GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED NEW CAR DEALERSHIP
2050 AND 2080 NW LOUISIANA AVENUE
CHEHALIS, WASHINGTON

PROJECT NO. 062-21008
APRIL 13, 2021

Prepared for:

RB ENGINEERING
ATTN: MR. ROBERT BALMELLI
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Prepared by:

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GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION MATERIALS TESTING & INSPECTION

April 13, 2021 KA Project No. 062-21005

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Reference: **Geotechnical Engineering Investigation**
Proposed New Car Dealership
2050 and 2080 NW Louisiana Avenue
Chehalis, Washington

Dear Mr. Balmelli,

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the referenced site. The results of our investigation are presented in the attached report.

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

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Theresa R. Nunan
Project Manager

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INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed New Car Dealership project located at 2050 and 2080 NW Louisiana Avenue in Chehalis, Washington, as shown on the Vicinity Map in Figure 1. Discussions regarding site conditions are presented in this report, together with conclusions and recommendations pertaining to site preparation, excavations, foundations, structural fill, utility trench backfill, concrete slabs and exterior flatwork, drainage, erosion control, and pavements.

A site plan showing the approximate locations of the exploratory test pits is presented following the text of this report in Figure 2. A description of the field investigation and laboratory testing, as well as the exploratory test pit logs, are presented in Appendix A. Appendix B contains a guide to aid in the development of earthwork specifications. Pavement design guidelines are presented in Appendix C. The recommendations in the main text of the report have precedence over the more general specifications in the appendices.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the subsurface soil and groundwater conditions at the site, to develop geotechnical engineering recommendations for use in design of specific construction elements, and to provide criteria for site preparation and earthwork construction.

Our scope of services was performed in general accordance with our proposal number G20062.2WAT for this project dated January 7, 2021, and included the following:

- Exploration of the subsurface soil and groundwater conditions at the project site by conducting seven (7) test pits using a subcontracted operator and excavation equipment under the direction of a Krazan geotechnical engineer;
- A site plan showing the geotechnical test pit locations;
- Comprehensive test pit logs including soil stratification and classification, and groundwater levels where applicable;
- Recommended foundation type for the proposed structure;

- Allowable foundation bearing pressure, anticipated settlements (both total and differential), coefficient of horizontal friction for footing design, and frost penetration depth;
- Recommendations for modulus of subgrade reaction for design of slabs-on-grade, as well as subgrade preparation, slab drainage, capillary break, and/or moisture barriers;
- Recommendations for seismic design considerations including site coefficient and ground acceleration based on the 2018 IBC;
- Recommendations for lateral earth pressures (active and passive) for below grade and retaining structures;
- Recommendations for structural fill materials, placement, and compaction;
- Recommendations for suitability of onsite soils as structural fill;
- Recommendations for temporary excavations;
- Recommendations for site drainage and erosion control;
- Recommendations for asphalt and Portland Cement Concrete (PCC) pavement sections.

Environmental services, such as chemical analysis of soil and groundwater for possible environmental contaminants, were not included in our geotechnical engineering scope of services for this project.

PROPOSED CONSTRUCTION

We understand that the site will be developed as a new car dealership. Specific plans for the car dealership were not available at the time of this report. However, we have assumed column and wall loads for the new building will not exceed 60 kips and 3 kips per lineal foot, respectively. Other site improvements will include installation of site utilities, and paved access drive and parking areas.

Based on the existing grades at the site, we do not anticipate significant cut or fill thicknesses will be required to attain finish design grades.

SITE LOCATION AND DESCRIPTION

Based on the plan drawing provided by the client titled "Short Plat for Barnes Investment Group, LLC" dated March 2018, the site is identified as Lots 2 and 3 of a three (3) lot short plat (APN 021612011002). The site is currently undeveloped and covers an area of approximately 4.76 acres. The site is bordered by undeveloped land to the north, the Les Schwab Tire Center commercial site to the south, Interstate 5 to the east, and NW Louisiana Avenue to the west.

The majority of the site is relatively level, with the ground surface at about Elev. 180 to 182 feet. The eastern edge of the site slopes from Elev. 181 down to about Elev. 160 to 165 feet at the drainage ditch alongside Interstate 5 at an inclination of approximately 2.5 Horizontal to 1 Vertical (2.5H:1V), or about 40 percent. A grass covered drainage ditch with a bottom elevation of roughly 179 feet is situated between the western edge of the site and NW Louisiana Avenue. The northern end of the site slopes down to undeveloped land at about 2H:1V. A review of historical aerial maps indicates that the project site was originally a marsh area. Later, following construction of Interstate 5, fill material was placed on the site to raise it to its current grade level. We understand that this fill material has likely been in place for at least 10 years. We understand that there are no records documenting the monitoring or testing of the fill material during its placement on the site. We contacted Lewis County and they did not have construction records for the fill material placed on this site.

Ground cover consists of short grass, bare earth, or rounded gravel, with small trees and shrubs located at the northern end of the site and along the slope on the eastern side of the site. A temporary storm pond is located within the central eastern portion of Lot 3, which is the northernmost lot. The pond is about 1.5 feet deep and roughly 1 foot of water was observed in the pond at the time of our field exploration. PVC pipes covered by earth berms extend out from the north and south sides of the pond.

GEOLOGIC SETTING

The site lies within the central Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history including at least four separate glacial advances and retreats. The Puget Lowland is bounded to the west by the Olympic Mountains and to the east by the Cascade Range. The lowland is filled with glacial and nonglacial sediments.

The Washington Department of Natural Resources (DNR) Geologic Information Portal website indicates that the property is located in an area that is predominantly underlain by Quaternary alluvium, consisting of "unconsolidated or semi-consolidated alluvial clay, silt, sand, gravel, and (or) cobble deposits; local areas of peat and muck; and locally includes modified land and artificial fill."

FIELD INVESTIGATION

Seven (7) test pits, designated TP-1 through TP-7, were completed to evaluate the subsurface soil and groundwater conditions at the project site. The test pits were conducted on March 8, 2021, using a subcontracted equipment operator and John Deere 50G excavator under the direction of a Krazan geotechnical engineer. The test pits were excavated to depths of 12.0 to 15.0 feet below the existing ground surface (bgs). A geotechnical engineer from Krazan and Associates was present during the excavations, continuously examined and visually classified the soils in general accordance with the Unified Soil Classification System (USCS), and maintained logs of the explorations. Representative

samples of the soils encountered in the geotechnical explorations were collected and transported to our laboratory for further examination and testing.

A detailed description of the field investigation is presented in Appendix A. The approximate locations of the test pits are shown on the Site Plan in Figure 2.

SOIL PROFILE AND SUBSURFACE CONDITIONS

Our field explorations exposed undocumented fill at the site ranging from 9.5 to 12.0 feet thick, overlying alluvial soils to the explored depths of the test pits.

Gravel / Topsoil: The test pits encountered 6 to 11 inches of topsoil consisting of moist, loose, brown silty sand with roots and trace gravel. Test pits TP-4 through TP-7 encountered 1 inch of gravel overlying the topsoil layer.

Undocumented Fill Material: Undocumented fill material was encountered beneath the topsoil layer in all of the test pits and extended to depths ranging from 9.5 to 12 feet below the ground surface (bgs). The fill consisted of moist, orangish brown to orangish brown and grey silty sand (SM) that exhibited a medium dense relative density based on the excavation efforts of the equipment. The fill also contained occasional layers or clumps of hard, cemented dark orangish brown silty sand and cobbles-sized rock pieces. Distinct 10 to 18-inch thick layers were observed in the majority of the test pits. The silty sand fill was predominantly fine-grained sand with 27 to 28 percent silt based on laboratory gradation tests conducted on two representative samples of the fill material.

We did not observe any buried debris in the fill. However, a 6 to 12-inch thick pocket of very stiff to hard, dark grey clay or clayey silt was encountered within the upper five feet of test pits TP-3, TP-4, and TP-6. The bottom 6 inches to 1.3 feet of the fill stratum in test pits TP-4, TP-5, and TP-7 consisted of loose, brown clayey sand, that was mixed with the underlying organic silt in test pit TP-4.

Native Black Organic Clayey Silt: The test pits encountered a 0.5 to 3-foot thick layer of black organic clayey silt (OH) beneath the fill material. The organic clayey silt exhibited very soft to hard consistencies, with the softer consistencies noted at or below the observed water level in the test pits. An Atterberg Limits test conducted on a sample of the very soft organic silt indicated a liquid limit (LL) of 57 and a plasticity index (PI) of 12 indicating the native organic clayey silt to have medium to high plasticity. A natural moisture content of 54.7 percent indicated this sample of the organic clay was very near its liquid limit.

