Oregon TECH
Procurement & Contract Services

Klamath Falls:
541.885.1133 (office)
3201 Campus Drive
Klamath Falls, OR 97601

Portland-Metro:
503.821.1266 (office)
27500 SW Parkway Avenue
Wilsonville, OR 97070

INVITATION TO BIDDERS #2024-01
INDUSTIRAL PARK DRIVE IMPROVEMENTS
ADDENDUM NUMBER ONE
FEBRUARY 29, 2024

On February 20, 2024, the Oregon Institute of Technology ("Oregon Tech") published Invitation to Bidders #2024-01 for INDUSTRIAL PARK DRIVE IMPROVEMENTS ("BID").

Oregon Tech has found that it is in its interest to amend the BID through the issuance of this Addendum Number One. Except as expressly amended below, all other terms and conditions of the original BID and any previous addenda shall remain unchanged.

1. BID #2024-01 Industrial Park Drive Improvements project geotechnical design report conducted and published by The Galli Group Engineering Consulting dated October 4, 2023 is attached as Exhibit A in this Addendum Number One.

2. BID #2024-01 Industrial Park Drive Improvements project AutoCAD (CAD) drawings are to be made available by formal request by completion of the ZCS Engineering and Architecture Electronic File Hold Harmless Agreement attached as Exhibit B in this Addendum Number One. The completed ZCS Engineering and Architecture Electronic File Hold Harmless Agreement is to be submitted by email to purchasing@oit.edu.

3. The ZCS Engineering and Architecture – Bid Quantities form is made available by Excel file in addition in addition to the PDF format. The ZCS Engineering and Architecture – Bid Quantities Excel file will be available as an attachment in BID #2024-01 Industrial Park Drive Improvements as published on the Oregon Public Universities Business and Bid Opportunities website (Opportunities :: ORPU Procurement and Bid Opportunities (wou.edu)).

End of Addendum

EXHIBIT A
THE GALLI GROUP ENGINEERING CONSULTING GEOTECHNICAL DESIGN REPORT
DATED OCTOBER 4, 2023

[Please see attached.]

THE GALLI GROUP
Engineering Consulting

GEOTECHNICAL DESIGN REPORT
INDUSTRIAL PARK DRIVE MPROVEMENTS
OREGON INSITUTE OF TECHNOLOGY
KLAMATH FALLS, OREGON

For: Josh Modin, Lead Designer
ZCS Engineering & Architecture
900 Klamath Avenue
Klamath Falls, OR 97601

By: **THE GALLI GROUP**
612 NW Third Street
Grants Pass, OR 97526
(541) 955-1611

02-6313-01
October 4, 2023

Table of Contents

THE GALLI GROUP
Engineering Consulting

GEOTECHNICAL DESIGN REPORT
INDUSTRIAL PARK DRIVE IMPROVEMENTS
OREGON INSTITUTE OF TECHNOLOGY
KLAMATH FALLS, OREGON

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation and evaluation of the site and existing roadway conditions for the proposed new roadway improvements to Industrial Park Drive, located in Klamath Falls, Oregon. Please see *Figure 1, Vicinity Map*, for the project location.

The purpose of our investigation and this report was to evaluate the site area surface and subsurface conditions with a series of five (5) exploratory borings in order to provide an assessment of the existing conditions of the roadway section and underlying subgrade support, and to provide geotechnical and structural section recommendations for final design and construction of the proposed street improvements.

2.0 SITE AND PROJECT DESCRIPTION

Industrial Park Drive extends north-south approximately 1,750 feet along the west edge of the Oregon Tech campus, between Dan O-Brien Way and College Way. The east side of Industrial Park Drive is bordered by the Oregon Tech CEET Building, and provides access to Parking Lot E and the Facilities Loop access road/entrance to parking lots F and G. The west side of Industrial Park Drive is generally undeveloped. Grades along the roadway range from approximately 2% to 6% as it extends across the broad natural drainage basin which makes up this area. The natural ground slopes along Industrial Park Drive are generally mild and trend down toward the west, toward Upper Klamath Lake. The roadway appears to have been generally constructed at or near the existing natural grades, with some minor 2' to 4' embankment fills along its west edge. The road prism/embankment fills thicken to approximately 5' to 7' at the south end of the alignment, at the intersection with Dan O'Brien Way. The roadway transitions into a cut condition at the north end of the alignment, with 6' to 20' cut slopes on the west and east sides of the roadway, respectively.

