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GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS

PROPOSED JIFFY LUBE
CASTRO VALLEY BOULEVARD AND STANTON AVENUE
CASTRO VALLEY, CALIFORNIA
GEA PROJECT NO. C-860608

FOR
CALIFORNIA LUBRICANTS LTD.
PALO ALTO, CALIFORNIA

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS

GEA

MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS
16021 ARMINTA STREET/VAN NUYS, CA 91406/ 818-997-1123

July 17, 1986

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JUL 21 1986
By W. H. SLAUTTERBACK

California Lubricants Ltd.
560 San Antonio Rd.
Suite 107
Palo Alto, CA 94306

Attention: Mr. Bill Slautterback

Subject: Subgrade Soil Contamination
Proposed Jiffy Lube Site
Castro Valley Blvd. and Stanton Ave.
Castro Valley, CA
GEA Project No. C-860608

Dear Mr. Slautterback:

The purpose of this letter is to formalize our conversation of July 16, 1986, regarding subgrade soil and water contamination encountered during the subsurface exploration conducted for the above referenced site.

Six soil test borings were drilled at the above referenced site, with boring number three being located in the approximate location of the old tank area. Slight to moderate petroleum odors were noted in the soils utilized to backfill the tank pit are, but were not noted in the soils encountered beneath the approximate 8½' depth (approximate bottom of tank pit). Petroleum odors were not noted in samples obtained from test borings drilled elsewhere on the property. With the exception of the soils utilized to backfill the old tank pit area, subgrade contamination was not noted during the Geotechnical Engineering Exploration and Analysis conducted for this project.

It has been a pleasure to be of continued service to you. If you have any questions, or wish additional information regarding this or other projects, please feel free to contact me at any time.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC

Dean Sandri

Dean Sandri, P.E.
Branch Manager

MILWAUKEE, WI
LOS ANGELES, CA

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS
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CONSULTING SOIL AND FOUNDATION ENGINEERS
16021 ARMINTA STREET/VAN NUYS, CA 91406/ 818-997-1123

June 26, 1986

California Lubricants Ltd.
560 San Antonio Road
Suite 107
Palo Alto, California 94306

Attention: Mr. Bill Slautterback

Subject: Geotechnical Engineering Exploration and Analysis
Proposed Jiffy Lube
Castro Valley Boulevard and Stanton Avenue
Castro Valley, California
GEA Project No. C-860608

Dear Mr. Slautterback:

In compliance with your request, a geotechnical engineering exploration and analysis has been conducted for the above referenced project. Transmitted herewith are four (4) copies of the report. The conclusions and recommendations developed from the exploration and analysis are summarized below and discussed in detail in the accompanying report.

1. The proposed project site is presently paved with asphaltic concrete pavements and is vacant, but is understood to have been previously occupied by a service station facility complete with underground storage tanks and product piping. The soils encountered at the test boring locations generally indicate that the site is underlain by cohesive deposits with a moderate to high strength. Exception to this was noted in the approximate area of the old tank pit where up to 8½ feet of fill was encountered. The fill placed in the tank pit area was understood to have been tested by a geotechnical engineer and appears to exhibit relatively competent strength characteristics and be composed of non-deleterious materials. The strength characteristics exhibited by the existing deposits are generally indicative of relatively competent strength characteristic cohesive materials. The phreatic groundwater table is considered to exist at depths in excess of those penetrated during the field exploration.

2. The proposed site does not appear to present a significant fault rupture hazard, nor does liquefaction potential appear to be of

significant consideration in design. All foundations should however be designed in accordance with the Uniform Building Code and local requirements.

3. The most economical foundation system for the proposed structure is considered to consist of conventional spread footing foundations designed for moderate net allowable soil bearing pressures and founded immediately beneath the floor slabs of the proposed development. A conventional slab-on-grade type floor supported by the existing soils may be utilized in the planned building area. Design of below grade walls must take into consideration lateral stresses imposed by soil backfill and other surcharge loads referenced in the text of this report.

4. In order to minimize the potential for a damp lower level and excessive hydrostatic lateral pressures against the subgrade walls, ? a specialized system of footing drains and a sump sa crock located in the floor slab of the structure are recommended. The specialized drainage system must be drained by gravity or supplied with a pump and fail safe backup system to pump collected water from the sump area to adjacent drainage devices.

5. Free draining granular soil placed adjacent to subgrade walls is recommended to reduce lateral pressures resulting from soil backfill. further, some specialized compaction recommendations for fill placed adjacent to the subgrade walls are contained herein.

6. The trash corral may consist of either a rigid or a flexible type enclosure. Where a flexible type fence enclosure is planned, the most economical foundation system is considered to consist of a properly reinforced Portland Cement concrete pad designed to resist the impact loads of trash removal equipment. Where a relatively rigid masonry block structure is utilized for the trash enclosure, conventional spread footings or a monolithically poured foundation and floor slab may be utilized with the foundation designed for moderate allowable soil bearing pressures.

7. Foundations for a new pole sign, if required, may be designed as a conventional spread footing or drilled pier designed for moderate, net allowable soil bearing pressures and designed for overturning requirements.

8. Conventional granular base flexible asphaltic concrete pavements may be utilized where new pavements will be required. Portland Cement concrete pavements area, however, recommended in the most highly stressed areas of the site.

9. With the exception of backfill behind subgrade walls, the on-site soils may be reused for structural fill on this site. Some sorting may be required during construction. If construction is conducted during wet periods, granular fill may be required to reduce moisture related problems.

(10.) Subgrade petroleum storage tanks are understood to exist on this site. Petroleum odors were noted in some soil samples obtained from the tank pit backfill. A substantial risk of subgrade contamination is considered to exist as a result of the sites prior history and subgrade petroleum odors. A Preliminary Subgrade Contamination Assessment is recommended to be performed for this property in order to assess relative risks associated (with respect to contamination) with development of this site.

Very important

11. Site preparation and construction of the foundations, floor slabs, and pavements must be monitored by a qualified geotechnical engineer, especially considering the moisture sensitive near surface soils, somewhat specialized foundation recommendations for "basement" building areas, somewhat specialized recommendation for backfilled placement near subgrade walls and potential for existing subgrade contamination.

We appreciate the opportunity to be of service on this project. If we may be of additional assistance should geotechnical related problems occur or to provide inspection during construction, please do not hesitate to contact us at any time.

Very truly yours,

GILES ENGINEERING ASSOCIATES, INC.