Native Blueish Grey Clayey Silt: Blueish grey clayey silt (MH) was encountered beneath the black organic silty clay and extended to the termination depths of the test pits at depths of 12.0 to 15.0 feet bgs. The clayey silt exhibited stiff to hard consistencies. An Atterberg Limits test conducted on a sample of

the clayey silt indicated a liquid limit (LL) of 64 and a plasticity index (PI) of 21, with a natural moisture content of 56.8 percent. The native clayey silt was interpreted to have high plasticity.

The subsurface conditions encountered in the test pits were consistent with the soils encountered during our exploration of the adjacent property to the south and with the mapped geology of the site. Detailed logs of the test pits are presented in Appendix A.

Groundwater: Groundwater was encountered in test pits TP-4 through TP-7 at depths of 13.0 and 14.0 feet below the ground surface. Groundwater was not observed in the remaining test pits during the short time they were open prior to backfilling.

It should be recognized that the absence or presence of groundwater and its elevation may fluctuate with time. The groundwater level will also be dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, water levels at the time of the field investigation may be different from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

LABORATORY TEST RESULTS

Laboratory gradation and Atterberg Limits tests were conducted on select soil samples from the test pits. The test results are graphically included in Appendix A and listed under the Lab Results/Notes section of the test pit logs where applicable.

GEOLOGIC HAZARDS

Erosion Concern/Hazard

The USDA Natural Resources Conservation Services (NRCS) Web Soil Survey map classifies the natural soils in the site area as Alvor Silty Clay Loam and Reed silty Clay Loam. The NRCS classifies the Alvor and Reed loams as Hydrologic Soil Groups C and D, respectively, with moderate to high potential for erosion in a disturbed state. However, the existing surface soils are interpreted to be undocumented fill, and based on our gradation tests, they are interpreted to have moderate potential for erosion in a disturbed state.

The relatively level ground surface did not show evidence of erosion during our site visit, and the site appeared to be in the same state as when we conducted our exploration of the property to the south about two years ago. However, the slope down to the drainage ditch along the eastern side of the site did show minor indications of erosion and the ground surface was soft. We recommend that the ground surface along the eastern side of the site be compacted during preparation of the site to minimize future erosion of the slope.

It has been our experience that soil erosion potential can be minimized by limiting the amount of bare areas exposed during construction activities, frequently wetting the surface soils during construction, and with proper landscaping of the site following completion of construction. Construction activities can alter the erosion potential of soils due to water. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be mitigated by the use of temporary erosion control measures, such as silt fences, hay bales, straw wattles, mulching, control ditches or diversion trenching, and contour furrowing. The walls of excavations should be covered with plastic sheeting during periods of rainfall. Erosion control measures should be in place before the onset of wet weather.

Seismic Hazard

The 2018 International Building Code (IBC), Section 1613.3.2, refers to Chapter 20 of ASCE 7-16 for Site Class Definitions. Site Class D applies to a "stiff soil" profile. The seismic site class is based on a soil profile extending to a depth of 100 feet. The test pits conducted on this site extended to a maximum depth of 15.0 feet bgs, and this seismic site class designation is based on the assumption that similar soil conditions continue below the explored depth. We have assumed that similar soil conditions continue below the explored depth.

We referred to the Applied Technology Council (ATC) Hazards website, ASCE 7-16, and the 2018 IBC to obtain values for S_S, S_{MS}, S_{DS}, S_1, S_{M1}, S_{D1}, F_a, and F_v based on a Risk Category II for the proposed structure. The ATC website utilizes the most updated published data on seismic conditions from the United States Geological Survey. The seismic design parameters for this site are presented in the following table:

Table 1: Seismic Design Parameters*
(Reference: 2018 IBC Section 1613.2.2, ASCE 7-16, and ATC)

Seismic Item	Value
Site Coefficient F_a	1.022
S_s	1.194
S_{MS}	1.221
S_{DS}	0.814
Site Coefficient F_v	1.811
S_1	0.489
S_{M1}	0.886
S_{D1}	0.590

*Based on use of the Equivalent Lateral Force (ELF) Design Procedure.

Additional seismic considerations include liquefaction potential and amplification of ground motions by loose/soft soil deposits. We have reviewed the "Liquefaction Susceptibility Map of Lewis County, Washington" by Palmer et al. (WA DNR, 2004) for the project area. The map indicates that the site area is located in a zone of moderate to high liquefaction susceptibility. The Hazard Zones are based on combined effects of ground shaking amplification, liquefaction, and earthquake-induce landslides. In addition, the undocumented fill encountered at the site may potentially be liquefiable. However, at the request of the client, a site-specific liquefaction analysis was not included in the geotechnical engineering investigation for this project.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the site is compatible with the planned development, **provided that the geotechnical engineering recommendations presented in this report are included in the project design and implemented during construction, and the client accepts the risks associated with construction on a site mapped as being in a zone of moderate to high liquefaction susceptibility**. At the request of the client, a site-specific liquefaction analysis was not conducted for this site; therefore, evaluation of the risks associated with liquefaction were beyond the scope of our services for this project.

Our field explorations encountered undocumented fill up to 12 feet below the existing ground surface. The undocumented fill generally consisted of silty sand soils in a medium dense condition. Based on the results of our field explorations, the building foundation support options are 1) complete removal of the undocumented fill and replacement with properly placed and compacted structural fill, 2) partial removal of the undocumented fill and replacement with structural fill, with or without placement of a geotextile over the subgrade, and 3) a deep foundation system, such as auger cast or pin piles. An additional field investigation utilizing soil test borings or Cone Penetrometer Testing (CPT) would be required to obtain information on a suitable soil bearing layer for use in design of a deep foundation system for support of the proposed building.

The subsurface soils encountered on this site during our field exploration are considered moisture-sensitive and may disturb easily in wet conditions. Measures to address moisture sensitivity of the onsite soils are discussed in the Site Preparation section of this report. In our opinion, the onsite silty sand soils are considered suitable for re-use as structural fill. The organic clayey silt (OH) and clayey silt (MH) may not be re-used as structural fill. If soil types other than those revealed during our field exploration are encountered during construction, then Krazan should be consulted regarding the suitability of these soils for use as structural fill.

Site Preparation

General site clearing should include removal of any organics, topsoil material, asphaltic concrete, abandoned utilities, and structures including foundations, slabs, rubble, and rubbish, down to native suitable soils. In addition, any buried structures, such as septic tanks, underground storage tanks, debris pits, cesspools, or similar structures, should be completely removed and backfilled with structural fill.

The temporary detention pond located within Lot 3 should be drained of water and accumulations of silt, vegetation, or other deleterious materials removed down to firm and unyielding soils.

The undocumented fill is considered unsuitable for support of the building and pavement loads. The building subgrade preparation is discussed in the Foundations section of this report. In the floor slab, exterior flatwork, and pavement areas, we recommend over-excavation of the undocumented fill to a depth of at least 12 inches below the planned slab or pavement subgrade. The areas should then be backfilled to the planned foundation bearing or slab/pavement subgrade elevation with structural fill placed and compacted in accordance with the recommendations of the Structural Fill section. Deeper excavation may be required, if soft and yielding soil conditions are exposed during over-excavation. We should evaluate the subgrade soil conditions, and observe the over-excavation and structural fill placement during construction.

The soils that will be encountered during site development are considered moisture-sensitive and may disturb easily in wet conditions. During wet weather conditions, subgrade stability problems and grading difficulties may develop due to the excess moisture, disturbance of sensitive soils, and/or the presence of perched groundwater. The prepared subgrade should be protected from construction traffic and surface water should be diverted around the prepared subgrade. Soils that have become unstable may require drying to near their optimal moisture content before compaction is feasible. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry, warm weather. If the soils cannot be dried back to a workable moisture condition, removal of the unstable soils or the use of remedial measures may be required. These remedial measures could include placement of a blanket of rock spalls to protect exposed subgrade and construction traffic areas. The lateral extent and depth of rock spalls, if required, should be determined based on evaluation of the near surface soil conditions at the time of construction.

