silty Sand (SM)
10	3.0	--	--	Silty Sand (SM)
11	3.0	--	--	Silty Sand (SM)
12	3.0	--	--	Silty Sand (SM)
13	2.8	--	--	Silty Sand (SM)
14	3.0	--	--	Silty Sand (SM)
15	3.0	--	--	Clay Silty Sand (SM)

R-VALUE TEST RESULTS AND PAVEMENT DESIGN

Bulk soil samples were obtained from the project site. The samples were analyzed to determine their subgrade reaction characteristics. Two R-Value samples were tested in accordance with the State of California Materials Manual Test, Designation 301. Results of the tests are as follows:

Sample	Depth	Description	R-Value at Equilibrium
1	12-24"	Clay Silty Sand (SM)	20
2	12-24"	Clay Silty Sand (SM)	30
3	12-24"	Silty Sand (SM)	55
4	12-24"	Silty Sand (SM)	51
5	12-24"	Silty Sand (SM)	50

These test results are low to moderate and indicate poor to fair subgrade support characteristics under dynamic traffic loads. A traffic study was not performed as part of this investigation. The following table shows the recommended pavement sections for various pavement thicknesses based on an R-Value of 20-55.

Traffic Index	Asphaltic Concrete	Class II Aggregate Base*	Compacted Subgrade**
4.0	4.0"	4.0"	12.0"
4.5	4.0"	4.0"	12.0"
5.0	4.0"	5.0"	12.0"
5.5	4.0"	6.0"	12.0"
6.0	4.0"	8.5"	12.0"
6.5	4.0"	10.0"	12.0"
7.0	4.0"	12.0"	12.0"
7.5	4.0"	13.0"	12.0"

**** 95% compaction based on ASTM Test Method D1557 or CAL 216***
***** 90% compaction based on ASTM Test Method D1557 or CAL 216***

Traffic Index	Portland Cement	Class II Aggregate Base*	Compacted Subgrade**
5.0	6.0"	4.0"	12.0"
7.0	7.0"	5.0"	12.0"

If traffic indices are not available, an estimated (typical value) index of 4.5 may be used for light automobile traffic, and an index of 7.0 may be used for light truck traffic.

EVALUATION

Based on the findings of our field and laboratory investigations, it is our opinion that the observed pavement cracking and failure at the Avocado HOA is due to the inadequate structural section of the asphalt concrete pavement.

RECOMMENDATIONS

This is the one option we consider applicable for repair and/or rehabilitation of the affected asphalt-concrete pavement areas within Avocado HOA in El Cajon, California. In the process of selecting an option, the Owner is advised to consider cost, ease of construction, availability of materials and/or equipment, and estimated design life of the pavement.

Option 1: Pulverize/Grind - Remove approximately 3.0" of asphaltic concrete. Stabilize entire section through Cement Treated Base down to a depth of 12.0"-14.0". This option includes stabilization of the subgrade soil which will result in a subgrade R-Value of 50 or higher. With improved stability, the design life of the pavement section is drastically improved.

Details: Includes pulverizing/grinding and removing of existing asphaltic, stabilize 12.0"-14.0" section. Demo manholes, valves, and monuments. Install 3.0"-3.5"" AC section. Stabilize 12.0"-14.0" inch subgrade section and 6% Cement Treated Base treatment. Compact and fine grade treated subgrade.

Area: NA Estimated Cost: $0.00

Option 2: Remove and replace pavement section, with design section of 3.0"-3.5" asphaltic concrete section over 7.0" section of aggregate base. With improved subgrade stability, the design life of the pavement section is dramatically improved.

Details: Includes removal of existing asphaltic concrete and aggregate base sections, mill out and off-haul AC, excavation and stockpile AB on-site. Demo manholes, valves, and monuments. Install 3.0"-3.5" asphaltic concrete section over 7.0" section of aggregate base and 4.0" asphalt concrete over 8.0" aggregate base section in heavier load areas. Compact and fine grade treated subgrade.

Area: NA Estimated Cost: $0.00

Note: A design section of 3.0"-3.5" asphaltic concrete over 12.0" Cement Treated Base section based on the traffic index for the sampled R-Value was prepared at 5.0-5.5 TI. Based on Caltrans Test Method 301, it has a design life cycle of 15-20 years, possibly longer, based on the amount of annual pavement maintenance that is applied.

ENGINEERED FILL

The organic-free, on-site, upper soils are predominately silty sand and clayey silty sand. These soils will be suitable for reuse as general Engineered Fill, provided they are moisture-conditioned to at least 2 percent above optimum moisture.

The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the contractor, since he has complete control of the project site at that time.

Imported non-expansive Fill should consist of a well-graded, slightly cohesive, fine silty sand or sandy silt soil with relatively impervious characteristics when compacted. This material should be approved by the Soils Engineer prior to use and should typically possess the following characteristics:

Percent Passing No. 200 Sieve	20 to 50
Plasticity Index	10 maximum
UBC Standard 29-2 Expansion Index	15 maximum

Fill soils should be placed in lifts approximately 6 inches thick, moisture-conditioned to a minimum of 2 percent above optimum moisture control, and compacted to achieve at least 90 percent of the maximum density as based on ASTM Test Method D1557. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

COMPACTED MATERIAL ACCEPTANCE

Compaction specifications are not the only criteria for acceptance of the site grading or other such activities. However, the compaction test is the most universally recognized test method for assessing the performance of the Grading Contractor. The numerical test results from the compaction test cannot be used to predict the engineering performance of the compacted material. Therefore, the acceptance of compacted materials will also be dependent on the stability of that material. The Soils Engineer has the option of rejecting any compacted material regardless of the degree of compaction if that material is considered to be unstable or if future instability is suspected. A specific example of rejection of fill material passing the required percent compaction is a fill which has been compacted with an in situ moisture content significantly less than optimum moisture. This type of dry fill (brittle fill) is susceptible to future settlement if it becomes saturated or flooded.

TESTING AND INSPECTION

A representative of Krazan & Associates, Inc., should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory field work. This activity is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor.

LIMITATIONS

It is recommended that the parking and access ways be removed and reconstructed with the minimum pavement thicknesses indicated in this report. Therefore, as with any flexible pavement an annual review and maintenance program should be established to address and/or mitigate any potential pavement concerns. Pavement failures that are not promptly and properly repaired tend to compound the failure and quickly increase in size and cost.

Field observations of existing construction are characterized by the presence of the calculated risk that the observed conditions have been fully revealed by those field observations. The risk is derived from the practical necessity of basing interpretation and calculations on limited sampling and that the sampling is representative of the overall structure. The risk is further compounded by the inability of access all areas.

This report is based on observations of external surfaces and select core locations, and may or may not, indicate problems not obvious from these types of observations. The report is prepared in accordance with generally accepted engineering practices. The report is limited to a period of one year from the date of

preparation. No other warranties, either expressed or implied, are made as to the professional conclusions and evaluations rendered.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Brian Nelson
Director of Pavement Design Engineering

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