Dean Sandri
KH

Dean Sandri, P.E.
Branch Manager
California Registration No. C039252

Terry L. Giles, P.E.
President
California Registration No. 32654

Enclosure: Report No. C-860608
cc: Jiffy Lube International
Attn: Mr. Jon Harvey
GEA585/kah

GEOTECHNICAL ENGINEERING EXPLORATION AND ANALYSIS

PROPOSED JIFFY LUBE
CASTRO VALLEY BOULEVARD AND STANTON AVENUE
CASTRO VALLEY, CALIFORNIA
GEA PROJECT NO. C-860608

INTRODUCTION

The scope of services for this project included a site reconnaissance, subsurface exploration, field testing, and geotechnical engineering analysis to provide criteria for preparing the foundation, floor slab, trash corral, sign, and pavement design for the proposed development.

SITE AND PROJECT DESCRIPTION

The site for the proposed project consists of a vacant rectangularly shaped tract of land situated in the northwestern quadrant in the intersection of Castro Valley Boulevard and Stanton Avenue, in Castro Valley, California. At the time of the subsurface exploration, the property was vacant and is understood to have been occupied by a service station with the approximate old building and underground storage tanks located as noted on the Boring Location Plan, Figure 1, which has been included in the Appendix of this report. The previously existing service station is understood to have been abandoned with the underground storage tanks removed and the tank pit excavation subsequently backfilled in November of 1983. Backfilling is understood to have been conducted by Bebco Paving Company with spot check testing of the backfill compaction conducted by Judd Hull and Associates of Hayward, California. Visual evidence of structure remains from the old service station were not noted during the field exploration, however portions of foundation, underground piping, and/or other subgrade structures may exist on the property. The surrounding topography may be described as very hilly with drainage generally directed toward the north. Drainage from the immediate site area is generally directed toward the southeast where surface runoff is collected by drainage devices located in the pavements. Structures noted in the vicinity of the subject property generally consist of one level relatively new frame and masonry type construction commercial developments which are considered to be in relatively good condition.

It should be noted that the proposed property is understood to be reduced in dimension by future widening of Castro Valley Boulevard. The approximate planned encroachments are indicated on the Boring Location Plan, Figure 1.

wood Above Ground - Stucco.

The proposed structure will generally consist of a 34 x 61 foot single-story masonry block structure with a truss type roof system and lower level extending 8± feet beneath the finished exterior elevations. The structure will be supported by a combination of interior and exterior bearing walls, while the main floor will consist of a composite concrete on steel decking supported by adjacent bearing walls and interior columns situated on either side of the service pit areas which are ultimately supported by combined isolated column footings. Maximum anticipated foundation loads are understood to be approximately 2,500 pounds per linear foot and 25 kips for walls and columns, respectively. The floor slab is assumed to carry a maximum design live load of approximately 100 psf.

Redo
load
calcs

The planned finished floor elevation noted on the preliminary site plan/survey prepared by William Glass and Associates is 171.1. The planned finished ground floor elevation is therefore understood to be approximately 7½ feet lower or at approximate El. 163.6±.

Specific traffic frequencies anticipated in the parking lot areas have not been specified. However, traffic frequencies assumed for the purpose of this report include approximately 1,000 light vehicles and five equivalent 18,000 pound single axle loads per day. If the actual traffic frequency and loadings differ from those presumed, Giles Engineering Associates should be contacted immediately to determine how such differences may affect the pavement design.

SUBSURFACE CONDITIONS

Six (6) soil test borings were drilled for this project. A copy of the Test Boring Logs (Record of Subsurface Exploration) and Boring Location Plan, Figure 1, is enclosed in the Appendix. the elevations shown on the test boring logs were interpolated from the contours shown on the Preliminary Site Plan prepared by William Glass and Associates, Architects and provided for use with this project. The elevations indicated on the test borings logs are, therefore presumed accurate to within 1.0± foot. The soil parameters indicating the engineering characteristics of the materials encountered in the test borings as determined by the field and laboratory testing are presented on the logs with the terms and symbols defined on the General Notes enclosed on the last page of the Appendix. All testing was performed in general accordance with ASTM and other applicable specifications.

The soils encountered in the test boring locations generally consist of 2 to 3 inches of asphaltic concrete over 3 to 4 inches of fine to coarse crushed stone aggregate base underlain by dark gray brown clay to silty clay exhibiting varying amounts of oxide staining and containing relatively minor amounts of fragmented weathered shale which was noted to the approximate 3± foot depth. The dark gray brown clay to silty clay was underlain by gray brown to yellow brown silty clay containing varied amounts of fine to coarse sand and/or very highly weathered fragmented shale noted to the approximate 8 (Boring No. 4) to 15 (Boring No. 3) foot depth. The soils encountered beneath the yellow brown deposits generally consist of brown to dark brown silty clay and very highly weathered shale containing occasional silty clay lenses. The brown to dark brown very highly weathered shale deposits were generally noted to extend from the point at which they were encountered (8 feet at Boring No. 4 and 13 feet at Boring Nos. 1 and 2) to the maximum depth explored (20 feet). An exception to the above was noted at Boring No. 3 and in the vicinity of the old tank pit area where up to 8½ feet of fill composed of silty clay, silt, coarse sand and gravel, asphalt, fragmented wood etc., was encountered. It should be noted that the soils obtained from the approximate 3 foot depth and extending to the approximate 8½ foot depth at Boring No. 3 contained slight to moderate petroleum odors. The soils encountered from the approximate 8½ foot depth to the boring termination depth of 15 feet at Boring No. 3 generally consist of tan to yellow brown silty clay containing varying amounts of fine to coarse fragmented weathered shale. It should further be noted that an obstruction was encountered at the approximate 8½ foot depth in Boring No. 3 thus necessitating boring offset and redrilling. The natural soils encountered at the test boring locations are considered to consist of a combination of residual deposits weathered from the underlying apparent bedrock, alluvial deposits resulting from geologically recent recession of the nearby bay, and colluvial deposits created as a result of gravitation deposition of weathered bedrock elements from higher elevation slopes. The cohesive soils encountered at the test boring locations generally exhibit stiff to very stiff comparative consistency with low to moderate plasticity.

Very important

what?