A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation are an integral part of our service, as acceptance of earthwork construction is dependent upon compaction and stability of the material. The geotechnical engineer may reject any material that does not meet compaction and stability requirements. Further recommendations, contained in this report, are predicated upon the assumption that earthwork construction will conform to the recommendations set forth in this section and in the Structural Fill Section.

Temporary Excavations

The onsite soils have variable friction and cohesion strengths, therefore the safe angles to which these materials may be cut for temporary excavations is variable, as the soils may be prone to caving and slope failures in temporary excavations deeper than 4 feet. Temporary excavations in the medium dense undocumented fill material should be sloped no steeper than 2H:1V (horizontal to vertical) where room permits. Some temporary slope stability measures may be required to conduct deeper excavations in some areas of the site depending on the utility excavation depths. The test pits conducted for our field exploration in March 2021 generally exhibited vertical sidewalls up to about 13 to 14 feet bgs, at which cave-ins were observed as the depth of excavation approached the observed groundwater level. It should be noted that the excavations for the test pits were only open for a short time, typically less than an hour, before being immediately backfilled after reaching their termination depth. The duration excavations remain open, as well as the intrusion of water into the excavations, will affect the stability of temporary excavations in the soils encountered at this site. The design and construction of any slope stability measures, including any temporary earth retention systems, are the sole responsibility of the contractor.

All temporary cuts should be in accordance with Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. The design and construction of any slope stability measures, including any temporary earth retention systems, are the sole responsibility of the contractor. The temporary slope cuts should be visually inspected daily by a qualified person during construction work activities and the results of the inspections should be included in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and minimizing slope erosion during construction. The temporary cut slopes should be covered with plastic sheeting to help minimize erosion during wet weather and the slopes should be closely monitored until the permanent retaining systems are complete. Materials should not be stored and equipment operated within 10 feet of the top of any temporary cut slope.

A Krazan & Associates geologist or geotechnical engineer should observe, at least periodically, the temporary cut slopes during the excavation work. The reasoning for this is that all soil conditions may not be fully delineated by the limited sampling of the site from the geotechnical explorations. In the case of temporary slope cuts, the existing soil conditions may not be fully revealed until the excavation work exposes the soil. Typically, as excavation work progresses the maximum inclination of the temporary slope will need to be evaluated by the geotechnical engineer so that supplemental recommendations can be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed smoothly and required deadlines can be met. If any variations or undesirable conditions are encountered during construction, Krazan & Associates should be notified so that supplemental recommendations can be made.

Structural Fill

Fill placed beneath foundations, pavement, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician under the direction of the geotechnical engineer. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction and moisture. The area to receive the fill should be suitably prepared as described in the Site Preparation subsection of this report prior to beginning fill placement.

Best Management Practices (BMP's) should be followed when considering the suitability of the existing materials for use as structural fill. The onsite silty sand soils that were encountered in our explorations are generally considered suitable for re-use as structural fill, provided the soil is free of organic material, debris, and cobbles, and it is within ± 2 percent of the optimum moisture content. The organic clayey silt (OH) and the clayey silt (MH) soils encountered in our explorations are unsuitable for re-use as fill material.

Imported fill material should be all-weather structural fill consisting of well-graded gravel or a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill may also consist of crushed rock, rock spalls, or controlled density fill (CDF). All structural fill material should be submitted for approval to the geotechnical engineer at least 48 hours prior to delivery to the site.

Fill soils should be placed in horizontal lifts not exceeding 8 inches loose thickness, moisture-conditioned as necessary (moisture content of soil shall not vary by more than ±2 percent of its optimum moisture content), and compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557 (Modified Proctor). In-place density tests should be performed on all structural fill to document proper moisture content and adequate compaction.

Additional fill lifts should not be placed if the previous lift did not meet the compaction requirements or if soil conditions are not considered stable. Placing several lifts of fill and then potholing down to each lift to conduct compaction testing is not acceptable, and will require complete removal of the fill down to the first lift. Ponding or jetting the soil is not an approved method of soil compaction.

Foundations

Our field explorations encountered undocumented fill up to a depth of 9.5 to 12.0 feet below the existing ground surface, underlain by highly compressible organic clayey silts and alluvial silts to the explored depths of the test pits. The undocumented fill is considered unsuitable for support of the building without subgrade modifications.

We have provided following two options for the building to be supported on a **shallow foundation system**.

Option 1: We recommend that entire undocumented fill below the planned footing elevations be removed and replaced with structural fill.

Option 2: We recommend that the undocumented fill be removed beneath the foundations to a depth of two (2) times the width of the footing, with the over-excavation extending laterally from the outside edges of the footing a horizontal distance of one-half the width of the footing. The resulting excavation should then be backfilled with structural fill up to the planned footing subgrade elevations. Depending on the time of year that construction takes place, it may be necessary to place a layer of rock spalls or a high strength geotextile fabric over the soils at the bottom of the over-excavation if water accumulates and softens the soils.

New utilities should not be located within the load influence zone of the footing defined as an imaginary line extending out at 1 horizontal to 1 vertical (1H:1V) from the bottom outside edge of the footing. Depending on the location of the utility, it may be necessary to deepen the planned footing elevation such that the utility pipe is located above the footing zone of influence so the footing does not impose a surcharge load on the utility.

We recommend that exterior footings bear a minimum depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower, for frost protection and bearing capacity considerations. Interior footings should have a minimum depth of 12 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footing widths should be based on the anticipated loads and allowable soil bearing pressure, but should not be less than 12 inches wide regardless of load. Additionally, footings should conform to current International Building Code (IBC) guidelines. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above and in the Site Preparation section of this report, we recommend that an allowable soil bearing capacity of **2,000 pounds per square foot (psf)** be used for foundation design for this project. A representative of Krazan and Associates should evaluate the foundation bearing soil prior to footing form construction.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the bases of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglecting the upper 12 inches). The allowable friction factor and allowable equivalent fluid passive pressure values include a factor of safety of 1.5. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. A 1/3 increase in the above values may be used for short duration wind and seismic loads.

For foundations constructed as recommended, the total estimated static settlement is not expected to exceed 1-inch. Differential settlement should be less than ½-inch. Most settlement is expected to occur during construction, as the loads are applied. Variations in the type and relative density/consistency of the undocumented fill soils influence the magnitude of anticipated settlement. Partial replacement of the undocumented fill within the major portion of the load influence zone beneath the building foundation is intended to minimize the effect of such variations in the undocumented fill. It is noted that the estimated settlements listed above are static settlements, and do not include the potential dynamic settlement contributions due to liquefaction of the soils during an earthquake event, which was not included for this project per client's request.

Seasonal rainfall, water run-off, and the normal practice of watering trees and landscaping areas around the proposed structures should not be permitted to flood and/or saturate foundation subgrade soils. To prevent the build-up of water within the footing areas, continuous footing drains (with cleanouts) should be provided at the base of footings. The footing drains should consist of a minimum 4-inch diameter rigid perforated PVC pipe, sloped to drain, with perforations placed near the bottom and enveloped in all directions by washed rock and wrapped with filter fabric to limit the migration of silt and clay into the drain.

Option 3 - Deep Foundation: Alternatively, considering the costs to over-excavate the undocumented fill and replace it with structural fill, and the settlements associated with the undocumented fill, a deep foundation may be considered to support the foundation. However, an additional field investigation utilizing soil test borings or Cone Penetrometer Testing (CPT) would be needed to develop deep foundation recommendations.

Floor Slabs and Exterior Flatwork

The near surface soils consisting of undocumented fill are unsuitable for support of floor slabs and exterior flatwork. Prior to the placement of concrete floors or flatwork, or before any floor supporting fill is placed, the subgrade within the building footprint and flatwork areas should be modified as described in the **Site Preparation** section of this report.

The floor slab and exterior flatwork subgrades should be prepared in accordance with the recommendations presented in the **Site Preparation** section of this report, and may be designed using a modulus of subgrade reaction value of k = 200 pounds per cubic inch (pci).

In areas where it is desired to reduce floor dampness, such as areas covered with moisture sensitive floor coverings, we recommend that concrete slab-on-grade floors be underlain by a water vapor retarder system. According to ASTM guidelines, the water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 6-inches of compacted clean (less than 5 percent passing the U.S. Standard No. 200 Sieve based on the fraction passing the No. 4 sieve), open-graded coarse rock of ¾-inch maximum size. The vapor retarder sheeting should be protected from puncture damage.

The exterior floors should be placed separately in order to act independently of the walls and foundation system.