Currently, the subject portion of Industrial Park Drive consists of asphaltic concrete (AC) paved drive lanes separated by an 8' to 10' wide center median with gravel surfacing and gravel shoulders. The AC contains moderate to severe alligator cracking throughout and the center median and shoulder gravel areas show signs of rutting and subsidence (pot holes). The areas beyond the shoulders on both sides of the roadway generally consist of grass/landscape covered cut and fill slopes (roughly 2.5H:1V to 3.5H:1V slopes) with scattered trees. Existing drainage ditches and/or vegetated drainage swales exist along the west side of the road to collect and convey runoff to the existing culverts.

Based on the *Oregon Tech Industrial Park Drive Improvements* plans (dated September 1, 2023) provided by ZCS Engineering and architecture, we understand the project will consist of reconstructing/improving an approximately 1,200-LF portion of the existing Industrial Park Drive roadway, beginning from its intersection with Dan O’Brien Way and extending north to just beyond the Facilities Loop access road entrance. We understand the new, two lane, fully improved access roadway will include bike lanes, a center median (or turn lanes) and sidewalks on both sides, in accordance with City of Klamath Falls Minor Collector Standards. The removal and replacement of the existing AC pavements and structural sections from the drive lanes, center median, and shoulders will be accomplished as part of this improvement project.

3.0 SITE INVESTIGATION

On September 7, 2023, our Project Engineer, Lyn Chand, P.E, and our drilling crew visited the site to accomplish the subsurface investigation. A total of five (5) exploratory borings were drilled, generally along the center of the existing roadway alignment, at the locations shown on *Figure 2*, *Site Plan with Boring Locations*. The drilling was accomplished with our ATV-mounted, solid-stem auger drill rig.

At boring locations with existing pavement, the asphalt was cored using an 8" diameter core barrel. Borings were advanced with sample collection and testing being accomplished at various depths. Standard Penetration Testing (SPT) was accomplished in each boring. This entails driving a 1½ inch I.D, 2-inch O.D., steel split spoon sampler by dropping a 140-pound weight for a 30-inch drop. The total number of blows it takes to drive the sampler the last 12 inches of an 18-inch drive is called the SPT N-value. These can be correlated with soil strength and density parameters from testing on thousands of other projects.

Borings penetrated to depths of between 2.5 and 9.0 feet through the existing structural support section and any fills, and terminating in the native, medium dense to dense, clayey Sand soils beneath the roadway. After drilling operations, all boreholes were backfilled with soils spoils and crushed rock and patched with AC cold patch, leaving the boring locations clear of most soil debris.

Our engineer identified the final exploration locations away from marked utilities, logged subsurface soils and water conditions and obtained soil samples for transport to our laboratory. Visual classification of the soils was made in the field and is presented in *Appendix A*, *Boring Logs*, at the end of this report.

4.0 LABORATORY TESTING

The soil samples collected during our investigation were tested for natural moisture content (ASTM D2216). In addition, two Washed Sieve analyses (ASTM D1140) and two California Bearing Ratio (CBR) Analyses (ASTM D1883) were conducted on representative native subgrade and fill soil bulk samples taken from borings B-4 and B-5. Individual lab test results are attached in *Appendix B.*

5.0 SUBSURFACE CONDITIONS

5.1 EXISTING STRUCTURAL SECTION

In general, the existing structural section along the paved areas of Industrial Park Drive consists of 3" to 3.5" of Asphaltic Concrete (AC) over 6" of 3/4"-0" crushed rock base. At boring B-1 (located at the Dan O'Brien Way intersection) we encountered 3 apparent AC layers totaling 10" in thickness underlain by approximately 8" of 3/4"-0" crushed rock base. In the unpaved center median areas, the surface/structural support section consisted of approximately 4" to 6" of mixed gravel and soil.

5.2 SUBGRADE SOILS

In general, we encountered two distinct subsurface conditions beneath the structural support sections in all the borings.