With the exception of Boring No. 2, free water was not noted at the test boring locations drilled during the field exploration. Free water was however encountered during drilling at a depth of approximately 8½ feet with the water level rising to the approximate 3 foot depth upon removal of the drilling tools from the boreholes. Determination of the phreatic groundwater table by observation of water elevation in open test borings drilled into cohesive materials similar to those encountered on the subject property is difficult, even after relatively long period of observation. Based on the water level observation in the open test borings drilled on this property in conjunction with soil coloration, relative permeability of the subgrade materials, and natural soil moisture content; the phreatic groundwater table is considered to exist at depths in excess of those penetrated during the field exploration. The water table is however considered to fluctuate with changes in seasonal moisture and precipitation and localized perched water zones may be encountered in relatively permeable seams underlain by less pervious materials. The free water encountered at Boring No. 2 is considered to represent perched moisture possibly trapped in the waste oil tank area and in a relatively permeable seam of the subgrade materials.

The above described subsurface conditions have been simplified somewhat for ease of report interpretation. A more detailed description of the subsurface conditions at the test boring locations are described on the Test Boring Logs enclosed in the Appendix.

CONCLUSIONS AND RECOMMENDATIONS

The conditions imposed by the proposed building, pavement, trash corral, and sign foundation have been evaluated on the basis of the engineering characteristics of the subsurface materials encountered in the borings and their anticipated behavior both during and after construction. The conclusions and recommendations for building, sign, and trash corral foundation, building and trash corral floor slab, and pavement design along with construction considerations and site preparation requirements are discussed in the following sections of this report.

Site Development Considerations

The proposed site is underlain by relatively competent strength characteristic cohesive deposits exhibiting a variable plasticity and weathered shale content. Further, a phreatic groundwater table is considered to exist below the depths penetrated by the field exploration but may be perched at higher elevations such as that noted at Boring No. 1. Based on the conditions encountered at the test boring locations, the most economical foundation system for the proposed structure is considered to consist of conventional spread footing foundations designed for moderate, net allowable bearing pressures and supported in the existing natural soil deposits. Some special precautions will be required to minimize lateral pressures on lower level subgrade walls and to ensure that tolerable surcharge loads are maintained. Foundation drains will also be required to prevent build-up of excessive hydrostatic pressures from developing against lower level walls.

The existing pavements generally appear to be in relatively poor condition and are therefore not considered suitable for reuse with this development. However, new flexible asphaltic concrete pavements with a granular base may be utilized on this site. Portland Cement concrete pavements are recommended for the most highly stressed areas of the site.

Underground Storage Tank Removal

Underground storage tanks are understood to have occupied this site but were removed in 1983. The tank pit area was backfilled with the compaction of the material tested by Judd Hull and Associates. However, based on the Judd Hull and Associates letter of November 15, 1983, the excavation was not visually inspected nor was full time density control imposed during the tank pit backfill process. Specific information with respect to the visual appearance of the tank pit excavation and/or potential for prior product releases (and hence existing subgrade contamination) is not available to date. It should be noted however that soil samples obtained from the approximate 3 to 8½ foot depth of Boring No. 3 (tank pit area) contained slight to moderate petroleum odors which may be indicative of limited subgrade contamination on this property. The soils samples beneath the

This should be followed on prior to close of Escrow.

the planned pavement surface elevation. Subsequent to proper site preparation and stripping as recommended above, the areas planned for paving must be proofrolled in order to detect soft, yielding or otherwise deleterious soil areas which must be removed to a stable subgrade. Lower level building areas may also be excavated to the planned subgrade elevation complete with isolated footings and wall foundation trenches being excavated into the natural soils. Excavation of the lower building area is anticipated to encounter some relatively stiff/very stiff cohesive deposits containing varying amounts of weathered shale. The soils encountered during the lower level structure excavation phases are not anticipated to create excavating problems; however, due to the relative density of some of the subgrade materials, some extra excavating time and expense may be required. Only limited caving and sluffing of excavation side slopes are anticipated, but will depend substantially on subgrade moisture conditions, perched water, length of time the excavation is left open, and excavation equipment utilized. Flattening of embankment slopes or widening of excavations may be required and should be anticipated in lieu of expensive sheeting, bracing, or other specialized and maintenance stabilization methods. Specific shoring, bracing, or other embankment stability recommendations are considered beyond the scope of services authorized for this exploration. If specialized embankment stabilization recommendations are required prior to or during construction, the soils consultant would be available for consultation. Some limited zones of perched moisture may also be encountered during foundation excavation. Where perched water is encountered, pumping from sumps excavated in lower level areas is anticipated to provide acceptable de-watering results. Where moisture infiltration is considered to be severe, the soils consultant must be contacted for appropriate treatment recommendations.

Note)

Note

H2O problem.

Subsequent to proper site preparation as discussed above, low areas may be raised with a structural fill placed and compacted under engineering controlled conditions in accordance with the specifications enclosed in the Appendix of this report (Modified Proctor Procedures). Special care must be utilized in maintaining positive drainage from the property in order to minimize potential for excessive moisture infiltration as a result of precipitation during construction. Minimization of moisture infiltration and subgrade deterioration can be accomplished by leaving the existing pavements in-place for as long as possible in order that they may serve as a working mat for construction vehicles.

The cohesive soils encountered on this site are considered to be moisture sensitive and may be difficult to compact if permitted to increase in moisture content. Some compaction related problems and construction equipment mobilization difficulties should be anticipated where the existing near surface materials are permitted to become wet. Modification of the subgrade with crushed stone or cement or removal and/or adjustment to the specified compaction requirements may be necessary if the subgrade soils become saturated during construction. Where moisture related problems occur, it is recommended that the soils consultant be contacted for appropriate remedial treatment measures.

Note

Foundation Design Parameters

The soils encountered at the test boring locations generally indicate relatively competent strength characteristics at the presumed foundation bearing subgrade elevations. The most economical method of structure support is therefore considered to consist of conventional wall and column type spread footing foundations designed for moderate, net allowable soil bearing pressures supported by existing suitable bearing materials anticipated to be present immediately beneath the planned floor elevation. Design of subgrade walls must take into consideration the effect of imposed surcharge pressures induced by vehicle traffic and lateral pressures exerted by compacted soil backfill.

Wood walls or Block walls loads

A maximum, net allowable soil bearing pressure of 4,500 psf may be utilized in dimensioning foundations constructed in the lower level area of the planned development. Lower allowable soil bearing pressures are also considered suitable for use on this site provided that all foundations are supported by suitable bearing soils as recommended herein.

Following proper site preparation as outlined in the preceding section of this report and the enclosed specifications, suitable bearing soils are anticipated to be present immediately beneath the planned lower level floor slab elevation. Minimum thickened foundation widths for walls and columns should be 14 and 24 inches, respectively for strength considerations. Standard longitudinal reinforcing steel is considered suitable.