Lateral Earth Pressures and Retaining Walls

Based on the proposed site development plans, we do not anticipate below grade or site retaining walls will be constructed for this site. However, we have developed criteria for the design of retaining walls should the site development plans change. Our design parameters are based on retention of the in-place soils and/or imported granular structural fill. The parameters are also based on level, well-drained wall backfill conditions. If other wall slope configurations are planned, we should be contacted to evaluate and provide additional recommendations for these cases.

Walls may be designed as "restrained" retaining walls based on "at-rest" earth pressures, plus any surcharge on top of the walls as described below, if the walls are braced to restrain movement and/or movement is not acceptable. Unrestrained walls may be designed based on "active" earth pressure, if the walls are not part of the building and some movement of the retaining walls is acceptable. Acceptable lateral movement equal to at least 0.2 percent of the wall height would warrant the use of "active" earth pressure values for design. We recommend that walls supporting horizontal backfill and not subjected to hydrostatic (water) forces be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 35 pcf for yielding (active condition) walls, and 55 pcf for non-yielding (at-rest condition) walls.

If vehicular loads are expected to act on the surface of the wall backfill within a horizontal distance of less than or equal to one-half of the wall height behind the back face of the wall, a live load surcharge should be applied for the design. In this case, we recommend the addition of vehicle surcharges of 70 psf and 100 psf to the active and at-rest earth pressures, respectively.

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls or loads imposed by construction equipment, slopes, foundations, or roadways adjacent to the wall (surcharge loads). To minimize the lateral earth pressure and prevent the build-up of water pressure against the walls, continuous footing drains should be provided at the base of walls. The footing drains should consist of a minimum 4-inch diameter perforated pipe, sloped to drain, and with perforations placed near the bottom. The drainpipe should be enveloped by 6 inches of washed gravel in all directions wrapped in filter fabric to prevent the migration of silt and clay into the drain.

The backfill placed adjacent to the wall and extending a lateral distance of at least 2 feet behind the wall should consist of free-draining granular material. All free-draining backfill should contain less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve) with at least 30 percent of the material retained on the U.S. Standard No. 4 Sieve. **Alternatively,** a drainage composite may be used. It should be realized that the primary purpose of the free-draining material is the reduction of hydrostatic pressure. Some potential for the moisture to contact the back face of the wall may exist, even with treatment, which

may require that more extensive waterproofing be specified for walls that require interior moisture sensitive finishes.

We recommend that backfill placed within a lateral distance of 3 feet behind the wall be compacted to between 92 and 95 percent of the maximum dry density based on ASTM D1557 Test Method to limit stresses on the retaining wall from compaction of the backfill. In-place density tests should be performed to verify adequate compaction. Soil compaction equipment places transient surcharge loads on the backfill. Consequently, only light, hand-operated equipment is recommended for fill compaction within a 3-foot horizontal distance from the wall so that excessive stress is not imposed on the wall. Backfill placed greater than 3 feet horizontally from the wall should be compacted to at least 95 percent relative density in accordance with ASTM D1557, which may be conducted using conventional compaction equipment.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to minimize the transportation of sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be taken and these measures should be in general accordance with local regulations. At a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features of the site:

1) Phase the soil, foundation, utility, and other work, requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMPs), grading activities can be undertaken during the wet season (generally October through April). It should be noted that this typically increases the overall project cost.

2) All site work should be completed and stabilized as quickly as possible.

3) Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.

4) Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited other filtration methods will need to be incorporated.

Groundwater Influence on Structures and Earthwork Construction

Groundwater was encountered at depths of 13.0 to 14.0 feet bgs in test pits TP-4 through TP-7, and was not observed in the remaining test pits conducted for this site exploration. It should be recognized that groundwater elevations may fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, groundwater levels at the time of the field investigation may be different from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

If earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated. These soils may not respond to densification techniques due to the excessive moisture. Typical remedial measures include: disking and aerating the soil during dry weather; mixing the soil with drier materials; removing and replacing the soil with an approved fill material. Krazan & Associates should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Drainage and Landscaping

The ground surface should slope away from building pads and pavement areas, toward appropriate drop inlets or other surface drainage devices. It is recommended that adjacent exterior grades be sloped a minimum of 2 percent for a minimum distance of 5 feet away from structures. Roof drains should be tight lined away from foundations. Roof drains should not be connected to the footing drains, but may use the same outfall piping if connected well away from the structure and with enough fall such that roof water will not back-up into the footing drains.

Subgrade soils in pavement areas should be inclined at a minimum of 1 percent and drainage gradients should be maintained to carry all surface water to collection facilities, and suitable outlets. These grades should be maintained for the life of the project.

Utility Trenches

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the contractor. Shoring or sloping back trench sidewalls may be required within these soils depending on the time period the excavation is left open. Traffic and vibration adjacent to trench walls should be minimized; cyclic wetting and drying of excavation side slopes should be avoided. Groundwater was observed at a depth of 13.0 to 14.0 feet bgs in test pits TP-4 through TP-7, conducted on this site at the time of our field exploration. Perched groundwater may also be encountered within the fill material. Depending on the location and depth of the utilities, groundwater flow into open excavations should be anticipated for the deeper utilities with invert elevations approaching 13 feet bgs, especially during or shortly following periods of precipitation. In

addition, caving-in of the sidewalls was observed at a depth of 13 to 14 feet in some of the test pit excavations, which generally coincided with the presence of groundwater.

If the utility invert is founded in the clayey silt soils, it may be necessary to stabilize the bottom of the trench with rock spalls and a layer of geotextile fabric, such as Mirafi 600X or equivalent, prior to placement of the bedding material. Organic clayey silt soils encountered at utility invert elevations should be removed in their entirety and replaced with rock spalls, CDF, crushed clean gravel, or properly placed and compacted structural fill prior to placement of the utility bedding material.

All utility trench backfill should consist of imported structural fill material. The onsite soils are considered suitable for re-use as trench backfill. Trench backfill should be placed in equal measures on each side of the utility pipe and compacted to the required relative density prior to placement of additional fill lifts.

Utility trench backfill placed within or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

It is recommended that utility trenches located within the building pad be compacted, as specified in our report, to minimize the transmission of moisture through the utility trench backfill.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

Pavement Design

Based on our explorations, the near surface soils at the site are interpreted as medium dense undocumented fill material, generally consisting of silty sand, to a depth of 9.5 to 12.0 feet bgs. The pavement subgrade should be prepared in accordance with the recommendations presented in the **Site Preparation** section of this report.

Traffic loading information was not provided, however, based on our knowledge of the proposed project, we expect the traffic to range from light duty (passenger automobiles) to heavy duty (delivery and fire trucks). A pavement design life of 20 years was assumed for our analysis. The following tables show the minimum recommended pavement sections for both light and heavy-duty traffic loads.

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT

Asphaltic Concrete	Aggregate Base*
3.0 in.	6.0 in.

PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT
4000 psi with FIBER MESH

Min. PCC Depth	Aggregate Base*
6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*

The asphaltic concrete depth listed in the above tables should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) ½-inch HMA. The pavement specification in Appendix C provides additional recommendations including aggregate base material.

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, including foundation bearing soils, are consistent with those exposed during our exploratory field work. This activity is an integral part of our services as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of our recommendations has been 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. Furthermore, Krazan & Associates is not responsible for the contractor's procedures, methods, scheduling, or management of the work site.

LIMITATIONS

Geotechnical engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences improves. Although your site was analyzed using the most appropriate current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to improvements in the field of geotechnical engineering, physical changes in the site either due to excavation or fill placement, new agency regulations, or possible changes in the proposed structure after the time of completion of the soils report may require the soils report to be professionally reviewed. In light of this, the owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that two years be considered a reasonable time for the usefulness of this report.

This report has been prepared for the exclusive use of RB Engineering and their assigns, for the specific application to the subject site. Foundation and earthwork construction are characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original geotechnical investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. Our report, design conclusions, and interpretations should not be construed as a warranty of the subsurface conditions. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report.

The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those encountered during our field investigation. The findings and conclusions of this report can be affected by the passage of time, seasonal weather conditions, manmade influences such as construction on or adjacent to the site, and natural events such as earthquakes, slope instability, flooding, or groundwater fluctuations. If any variations or undesirable conditions are encountered during construction, the geotechnical engineer should be notified so that supplemental recommendations can be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The geotechnical engineer should be notified of any changes so that the recommendations can be reviewed and re-evaluated.