Borings B-1 and B-4 encountered fill soils layers consisting of stiff, sandy/clayey Silts and loose to medium dense Sands extending to a depth of approximately 5.0 feet. Beneath these native fill soils, the borings encountered native soils consisting of medium dense to dense, clayey Sands.

Borings B-2, B-3, and B-5 all encountered the native, medium dense to dense, clayey Sands directly beneath the structural support sections.

Please see more specific structural support section and soils information in the *Boring Logs in Appendix A.* Please note that the soils are shown as distinct layers in the Boring Logs, while in nature they may change more gradually. Soils conditions and fill depths may also change somewhat between the locations investigated.

5.3 GROUNDWATER

Generally, the soils encountered in the borings were damp to moist. No seepage zones or free groundwater table were encountered in any borings during our site exploration. Well log data from nearby wells indicates that water is typically encountered at depths greater than 100 feet. We do not anticipate groundwater being a problem for the proposed project.

6.0 GEOLOGIC HAZARDS AND SEISMIC DESIGN PARAMETERS

6.1 GEOLOGIC HAZARDS EVALUATION

Flooding. The project is not within any designated FEMA Special Flood Hazard Area (“100-year” flood zone), as shown on online mapping (OregonRiskMap, 2018). Therefore, the risk from flooding is very low.

Expansive Soil. The fine-grained soils encountered in the fill and native subgrade soils beneath the roadway are known to have low to medium expansion potential (based on our recent subsurface investigation and Plasticity Index testing of the native site soils at this site for the Oregon Tech New Student Housing Project, located on the east side of the campus). Therefore, recommendations to mitigate any adverse impact due to expansive soil will be provided in the geotechnical recommendation section of this report.

Landslides/Slope Instability. The project site is located on a parcel of land that is mildly sloping. However, moderately steep cut and fill slopes (approximately 27% and 33% respectively) exist on the immediate east and west sides of the roadway. Based on the densities and slope inclinations, these cut and fill slopes within the project area and surrounding area are stable in their current condition.

The project site is not within an existing Quaternary landslide (Qls) area, according to the air photos (Google Earth, 2021), and Lidar imagery (bare earth and highest hit imagery) of the Wocus Quadrangle (DOGAMI, 2021). The State Landslide Information Database for Oregon (Hazvu, 2021) mapped the area as moderate risk for a regional scale landslide. Therefore, all aspects of the cut/fill recommendations we have provided in *Section 8.3* of this report must be followed during project design and construction and care must be taken during site excavation and fill placement operations.

Note: *Typical recommendations for site grading and proper methods of cut-and-fill construction have been provided in the following sections of this geotechnical report. It is essential these recommendations be followed in order to minimize slope instability during excavations on the site.*

Liquefaction. The project is underlain by medium dense to very dense silty Sand and very stiff to hard sandy Silt. Free groundwater was not encountered in any of the borings drilled during our site exploration. Data from nearby wells indicate that the depth to free water is greater than 100 feet. Therefore, liquefaction and lateral spread is not considered to be a potential hazard at the site.

Seismic Ground Amplification or Resonance. No unusually hazardous amplification or resonance effects of seismic waves have been associated with soil/bedrock subsurface conditions in the project area. The peak horizontal acceleration, or PGA_M, is 0.565g for this project (see *Section 6.3*, below, for more information).

Tsunami/Seiche Hazard. The project is located nearly 135 miles inland and is not subject to tsunami hazard**.** The project site is not located downhill of any large lakes or bodies of water. Therefore, no seismically induced seiche hazard exists for the project.

Surface Rupture. The nearest active quaternary fault traces, part of the South Klamath Graben Fault system, are mapped to be approximately 1000 feet north of the project location. Typically, structures more than 100 feet away from an active fault are relatively safe from the impact of the surface fault rupture. Given the distance to the fault, the risk of surface rupture is very low at the project.

6.2 ASCE 7/16 DESIGN EARTHQUAKE

The design earthquake for the project area is based upon established values and methodology in ASCE 07-16 as recommended by the OSSC 2022. The Maximum Considered Earthquake (MCE_{R}) and spectral response accelerations were established as set forth in Chapter 11, the site class was determined using the method in Chapter 20 of ASCE 7-16 and the seismic parameters were obtained partly from the online ATC Hazard by Location tool. Table 1, below, provides the design acceleration parameters recommended to be used for design of the project.