Note

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Suitable soils for support of a foundation system designed for a 4,500 psf bearing pressure and/or structural fill used to support a 4,500 psf foundation bearing pressure must have at least a stiff comparative consistency (qu greater than or equal to 2.2 tsf) for cohesive soils. The foundation bearing surfaces must be tested and inspected at the time of construction by a qualified geotechnical engineer in order to ensure that the foundations will perform as intended. If unsuitable bearing soils are encountered at the proposed subgrade elevation, they must be removed to a suitable bearing subgrade and throughout the foundation influence zone defined by Item No. 3 of the enclosed specifications and the excavation backfilled with structural fill or the foundations may be extended by thickening the footing pad. Backfilling with on-site or imported soils containing a high silt or clay content may result in compaction control problems if wet weather is encountered. Utilization of imported granular soils will aid in minimizing compaction problems as a result moisture fluctuations and is, therefore recommended. Some sorting of on-site soils may be required if on-site materials will be used for structural fill. All structural fill must be selected in accordance with the requirements set

Import materials 1st ?

forth in Item No. 2 of the enclosed specifications and must be approved by the soils consultant prior to fill placement. The most desirable method of establishing foundation support should be determined by a qualified geotechnical engineer at the time of construction if unsuitable bearing soils are encountered at the planned foundation bearing elevation.

The proposed foundation planned for lower level areas will exceed "minimum depth" requirements, however, where near surface "non-basement" area foundations may be required, they must extend at least 18 inches beneath the adjacent exterior grades. All foundations must be supported by suitable bearing soils as recommended by this report.

18" to 24"

Post-construction total and differential settlements of a foundation system designed and constructed in accordance with the enclosed recommendations are estimated to be less than 1.0 and 0.5 inches, respectively, which is considered within tolerable limits for the proposed structure.

Floor Slab Design Parameters

After the site has been prepared in accordance with the recommendations contained in the Site Preparation Requirements section of this report and the foundation or other excavations backfilled with structural compacted fill in accordance with the enclosed specifications, the floor areas may be designed as conventional slab-on-grade supported by the existing suitable bearing soils. If desired, the floor slabs may be poured monolithically with the perimeter foundations and/or separated and designed as separate units. The floor slab must be suitable reinforced and supported by a typical 6 to 8 inch compacted uniformly graded well draining, clean granular base placed on the suitably prepared existing subgrade soils. A polyvinyl sheet should be placed immediately below the floor slabs to serve as a vapor barrier. If the materials underlying the polyvinyl sheet contain sharp, angular particles, a cushion layer of sand approximately 2 inches thick should be provided to protect it from puncture.

(option)

Specialized de-watering systems for lower level floor areas are not anticipated to be required on this site. However, it is recommended that a sump crock be utilized in the lower level floor slab area for the purpose of collecting free moisture which may accumulate in the lower level area or beneath the lower level floor slabs. The sump crock must be constructed so as to provide a continuous drainage medium between the underfloor granular base and sump crock backfill. further, moisture which is accumulated in the sump crock must be removed from the building area by pumping from the sump or gravity drainage to suitable discharge areas. If the drainage of accumulated moisture from the sump crock will require utilization of pumping devices, a failsafe type backup system must be incorporated in the sump system in order to ensure continued safe operation during power outages and/or primary unit malfunctions.

With proper site preparation and inspection, the post-construction total and differential settlement of the floor slabs constructed as recommended is estimated to be less than 0.5 and 0.3 inches, respectively, which is considered within tolerable limits for the proposed structure.

Below Grade Walls

The hydrostatic water table was not noted within the depths penetrated during the field exploration. However, due to the relatively low permeability of the fine grained soils encountered on this site and to eliminate excessive hydrostatic pressure build-up against the subgrade walls, a drainage blanket placed adjacent to subgrade walls in conjunction with a permanent subdrainage system around the exterior lower level foundations which is connected to a system of sumps and/or gravity drains which will direct water away from the foundation areas of the proposed construction is recommended. Subgrade walls must be designed for an equivalent fluid pressure of at least 55 psf per lineal foot with a minimum subgrade wall height of 7 feet. In order to lessen the lateral earth pressure against the exterior below grade walls and allow for drainage to minimize the potential for damp walls, backfill adjacent to the exterior walls should consist of at least a 24 inch wide layer of free draining granular material, such as clean sand and gravel. The sand and gravel drainage layer should be continuous to the perimeter foundation drains with proper damp proofing applications applied to subgrade walls and a minimum 12 inch surficial clay cap sloped away from the structure to prevent surface water intrusion. The on-site soils contain a very high silt and clay content and are therefore not considered suitable for subgrade wall backfill. A granular imported soil will be required to construct the drainage blanket behind lower level subgrade walls. Standard poured concrete walls and/or properly reinforced masonry block walls are considered suitable with appropriate basement backfill and subdrain systems implemented. If on-site soils containing a substantial percentage of silt and clay is used, a geodrain may be used for damp-proofing and wall drainage. The specific geodrain which may be used must be approved by the soils consultant prior to use and applied in accordance with the manufacturer's specifications. If well draining materials are not used in backfilling the basement wall excavations, the lateral earth pressures recommended above must be adjusted to reflect the increased lateral earth pressures imposed.

Basement

Utilization of retaining walls to make grade transitions on this site were not indicated in the information provided for this project and area, therefore not anticipated. If retaining walls will be utilized on this site, the soils consultant should be notified in order that appropriate recommendations may be formulated.

The soils utilized to backfill excavations adjacent to below grade walls must be very carefully placed and compacted to ensure that they do not induce excessive locked-in lateral compaction pressure during and after placement. All backfill placed within a distance of approximately 5 feet of the wall should be compacted using light hand compaction equipment. Where settlement of the backfill is not critical, backfill material may be compacted to an in-place density of between 80 and 85 percent of the maximum dry density as determined by the Modified Proctor Method (ASTM D-1557) and should be overfilled such that settlement does not result in drainage toward the building. Backfill beneath areas where settlement is critical (sidewalks and pavement) must be compacted to greater than 85 percent but less than 90 percent of the Modified Proctor maximum density. Specific compaction requirements for the backfill material can be provided when the actual materials to be used and the type of construction and de-watering have been defined.

Standard poured concrete walls are considered suitable with the recommended subdrainage system, however additional reinforcing may be required with conventional masonry block walls. The final design of the walls should however be determined by a qualified structural engineer and conducted in accordance with the Uniform Building Code and/or local governing requirements.