Misinterpretations of this report by other design team members can result in project delays and cost over-runs. These risks can be reduced by having Krazan & Associates, Inc. involved in the design team's meetings and discussions prior to and following submission of the geotechnical report. Krazan & Associates, Inc. should also be retained to review pertinent elements of the design team's plans and specifications. To reduce the risk of contractors misinterpreting the recommendations of this report, Krazan & Associates should participate in pre-bid and preconstruction meetings, and provide construction observations and testing during the site work.

This report is a geotechnical engineering investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any environmental site assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater or atmosphere, or the presence of wetlands. Any statements, or absence of statements, in this report or on any test pit log regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessments.

The geotechnical information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical developments. We

emphasize that this report is valid for this project as outlined above, and should not be used for any other site. Our report is prepared for the exclusive use of our client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (253) 939-2500.

Respectfully submitted,

KRAZAN & ASSOCIATES, INC.

4/13/2021

Theresa R. Nunan
Project Manager

Vijay Chaudhary, P.E.
Assistant Regional Engineering Manager

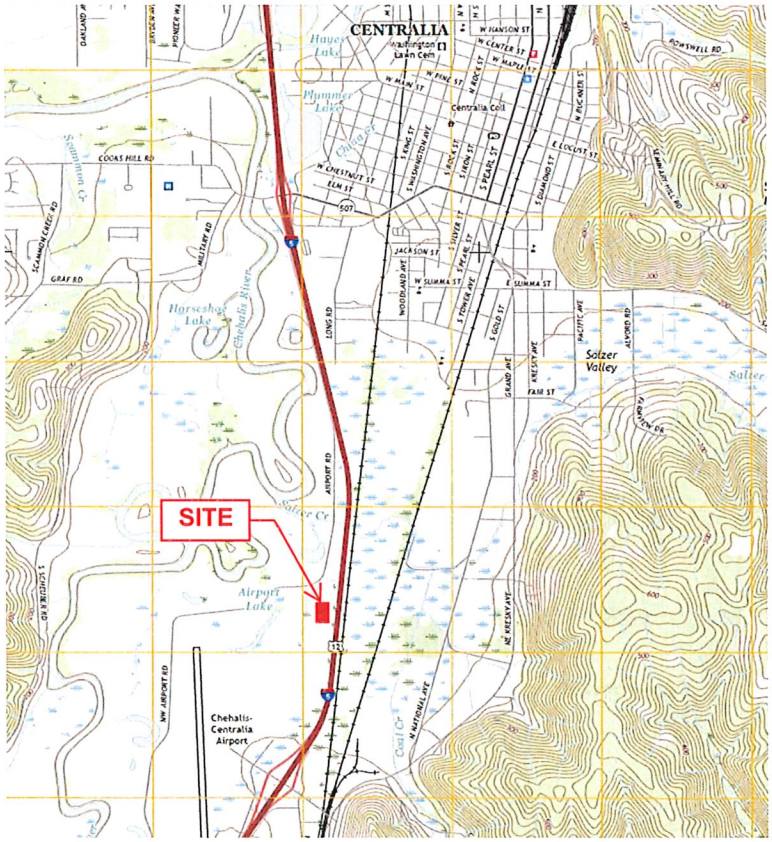
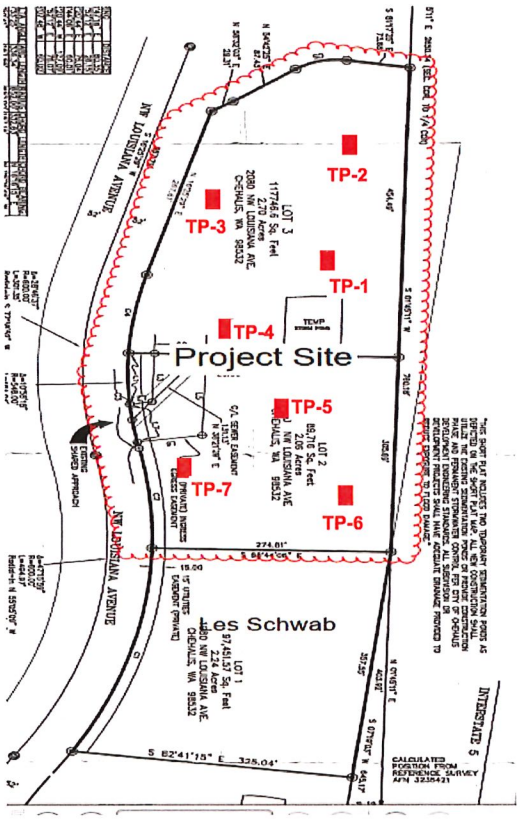


Figure 1 - Vicinity Map

Reference: TopoView - USGS Topographic Map for Chehalis Quadrangle, Washington, 7.5-Minute Series, 2014.

Krazan		
Proposed New Car Dealership: 2050 & 2080 NW Louisiana Ave., Chehalis, WA		
Date: April 2021	Project Number: 062-21008	
Drawn By: TRN	Not to Scale	Figure 1



N

LEGEND

TP-1 Number and Approximate Location of Test Pit

REFERENCE: Short Plat for Barnes Investment Group, LLC prepared by Forsight Surveying, dated March 2018.

Krazan & Associates, Inc.

825 Center St., Ste. A
Tacoma, WA 98409

Phone: (253) 939-2500
Fax: (253) 9392556

PROJECT NUMBER:
062-21008

PROJECT NAME:
Proposed New Car Dealership

LOCATION:
2050 & 2080 NW Louisiana Ave., Chehalis, WA

SCALE: N.T.S.
(NOT FOR CONSTRUCTION)

DATE: March 2021

FIGURE 2
SITE PLAN

APPENDIX A

FIELD INVESTIGATION – LABORATORY TESTING

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploration program. Seven (7) test pits, designated TP-1 through TP-7 were excavated and sampled for the subsurface investigation at this site. Test pits were advanced to depths of 12.0 to 15.0 feet below the existing ground surface on March 8, 2021, utilizing a subcontracted equipment operator and John Deere 50G excavator under the direction of a Krazan geotechnical engineer. The soils encountered were logged in the field during the exploration and are described in accordance with the Unified Soil Classification System (USCS). Select samples were returned to our laboratory for testing and evaluation.

The test pits were field located based on existing site features and their approximate locations are shown on the Site Plan (Figure 2). The test pit logs are presented in this Appendix. The depths shown on the attached logs are from the existing ground surface at the time of our exploration.

Laboratory Testing

The laboratory testing program was developed primarily to determine the index and engineering properties of the soils, and consisted of gradation, moisture content, and Atterberg Limits tests. Test results were used for soil classification and as criteria for determining the engineering suitability of the subsurface materials encountered. The test results are listed under the Notes/Lab Test Results section of the test pit logs, where applicable, and included in this appendix.

Krazan & ASSOCIATES, INC.

Project: New Car Dealership	**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	**TP-1**
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** **Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan	**Completed:** 3.8.2021			
Groundwater Depth: Not Encountered		**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 12.5 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						8" Dark Brown Silty Sand (SM) with gravel **(TOPSOIL)**	
	1						Orangish Brown **Silty SAND (SM)**, fine grained, medium dense, moist	
	2							
	3							
	4	BULK	S-1					% G = 1 % Sa = 71 % Si/Cl = 28
	5							
	6							
	7							
	8							
	9	BULK	S-2					
	10						**(FILL)**	
	11						Black **Organic Clayey SILT (OH)**, with marsh grass, stiff, moist	
	12						Blueish Grey **Clayey SILT (MH)**, trace grey fine sand, very stiff, moist	
	13						**Test Pit Terminated at 12.5 Feet**	
	14						**Note:** Trench sidewalls remained vertical during excavation. No groundwater seepage observed.	
	15							
	16							

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Project: New Car Dealership	**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	**TP-2**
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** **Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan	**Completed:** 3.8.2021			
Groundwater Depth: Not Encountered		**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 12.0 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						6" Dark Brown Silty Sand (SM) w/gravel, loose **(TOPSOIL)**	
	1						Orangish Brown **Silty SAND (SM)**, fine grained, with layers grey fine silty sand, medium dense, moist	
	2							
	3							
	4							
	5							
	6							
	7	BULK	S-1				- - - With layers dark orange brown silty sand (SM), trace gravel, medium dense, moist	% G = 15 % Sa = 58 % Si/Cl = 27
	8							
	9							
	10	BULK	S-2				**(FILL)** Black **Organic Clayey SILT (OH)**, medium stiff, moist	
	11	BULK	S-3				Blueish Grey **Clayey SILT (MH)**, with seams and 2 to 3-inch thick layers fine sand, very stiff to hard, moist	
	12						**Test Pit Terminated at 12.0 Feet**	
	13							
	14						**Note:** Trench sidewalls remained vertical during excavation. No groundwater seepage observed.	
	15							
	16							

Krazan & ASSOCIATES, INC.

Project: New Car Dealership		**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	TP-3
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA				**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date**	**Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan		**Completed:** 3.8.2021			
Groundwater Depth: Not Encountered			**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 12.5 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						10" Dk Brown Silty Sand (SM) with gravel, loose **(TOPSOIL)**	
	1						Orangish Brown and Grey **Silty SAND (SM)**, fine grained, with layers grey fine silty sand, medium dense, moist	
	2							
	3							
	4	BULK	S-1				- - - At 2 to 2.5 feet, encountered layer dark grey organic clayey silt, very stiff, moist	
	5							
	6							
	7	BULK	S-2					
	8						- - - With layers and hard cemented clods of dark orange brown silty sand (SM) and rocks, dense, moist **(FILL)**	
	9							
	10						Black **Organic Clayey SILT (OH)**, very stiff to hard, moist	
	11						Blueish Grey **Clayey SILT (MH)**, with fine sand and trace gravel, very stiff, moist	
	12						- - - At 12 feet, becomes hard	
	13						**Test Pit Terminated at 12.5 Feet**	
	14						**Note:** Trench sidewalls remained vertical during excavation. No groundwater seepage observed.	
	15							
	16							

Krazan & ASSOCIATES, INC.

Project: New Car Dealership	**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	**TP-4**
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** **Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan	**Completed:** 3.8.2021			
Groundwater Depth: 13 feet During Drilling		**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 14.5 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						1" Crushed Gravel underlain by 8" Dark Brown Silty Sand (SM), with gravel and roots, loose, moist **(TOPSOIL)**	
	1						Orangish Brown **Silty SAND (SM)**, fine grained, medium dense, moist	
	2							
	3						- - - At 2.5 to 3.6 feet, encountered pocket of dark grey organic clay, very stiff, moist	
	4							
	5						- - - with occassional seams and cemented clumps of grey silty sand (SM) and hard cemented clumps of dark orange silty sand and rock	
	6							
	7							
	8							
	9							
	10	BULK	S-1				**(FILL)** Brown **Clayey SAND (SC) mixed with Black Organic CLAY (OH)**, loose/soft, moist **(FILL)**	MC = 50.1 %
	11							
	12	BULK	S-2				Black **Organic Clayey SILT (OH)**, with marsh grass, very soft to soft, moist to wet	LL = 57 PI=12 MC = 54.7 %
	13							
	14	BULK	S-3				Dark Bueish Grey **Clayey SILT (MH)**, very stiff, wet	LL = 64 PI=21 MC = 56.8 %
	15						**Test Pit Terminated at 14.5 Feet**	
	16							

Krazan & ASSOCIATES, INC.

Project: New Car Dealership	**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	TP-5
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** **Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan	**Completed:** 3.8.2021			
Groundwater Depth: 13.5 feet During Drilling		**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 14.5 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						1" Gravel underlain by 8" Dark Brown Silty Sand (SM), with roots, loose, moist **(TOPSOIL)**	
	1						Orangish Brown **Silty SAND (SM)**, fine to medium grained, medium dense, moist	
	2							
	3							
	4							
	5						- - - with occassional seams and cemented clumps of dark orange silty sand and rock	
	6							
	7							
	8							
	9							
	10						**(FILL)**	
	11						Brown **Clayey SAND (SC)**, fine to medium grained, loose, moist	
	12						Black **Organic Clayey SILT (OH)**, with marsh grass, soft, moist **(FILL)**	
	13	BULK	S-1				- - - At 13 feet, becomes very soft to soft, wet	MC = 59.8 %
	14						Dark Blueish Grey **Clayey SILT (MH)**, trace fine sand, very stiff, wet	
	15						**Test Pit Terminated at 14.5 Feet**	
	16							

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Project: New Car Dealership	Project Number: 062-21008	Client: RB Engineering	Test Pit No.:	TP-6
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			Contractor: Strickland & Sons Excavation	
Project Manager: Theresa Nunan	Date Started: 3.8.2021		Equipment: J Deere 50G Excavator	
Field Engineer: Theresa Nunan	Date Completed: 3.8.2021			
Groundwater Depth: 14 feet During Drilling		Ground Elevation: +/- feet	Total Depth of Test Pit: 15.0 feet	

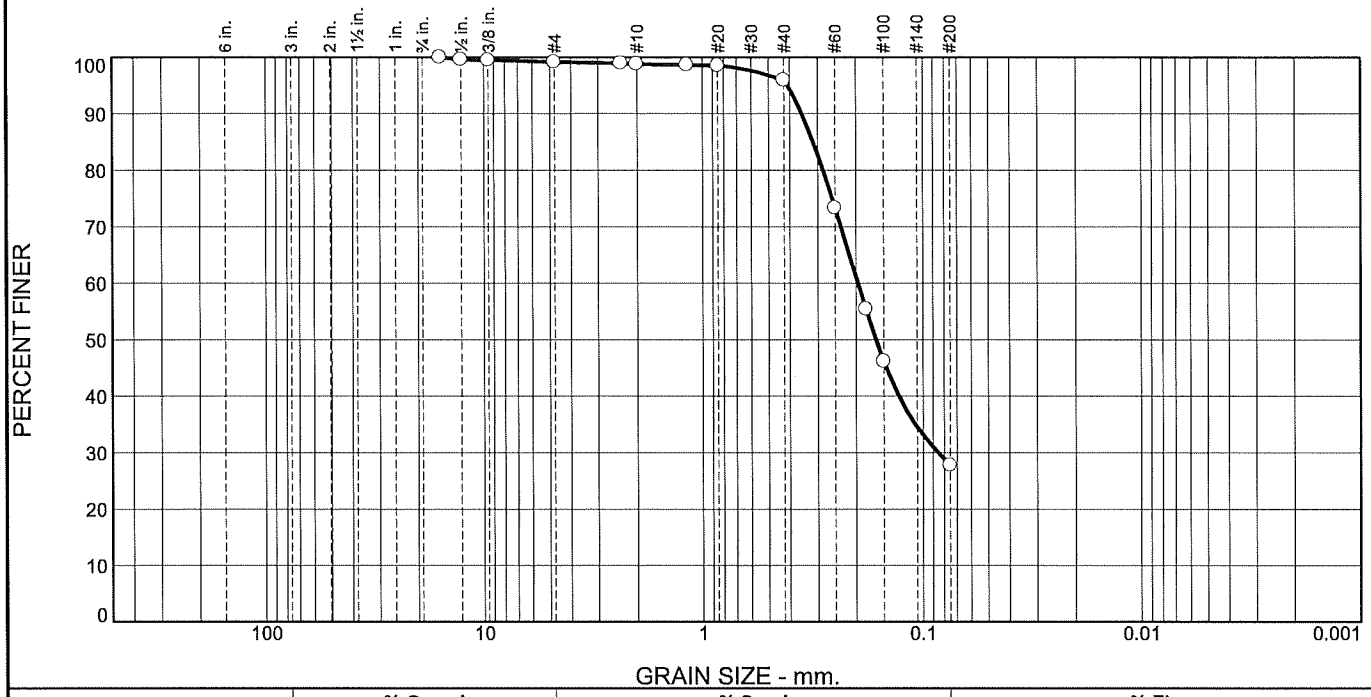
Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						1" Rounded GRAVEL over 11" Dark Brown Silty Sand (SM) with gravel and roots, loose, moist **(TOPSOIL)**	
	1						Orangish Brown and Grey **Silty SAND (SM)**, fine grained, medium dense, moist	
	3	BULK	S-1				- - - Fill layers alternate between orangish brown silty sand (SM), dark orangish brown silty sand (SM), and light grey/tan fine silty sand (SM), medium dense	
	4						- - - At 4 to 4.5 feet, encountered layer of Dark Grey Clayey Silt, very stiff to hard, moist	
	5							
	6	BULK	S-2					
	7							
	8							
	9							
	10							
	11							
	12						**(FILL)**	
	13						Black **Organic Clayey SILT (OH)**, medium stiff to stiff, moist to wet	
	14 ▼						Dark Blueish Grey **Clayey SILT (MH)**, stiff, wet	
	15						- - - At 14.5 feet becomes very stiff	
	16						**Test Pit Terminated at 15.0 Feet**	

Krazan & ASSOCIATES, INC.