Trash Corral Design Parameters

The proposed trash corral will be located in the vicinity of Test Boring No. 4. The subsoils encountered at Test boring No. 4 generally consist of soils similar to those encountered elsewhere on this site which appear to be representative of relatively competent strength characteristic materials.

The trash enclosure is understood to consist of either a flexible wooden fence type structure or a relatively rigid masonry block enclosure. A flexible, very light weight trash enclosure is not considered to impose significant loads to the underlying soil and therefore, a conventional bearing capacity analysis is not considered to be applicable, but will require design against impact loads imposed by trash removal equipment. The more rigid masonry block type enclosure will be somewhat sensitive to minor settlements and will, therefore require a conventional bearing capacity analysis.

Where a flexible type enclosure is planned, a minimum 6 inch thick properly reinforced and air-entrained 3,000 psi compressive strength concrete slab supported on a 4 to 6 inch aggregate base and properly prepared subgrade may be utilized. If a rigid masonry block enclosure is planned, conventional shallow depth perimeter spread footings or a monolithically poured foundation and floor slab with edges thickened to 12 inches for wall support may be utilized. The floor slab for the rigid type enclosure should be similar to that described above with the foundation areas supporting the perimeter walls designed for a maximum, net allowable soil bearing pressure of 3,500 psf and founded at least 18 inches beneath the adjacent exterior grade.

Sign Design Parameters N/A

Plans for a new pole sign were not noted on the information supplied for use with this project. However, preliminary sign foundation recommendations have been formulated and based on soil parameters as noted as the test boring locations drilled elsewhere on the property.

The structural details and loading requirements of a pole sign which may be constructed on this site were not known at the time of this report. Therefore, only preliminary foundation design parameters can be provided. However, the conventional sign is understood to typically be supported by a conventional square footing or shallow drilled pier extending about 4 to 6 feet below the adjacent grade and designed for overturning resistance.

The most economical foundation system for the proposed sign is considered to consist of either conventional spread footings or a shallow drilled pier dimensioned for a net allowable soil bearing pressure of 4,000 psf and founded in suitable bearing soils as recommended previously in this report. Utilization of casing may be required in a drilled pier excavation where perched water conditions may be encountered. Specific embankment stability problems and/or perched water problems are not however anticipated in sign foundation excavations.

Pavement Design Parameters

Subgrade preparation in areas planned for new pavements should be performed as described in the Site Preparation Requirements section of this report. After preparation, exposed subgrade areas are anticipated to generally consist of a silty clay and clay. Soils similar to those encountered near the surface of the site generally exhibit pavement support characteristics equivalent to R-values ranging from 8 to 25 based on the Unified Soil Classification of CL-CH. Since the least R-value soils must be utilized to determine the support characteristics of the subgrade soils and hence, the pavement design, an R-value of 8 was used for pavement design. In order to use this R-value, all fill added to the site must have pavement support characteristics at least equivalent to the existing soils, and must be placed and compacted in accordance with the enclosed specifications.

The underground storage tanks are understood to have been removed in 1983. The tank pit was subsequently backfilled and several density tests were performed in the backfill material. However, preparation of the tank pit excavation and/or field fill compaction control was not imposed during backfill placement. Some variation in soil type and density may therefore

compaction Testing

exist in the recently placed fill. However, the test boring drilled into the recent backfill appears to indicate relatively competent strength characteristic soils. Complete removal and replacement with structural fill is therefore not considered necessary for the soils existing in the tank pit area provided that a limited risk of future maintenance can be tolerated. Acceptance of a limited risk of future pavement maintenance in existing potentially variable strength characteristics fill deposits is considered more economical than complete removal of fill and replacement with structural compacted fill.

The following table is presented to indicate the thicknesses for new conventional asphaltic concrete pavements. The table also includes appropriate state highway specifications to ensure that proper materials are used.

Asphaltic Concrete Pavement Section Thickness (inches)

Materials	New Pavement Areas	California DOT Specifications
Asphaltic Concrete Surface Course	1	Section 39, 3/8 Inch Maximum
Asphaltic Concrete Binder Course	1½	Section 39, 3/4 Inch Maximum Medium
Crushed Aggregate Base Course	6	Section 26, 3/4 Inch Maximum

concrete
2½ ASP.
6 B.R.

Pavement recommendations assume proper drainage and construction inspection and are based on AASHTO design parameters for a 10 year period.

Areas of the site which will be subjected to relatively high vehicular stresses such as entrances and exits of the service bays and in front of the trash enclosure should be paved with a Portland Cement concrete pavement similar to that recommended for the trash corral area. Utilization of Portland Cement concrete pavements in these areas will minimize future maintenance requirements.

Construction and Other Design Considerations

The water tale was considered to be below the depths planned for construction related excavations, but may become trapped at shallower depths.

If water is encountered, filtered sump pumps placed in the bottoms of excavations or other conventional de-watering methods are anticipated to be adequate, with the anticipated shallow excavations.

Berm.

Foundation excavation and general site stripping will expose predominately clayey soils which contain varying quantities of granular materials. The fine grained soils may soften and increase in settlement characteristics if permitted to be exposed to free moisture. The site should therefore be graded to prevent ponding and surface water from running into excavations. Foundation and floor slab concrete should be poured as soon as possible after excavation with all trenches backfilled immediately after the concrete has set up. Softened or excessively wet soils should be dried and recompacted and/or removed and replaced with a structural fill that has been placed and compacted in accordance with the enclosed specifications.

dike Around Excavation

If the soils which contain a relatively high percentage of fine materials become wet or increase in moisture content, they may become unstable and lose shear resistance. Modification with cement or a crushed stone working mat may be required. The soils consultant would be available for appropriate recommendations at the time of construction, if required.

With the exception of the areas described in the Below Grade Walls section of this report, the on-site soils may be reused as structural compacted fill for foundation, floor slab, and pavement support provided they do not contain significant organic content. Due to the variable cohesive character, some sorting of on-site soils used for backfill may be required. On-site soils which have a relatively high silt and clay content must be placed and compacted within a narrow range of the optimum moisture content to obtain proper compaction characteristics. Some construction problems during wet periods and in wet excavations should also be anticipated with these soils. If construction is carried out during wet periods, utilization of granular backfill may be desirable and will reduce moisture related problems.

Note.

Some excavation bank stability problems may be encountered in steep, unbraced excavations due to perched water in the subsoil structure. The excavations may possibly be widened in anticipation of instability in lieu of bracing.