Project: New Car Dealership	**Project Number:** 062-21008	**Client:** RB Engineering	**Test Pit No.:**	TP-7
Location: 2050 and 2080 NW Louisiana Ave., Chehalis, WA			**Contractor:** Strickland & Sons Excavation	
Project Manager: Theresa Nunan	**Date** **Started:** 3.8.2021		**Equipment:** J Deere 50G Excavator	
Field Engineer: Theresa Nunan	**Completed:** 3.8.2021			
Groundwater Depth: 13.8 feet During Drilling		**Ground Elevation:** +/- feet	**Total Depth of Test Pit:** 14.0 feet	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Soil Classification	Notes / Lab Test Results
	0						1" GRAVEL over 7" Dk Br Silty SAND (SM), loose, moist **(TOPSOIL)**	
	1						Orangish Brown and Grey **Silty SAND (SM)**, fine to medium grained, with layers of dark orangish brown Silty SAND (SM), medium dense, moist	
	2							
	3	BULK	S-1					
	4							
	5							
	6							
	7							
	8							
	9	BULK	S-2					
	10							
	11						Brown **Poorly Graded SAND (SP-SM)** with Silt, loose, moist **(FILL)**	
	12	BULK	S-3				Black **Organic Clayey SILT (OH)**, medium stiff to stiff, moist	
	13							
	14	BULK	S-4				Dark Blueish Grey **Clayey SILT (OH)**, stiff to very stiff, moist to wet	
	15						**Test Pit Terminated at 14.0 Feet**	
	16							

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	0	3	68	28	

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.625	100		
.5	100		
.375	100		
#4	99		
#8	99		
#10	99		
#16	99		
#20	99		
#40	96		
#60	73		
#80	55		
#100	46		
#200	28		

* (no specification provided)

Material Description

Orangish brown with grey silty SAND.
Sampled by T.Nunan

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 0.3531 D_{85}= 0.3145 D_{60}= 0.1959
D_{50}= 0.1624 D_{30}= 0.0852 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample ID:21L091
Sample Date:3-8-21

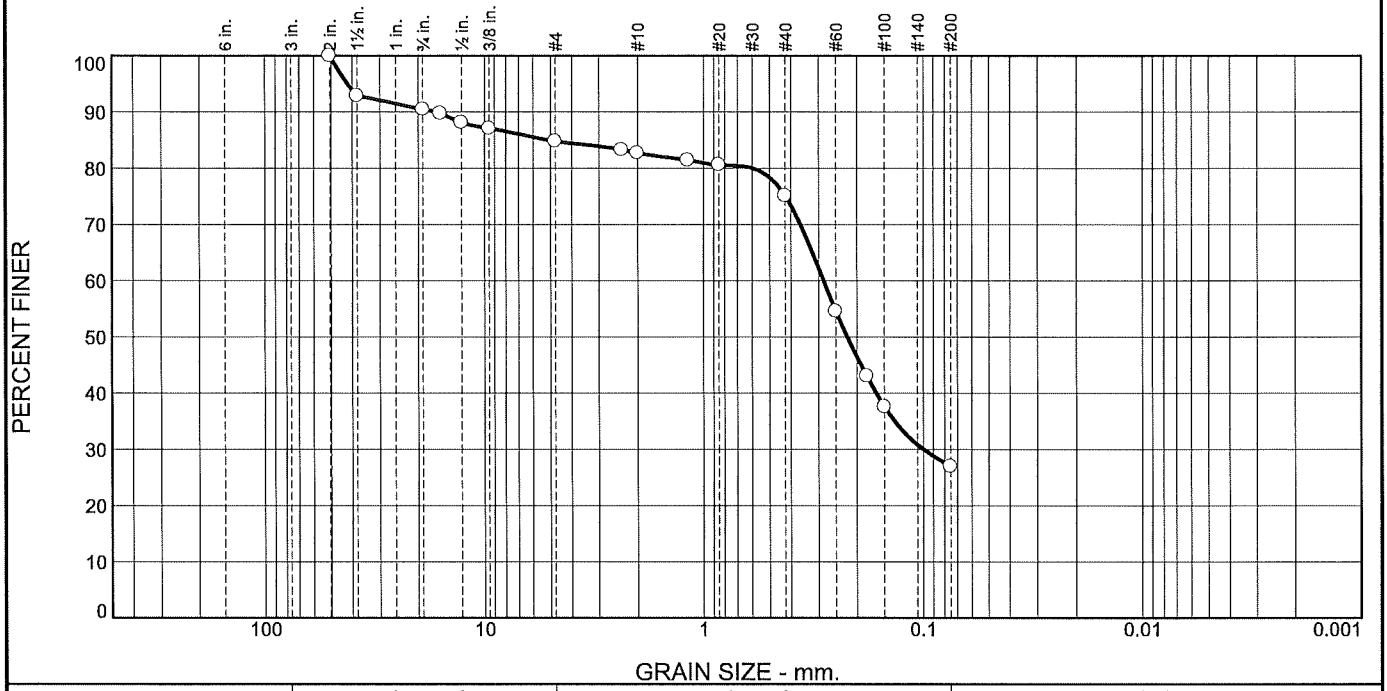
Date Received: 3-8-21 **Date Tested:** M.Thomas
Tested By: 3-8-21
Checked By: T.Nunan
Title: Project Manager

Location: TP-1 S1
Sample Number: 21L091 **Depth:** 3.5' to 5.0'
Date Sampled: 3-8-21

Krazan

Client: RB Engineering
Project: New Car Dealership
Project No: 062-21008 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	10	5	2	8	48	27	

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2	100		
1.5	93		
.75	90		
.625	90		
.5	88		
.375	87		
#4	85		
#8	83		
#10	83		
#16	81		
#20	81		
#40	75		
#60	55		
#80	43		
#100	38		
#200	27		

* (no specification provided)

Material Description

Orangish brown with grey silty SAND with gravel.
Sampled by T.Nunan

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 16.5374 D_{85}= 5.0585 D_{60}= 0.2850
D_{50}= 0.2216 D_{30}= 0.0998 D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample ID:21L092
Sample Date:3-8-21

Date Received: 3-8-21 **Date Tested:** 3-9-21

Tested By: M.Thomas

Checked By: T.Nunan

Title: Project Manager

Location: TP-2 S1
Sample Number: 21L092 **Depth:** 6.5' to 8.0'