The subject property had been occupied by a service station and associated pavements, pump islands, and underground petroleum storage tanks. A potential for subgrade contamination is considered to exist on this site which may lead to additional development time and expenses associated with clean-up/treatment of the existing contamination. Appropriate allowances in the project budget must, therefore be made for this site.

Development of the proposed site entails some soil and foundation oriented problems, especially with respect to the moisture sensitive soils,

Note ?

somewhat critical foundation design/construction recommendations, relatively high net allowable soil bearing pressures, construction of below grade walls and potential for petroleum contamination. Further, grading problems should be anticipated if carried out during wet weather. The recommendations presented in this report are, therefore predicted upon site preparation, foundation, floor slab, and pavement construction inspected under the supervision of the soils consultant.

GENERAL COMMENTS

The soil samples obtained during the subsurface exploration will be retained for a period of thirty (30) days. If no instructions are received, they will be disposed of at that time.

This report has been prepared in order to aid in the evaluation of this property and to assist the architects and engineers in the structural design. It is intended for use with regard to the specific project discussed herein and any substantial changes in the building, loads, locations, or assumed grades should be brought to our attention so that we may determine how such changes may affect our conclusions and recommendations. We would appreciate the opportunity to review the plans and specifications for the foundation and floor construction to ensure that our conclusions and recommendations are interpreted correctly.

The analysis of this site was based on a subsoil profile interpolated from a limited subsurface exploration. If the actual conditions encountered during construction vary from those indicated by the borings, we must be contacted immediately to determine if the conditions alter our recommendations.

The conclusions and recommendations presented in this report have been promulgated in accordance with generally accepted professional engineering practice in the field of foundation engineering, soil mechanics and engineering geology.

APPENDIX

The boring logs and related information enclosed in the appendix depict subsurface conditions only at the specific locations drilled and at the particular times designated on the logs. Soil conditions at other locations may differ from conditions occurring at these boring locations. Also the passage of time may result in a change in the soil conditions at the boring locations drilled.

SPECIFICATIONS FOR SUBGRADE AND GRADE PREPARATION FOR FILL, FOUNDATIONS, FLOOR SLABS, AND PAVEMENT SUPPORT; AND SELECTION, PLACEMENT AND COMPACTION OF FILL SOILS USING MODIFIED PROCTOR PROCEDURES

1. Inspection and testing of subgrades and grades for fill, foundation, floor slab and pavement; and fill selection, placement and compaction shall be performed under the supervision of an experienced soils engineer.

2. All subgrades and grades shall consist of and be (a) underlain by suitable bearing material, (b) free of all organic, frozen, or other deleterious material, and (c) inspected and approved by qualified engineering personnel under the supervision of an experienced soils engineer. Preparation of subgrades after stripping vegetation, organic or other unsuitable materials shall consist of (a) proof-rolling to detect soft, wet, yielding soils or other unstable materials that must be undercut, (b) scarifying top 6 to 8 inches, and (c) recompaction to same minimum in-situ density required for similar materials indicated under item 5. *Note:* Compaction requirements for pavement subgrade higher than other areas.

3. In undercut and fill areas, the compacted fill must extend (a) a minimum 1 foot beyond the edge of the foundation or pavement at grade and down to compacted fill subgrade on a maximum 2(V):1(H) slope, (b) 1 foot above footing grade outside the building, and (c) to floor subgrade inside the building. Fill shall be placed and compacted on a maximum 1(V):5(H) slope or must be stepped or benched as required to flatten if not specifically approved by qualified personnel under the direction of an experienced soils engineer.

4. The compacted fill materials shall be free of deleterious, organic or frozen matter, and shall have a maximum Liquid Limit (ASTM D-423) and Plasticity Index (ASTM D-424) of 30 and 10, respectively, unless specifically tested and found to have low expansive properties and approved by an experienced soils engineer. The top 12 inches of compacted fill should have a maximum 3 inch particle diameter and all underlying compacted fill a maximum 6 inch diameter unless specifically approved by an experienced soils engineer. All fill material must be tested and approved under the direction and supervision of an experienced soils engineer prior to placement. If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean GW, GP, SW or SP per Unified Soil Classification System (ASTM D-2487).

5. The density of the structural compacted fill and scarified subgrade and grades shall not be less than 90 and 95 percent of the maximum dry density as determined by Modified Proctor (ASTM D-1557) for cohesive and granular materials, respectively, with the exception of the top 12 inches of pavement subgrade which shall have a minimum in-situ density of 95 and 100 percent of maximum dry density for cohesive and granular soils, respectively, or 5 percent higher than underlying fill materials. The moisture content of cohesive soil shall not vary by more than –1 to +3 percent and granular soil ±3 percent of optimum when placed and compacted or recompacted. The fill shall be placed in layers with a maximum loose thickness of 8 inches for foundations and 10 inches for floor slabs and pavements unless specifically approved by a qualified soils engineer taking into consideration the type of materials and compaction equipment being used. The compaction equipment must be approved by personnel under the direction of a qualified soils engineer who is also performing the inspection of fill placement and compaction to ensure that it is suitable for the type of materials being compacted. Under no circumstances may bulldozers or similar tracked vehicles be used for compaction equipment.

6. Excavation, filling, subgrade and grade preparation shall be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working platform. Springs or water seepage encountered during grading/foundation construction must be called to the soil engineer's attention immediately, for possible revision or inclusion of an underdrain system.

7. Non-structural fill adjacent to structural fill shall be placed in unison to provide lateral support. Backfill along building walls must be placed and compacted with care to ensure excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls (i.e. basement walls and retaining walls) must be properly tested and approved by an experienced soils engineer with consideration for the lateral earth pressure used in the wall design.

Appears to be top 4 to 5 FT of Soil - could be 44 cubic yards

W 30 x 46 L X 4 FT. H.

approximate 8½ foot depth in Boring No. 3 did not appear to exhibit petroleum odors. However, since substantial costs may be associated with clean-up of contaminated soils, it is recommended that a Preliminary Subgrade Contamination Assessment be conducted by the soils consultant prior to formulization of the purchase/lease agreements in order to ensure a relatively low risk of contamination related problems subsequent to purchase/lease of the proposed site. The scope of services for a Preliminary Subgrade Contamination Assessment must be determined on local and state requirements, and would therefore be addressed under separate cover and conducted in accordance with regional requirements.

Seismic Design Considerations

Research of the available geologic information indicates the proposed site is located immediately to the east of mapped fault traces of the Hayward Fault Zone. The site is also situated within several miles of the Calaveras Fault Zone. Both fault zones have experienced movement in the last 200 years and are therefore considered to be active. The subject property is therefore located in an area of Southern California which is considered to be subject to lateral ground accelerations induced by seismic activity.

Northern CA.

The site is however not located in an area designated for special studies under the Alquist-Priolo Special Study Act of 1972 and does not, therefore, appear to represent a significant potential for fault rupture hazard.

North or South study?

The subgrade soils encountered on this site generally consist of cohesive soil deposits which are not considered to be susceptible to liquefaction under seismic loading. Specific structural design procedures with respect to soil liquefaction on this property are therefore not considered to be required.

The site is situated in a potentially active seismic zone of Southern California and may be subject to lateral accelerations and moderate ground shaking during a seismic event. All foundation designs must, therefore be performed in accordance with the Uniform Building code and governing local regulations.

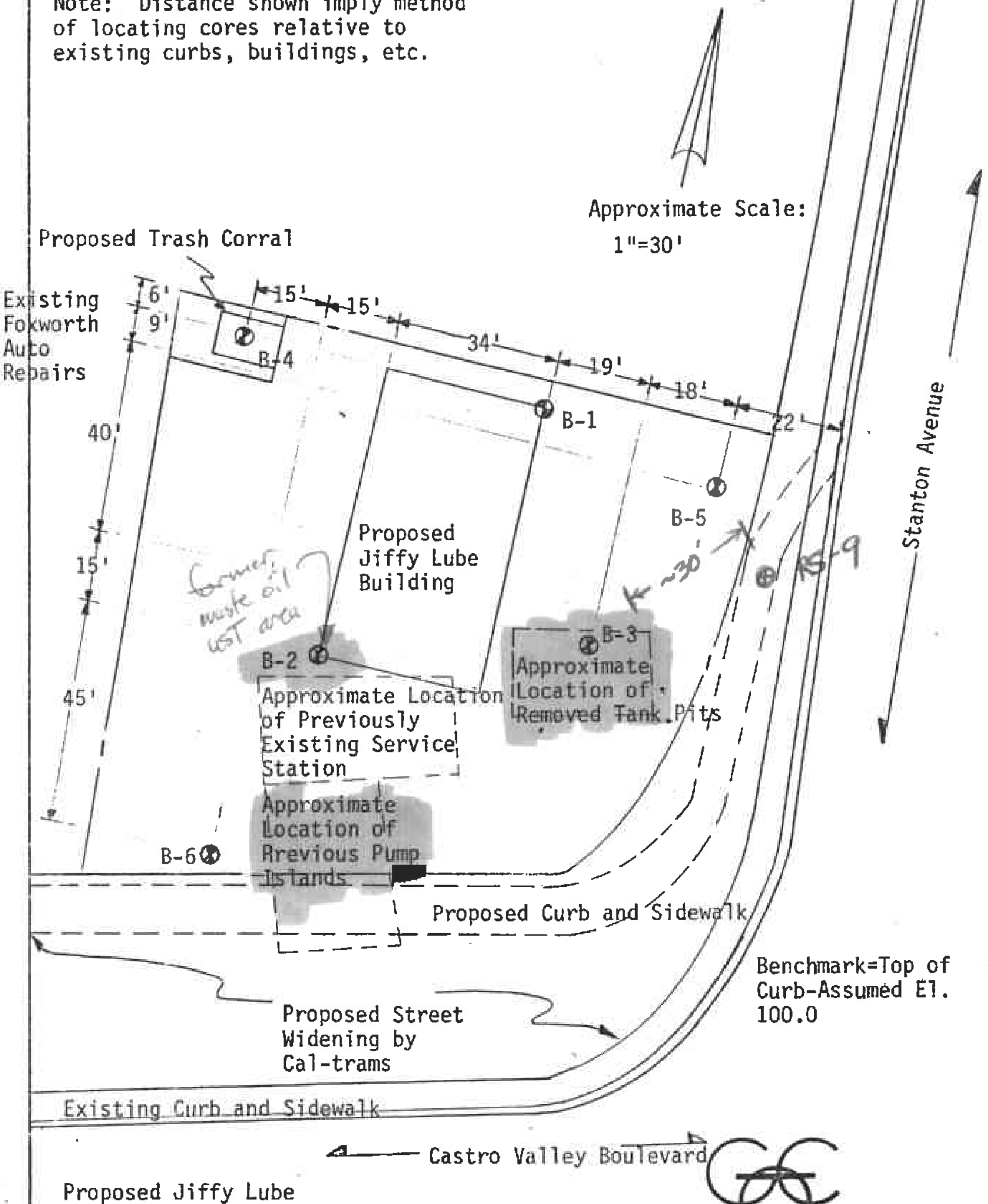
— what North.

Site Preparation Requirements

note.

Site preparation for this site must consist of stripping the existing pavements and excessively organic deposits which may be encountered in the planned building and pavement areas. Further, existing subgrade utility lines, product dispensing lines, or underground storage tanks not abandoned during prior tank removal must be removed in accordance with local and state guidelines. Further, where foundations are encountered within the planned pavement areas, they must be removed to a depth of at least 12 inches beneath

Note: Distance shown imply method of locating cores relative to existing curbs, buildings, etc.



Proposed Jiffy Lube
Castro Valley, California
GEA Project No. C-860608

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS

FIGURE 1
BORING LOCATION PLAN

RECORD OF SUBSURFACE EXPLORATION

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS

BORING NO. B-1

GEA PROJECT NO. C-860608

DATE 6/23/86

FIELD REPRESENTATIVE Kevin Sheridan

PROJECT
Proposed Jiffy Lube
Castro Valley, California

DESCRIPTION Ground Surface Elevation 169.5±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	15					
Gray Brown to Gray Silty Clay, little fine to coarse Sand-Moist	5'	3-SS	14					
Yellow Brown to Tan Silty Clay-Moist		4-SS	19					
	10'	5-SS	23					
Brown to Dark Brown very highly Weathered Shale, occasional Silty Clay layer-Moist	15'	6-SS	55					
Brown Silty Clay, little fine to coarse weathered Shale Fragments(Very highly Weathered Shale)-Moist	20'	7-SS	41					
Boring Terminated At 20'								Caved and dry at completion
Note A: 3"± Asphalt, 3"± fine to coarse Crushed Stone Base-Damp	25'							
Note B: Dark Gray Brown Clay to Clayey Silt, little medium Sand (Weathered Shale Fragments), trace Oxide Staining-Moist	30'							
	35'							
	40'							
	45'							

▽ Water encountered at ____ft. while drilling

▼ Water at ____ft. at completion

▼ Water at ____ft. after ____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.