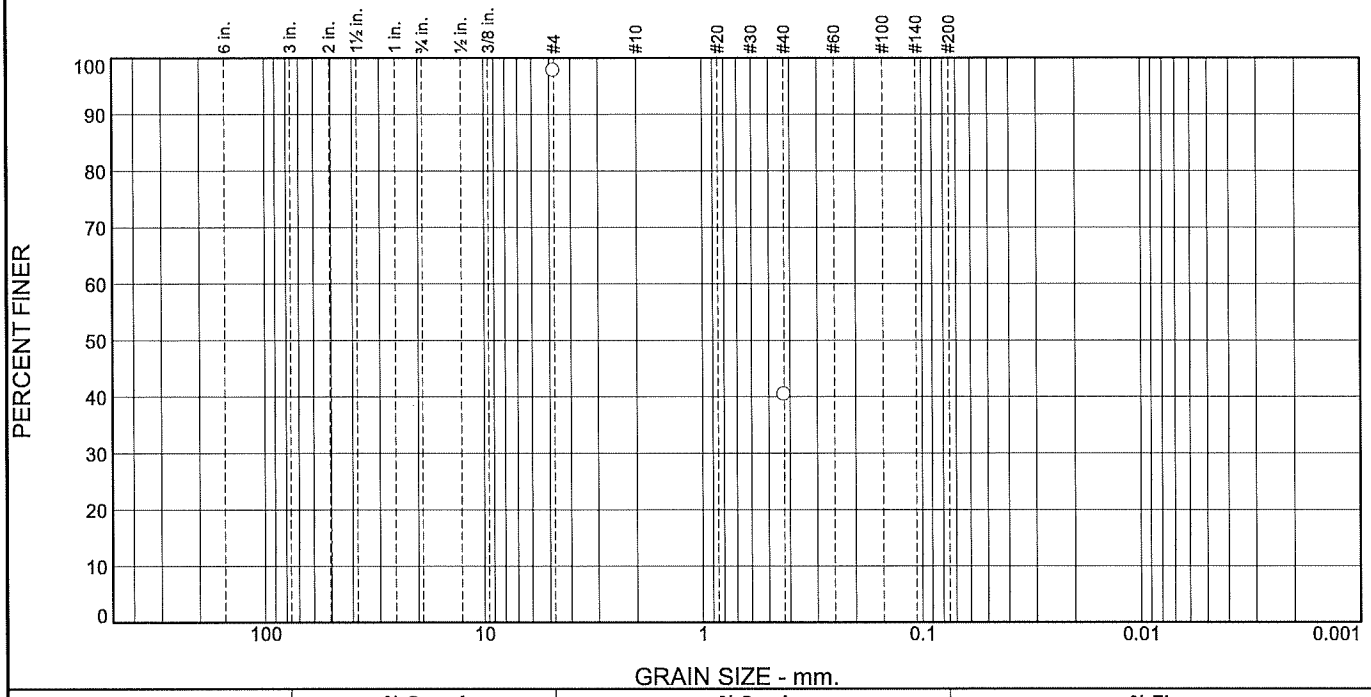
Date Sampled: 3-8-21

Krazan

Client: RB Engineering
Project: New Car Dealership

Project No: 062-21008 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			21	37		40	

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	98		
#40	40		

* (no specification provided)

Material Description

Grey SILT.
Sampled by T.Nunan

Atterberg Limits (ASTM D 4318)

PL= 43.5 LL= 64.4 PI= 20.9

Classification

USCS (D 2487)= MH AASHTO (M 145)=

Coefficients

D_{90}= 3.4246 D_{85}= 2.7744 D_{60}= 0.9682
D_{50}= 0.6355 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample ID:21L095
Sample Date:3-8-21

Date Received: 3-8-21 **Date Tested:** 3-9-21
Tested By: M.Thomas
Checked By: T.Nunan
Title: project Manager

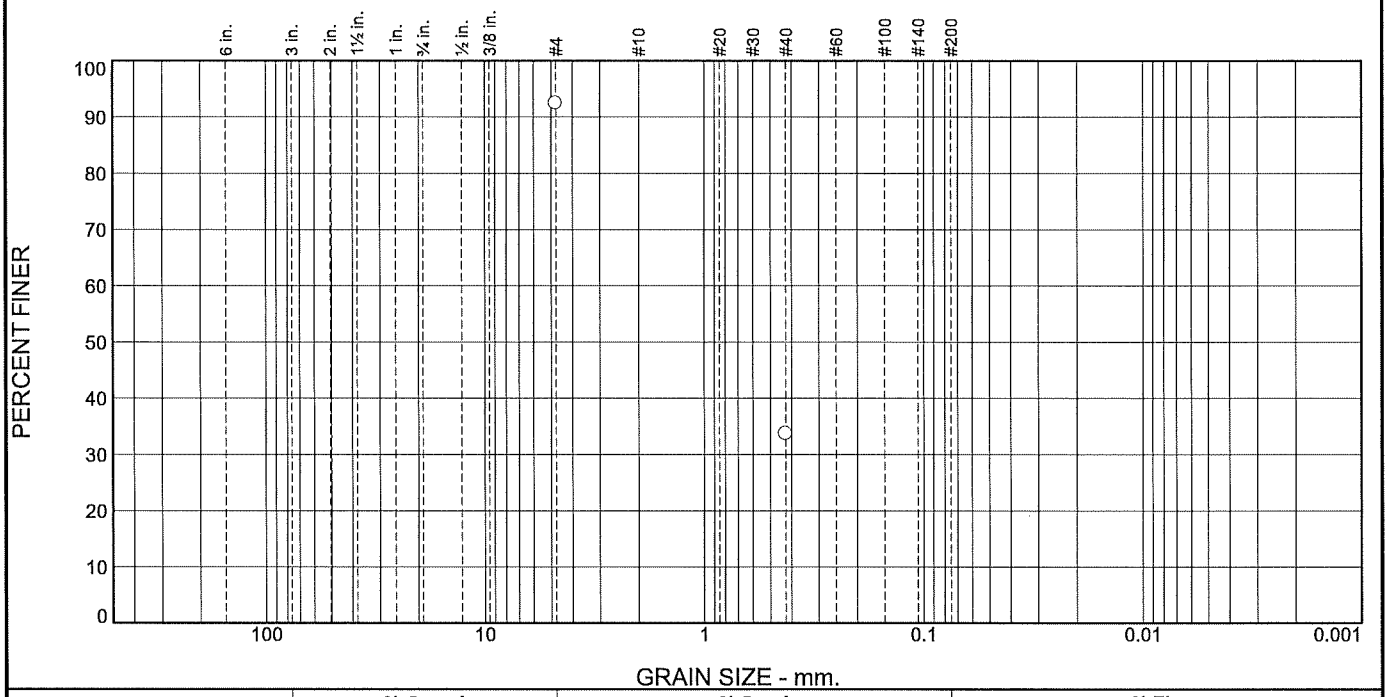
Location: TP-4 S3
Sample Number: 21L095 **Depth:** 13.5' to 14.0'
Date Sampled: 3-8-21

Krazan

Client: RB Engineering
Project: New Car Dealership

Project No: 062-21008 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			21	37		34	

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	92		
#40	34		

* (no specification provided)

Material Description

Black organic SILT.
Sampled by T.Nunan.

Atterberg Limits (ASTM D 4318)

PL= 44.6 LL= 56.5 PI= 11.9

Classification

USCS (D 2487)= OH AASHTO (M 145)=

Coefficients

D_{90}= 4.2970 D_{85}= 3.4991 D_{60}= 1.2530
D_{50}= 0.8309 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample ID:21L096
Sample Date:3-8-21

Date Received: 3-8-21 **Date Tested:** 3-9-21
Tested By: M.Thomas
Checked By: T.Nunan
Title: Project Manager

Location: TP-4 S2
Sample Number: 21L096 **Depth:** 11.5' to 12.5'
Date Sampled: 3-8-21

Krazan

Client: RB Engineering
Project: New Car Dealership
Project No: 062-21008 **Figure**

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Geotechnical Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified to by the project Civil Engineer. Both the Geotechnical Engineer and Civil Engineer are the Owner's representatives. If the contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Geotechnical Engineer and Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Geotechnical Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork. The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner of the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be compacted to a density not less than 95 percent of maximum dry density as determined by ASTM Test Method D1557 as specified in the technical portion of the Geotechnical Engineering Report. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Geotechnical Engineer.

SOIL AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report. The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the contract for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation

either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including Court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Geotechnical Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building area should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree root removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill or tree root excavation should not be permitted until all exposed surfaces have been inspected and the Geotechnical Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

SUBGRADE PREPARATION: Subgrade should be prepared as described in our site preparation section of this report.

EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Geotechnical Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Geotechnical Engineer. All materials utilized for constructing site fills shall be free from vegetable or other deleterious matter as determined by the Geotechnical Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Geotechnical Engineer. Both cut and fill shall be surface compacted to the satisfaction of the Geotechnical Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Geotechnical Engineer indicates that the moisture content and density of previously placed fill are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. DEFINITIONS – The term "pavement" shall include asphalt concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

2. SCOPE OF WORK – This portion of the work shall include all labor, materials, tools, and equipment necessary for and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically notes as "Work Not Included."

3. PREPARATION OF THE SUBGRADE – Subgrade should be prepared as described in our site preparation and pavement design sections of this report.

4. AGGREGATE BASE – The aggregate base shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base should conform to WSDOT Standard Specification for Crushed Surfacing Base Course or Top Course (Item 9-03.9(3)). The base material shall be compacted to a minimum compaction of 95% as determined by ASTM D1557. Each layer of subbase shall be tested and approved by the Geotechnical Engineer prior to the placement of successive layers.

5. ASPHALTIC CONCRETE SURFACING – Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The drying, proportioning, and mixing of the materials shall conform to WSDOT Specifications.

The prime coat, spreading and compaction equipment, as well as the process of spreading and compacting the mixture, shall conform to WSDOT Specifications, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with combination steel-wheel and pneumatic rollers, as described in WSDOT Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

6. TACK COAT – The tack (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of WSDOT Specifications.