RECORD OF SUBSURFACE EXPLORATION

Giles Engineering Associates, Inc.
Consulting Soil and Foundation Engineers

BORING NO. [redacted]

GEA PROJECT NO. C-860608

DATE 6/23/86

FIELD REPRESENTATIVE Kevin Sheridan

PROJECT Proposed Jiffy Lube

Castro Valley, California

DESCRIPTION Ground Surface Elevation 170.8±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	13					▼
Yellow Brown to Tan Silty Clay, little fine to coarse Fragmented Shale-Moist	5'	3-SS	21					
Yellow Brown to Tan Silty Clay-Very Moist		4-SS	18					Perched water from 8½ to 10 feet
Yellow Brown to Tan Silty Clay, little fine to coarse Fragmented Shale-Very Moist	10'	5-SS	24					▽
Brown to Dark Brown very highly Weathered Shale, occasional Silty Clay layer-Moist	15'	6-SS	82					
Dark Gray to Brown very highly weathered and Silty Clay-Moist		7-SS	50/5"					
Boring Terminated At 19'	20'							
	25'							
	30'							
	35'							
	40'							
	45'							

Note A: 3"± Asphalt, 4"± fine to coarse Crushed Stone Aggregate-Damp

Note B: Dark Gray Brown Clay to Clayey Silt, little medium Sand (Weathered Shale Fragments), trace Oxide Staining-Moist

▽ Water encountered at ____ft. while drilling

▼ Water at ____ft. at completion

▼ Water at ____ft. after ____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.

RECORD OF SUBSURFACE EXPLORATION

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS

BORING NO. [redacted]
GEA PROJECT NO. C-860608
DATE 6/23/86
FIELD REPRESENTATIVE Kevin Sheridan
PROJECT Proposed Jiffy Lube
Castro Valley, California

DESCRIPTION Ground Surface Elevation 169.3±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	25					
Dark Gray Silty Clay, little fine to coarse Sand, trace Asphalt(slight to moderate Petroleum Odor)(FILL)-Moist	5'	3-SS	16					
		4-SS	12					
		5-AU	--					
Tan to Yellow Brown Silty Clay, little fine to coarse Weathered Shale Fragments-Moist	10'	6-SS	9					
	15'	7-SS	60					▨
Boring Terminated At 15'								Caved and dry at completion

Note A: 12"± Coarse Sand and Gravel, occasional Cobbles and Boulders-Damp

Note B: Brown Silty Clay and Silt, little coarse Sand and Gravel, trace Asphalt, trace Wood Fragments(FILL)-Moist

*Possible obstruction at 8½' depth, Boring offset 8 feet north to location indicated on Figure 1

20' 25' 30' 35' 40' 45'

▽ Water encountered at ____ft. while drilling
▼ Water at ____ft. at completion
▼ Water at ____ft. after ____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.

RECORD OF SUBSURFACE EXPLORATION

Giles Engineering Associates, Inc.
Consulting Soil and Foundation Engineers

BORING NO. B-4	GEA PROJECT NO. C-860608
DATE 6/23/86	FIELD REPRESENTATIVE C-860608
PROJECT Proposed Jiffy Lube Castro Valley, California	

DESCRIPTION Ground Surface Elevation 172.0±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	12					
Gray Brown to Gray Silty Clay, little fine to coarse Sand-Moist	5'	3-SS	15					
Yellow Brown to Tan Silty Clay-Moist		4-SS	14					
Brown Silt and Silty Clay, some layered very highly Weathered Shale-Moist	10'	5-SS	40					
Boring Terminated At 10'								Caved and dry at completion
Note A: 2"± Asphalt, 3"± fine to coarse Crushed Stone Base-Damp	15'							
Note B: Dark Gray Brown Clay to Clayey Silt, little medium Sand (Weathered Shale Fragments), trace Oxide Staining-Moist	20'							
	25'							
	30'							
	35'							
	40'							
	45'							

▽ Water encountered at _____ft. while drilling

▼ Water at _____ft. at completion

▼ Water at _____ft. after _____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.

RECORD OF SUBSURFACE EXPLORATION

Giles Engineering Associates, Inc.
Consulting Soil and Foundation Engineers

BORING NO. B-5

GEA PROJECT NO. C-860608

DATE 6/23/86

FIELD REPRESENTATIVE Kevin Sheridan

PROJECT Proposed Jiffy Lube
Castro Valley, California

DESCRIPTION Ground Surface Elevation 168.0±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	15					
Gray Brown to Gray Silty Clay, little fine to coarse Sand-Moist	5'	3-SS	12					
Boring Terminated At 5'								Caved and dry at completion
Note A: 2½"± Asphalt, 3"± fine to coarse Crushed Stone Base-Damp	10'							
Note B: Dark Gray Brown Clay to Clayey Silt, little medium Sand (Weathered Shale Fragments), trace Oxide Staining-Moist	15'							
	20'							
	25'							
	30'							
	35'							
	40'							
	45'							

▽ Water encountered at ____ft. while drilling

▼ Water at ____ ft. at completion

▼ Water at ____ ft. after ____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.

RECORD OF SUBSURFA EXPLORATION

GILES ENGINEERING ASSOCIATES, INC.
CONSULTING SOIL AND FOUNDATION ENGINEERS

BORING NO. B-6	**GEA PROJECT NO.** C-860608
DATE 6/23/86	**FIELD REPRESENTATIVE** Kevin Sheridan
PROJECT Proposed Jiffy Lube Castro Valley, California	

DESCRIPTION Ground Surface Elevation 171.5±	Depth Below Surface	Sample No. & Type	N	q_u	q_p	q_s	w	REMARKS
Note A		1-AU	--					
Note B		2-SS	17					
Gray Brown to Gray Silty Clay, little fine to coarse Sand-Moist	5'	3-SS	21					
Boring Terminated At 5'								Caved and dry at completion
Note A: 2½"± Asphalt, 4"± fine to coarse Crushed Stone Aggregate-Damp	10'							
Note B: Dark Gray Brown Clay to Clayey Silt, little medium Sand (Weathered Shale Fragments), trace Oxide Staining-Moist	15'							
	20'							
	25'							
	30'							
	35'							
	40'							
	45'							

▽ Water encountered at ____ft. while drilling
▼ Water at ____ft. at completion
▼ Water at ____ft. after ____hours

Changes of strata indicated by the lines are approximate boundary between soil types. The actual transition may be gradual and may vary considerably between boring locations. Dashed lines should be interpreted as more approximate than solid lines.