Table 2: Recommended Design Acceleration Parameters

Industrial Park Drive Improvements (02-6313-01)		
Project Area: 3201 Campus Drive, Klamath Falls, Oregon	Latitude: 42.256325	
	Longitude: -121.790567	
Risk Category (Table 1.5-1, ASCE 7-16)	III	
Mapped Spectral Response Acceleration, MCER Short Period **Ss**, 0.2s (from Figure 22-1) ASCE 7-16	105.4% of g =	1.054 g
MCER 1 sec Period **S1**, (from Figure 22-2) ASCE 7-16	39.8% of g =	0.398 g
Site Class	C	
Site Coefficients **F_a**, Short Period (Table 11.4-1 ASCE 7-16)	1.200	
Site Coefficients F_v, 1 sec Period (Table 11.4-2 ASCE 7-16)	1.500	
Spectral Response Acceleration, **S_{MS}**, Short Period (Fa*Ss equation 11.4-1 ASCE 7-16)	1.265 g	
Spectral Response Acceleration, **S_{M1}**, 1 sec Period (Fv*Ss equation 11.4-1 ASCE 7-16)	0.597 g	
Design Spectral Acceleration **S_{DS}**, Short Period ((2/3)*SMS equation 11.4-3 ASCE 7-16)	0.843 g	

Design Spectral Acceleration **S_{D1}**, 1 sec Period ((2/3)*SM1 equation 11.4-3 ASCE 7-16)	0.398 g
MCEG, PGA (Figure 22-9 ASCE 7-16)	47.1% of g = 0.471 g
Site coefficient, **F_{PGA}** (Table 11.8-1 ASCE 7-16)	1.200
MCEG adjusted for site class effects, **PGA_M** (FPGA*PGA equation 11.8-1 ASCE 7-16)	0.565 g
Seismic Design Category **SDC** (Table 11.6-1 and 11.6-2 ASCE 7-16)	**0.5<=SDS = D** **SD1>0.2 = D**
Per the requirements of Section 11.6 of the ASCE 7-16 code, the more severe seismic category is assigned, which is **CATEGORY D**	

7.0 CONCLUSIONS

The primary geotechnical considerations for this project are the variable thicknesses of the undocumented fill and stiff surficial soils support layers located beneath the existing roadway. Based on the borings accomplished and our evaluation of the site geology, the roadway is considered to be stable. The grading required for the road improvements, when constructed properly and in accordance with this Geotechnical Design Report, will not adversely impact the general slope stability of this or adjacent parcels.

There is very little water present (no seepage or groundwater in borings). After development, all site surface runoff will end up in approximately the same location, downslope of the site, as it does now. Proper grading techniques, surface water control and installed erosion control items will adequately mitigate potential for off-site movement of soil fines and any impacts of the grading work.

Therefore, in our professional opinion, based on our site investigation and office review, the soils conditions at the site are suitable for the proposed new Industrial Park Drive improvements, provided the recommendations of our report are incorporated in the design and construction of the project.

8.0 GEOTECHNICAL RECOMMENDATIONS

The following sections of this report provide general site preparation recommendations and design recommendations for creating stable cut and fill slopes for roadway support and providing Asphaltic Concrete section designs for long-term support of the proposed roadway.

8.1 SITE PREPARATION AND GRADING

We understand the existing AC and base rock layers along the roadway project extents will be demolished and removed. Based on our site observations and the subsurface investigation, the subgrade soils for the roadway will generally consist of the existing stiff, clayey Sand fill soils and/or medium dense to dense, native Sand soils. Therefore, subgrade preparation should include removing the AC surface base rock layers to expose the existing native and fill subgrade soils. Portions of the site may also require debris removal from the existing fill slopes and clearing, grubbing and stripping of organic materials from these existing slopes, in order to construct/extend the width of the fill areas. Normal methods of clearing, grubbing and stripping for organic removal (on existing embankment slopes) will apply.

8.1.1 Clearing, Grubbing and Stripping

All areas proposed for the new AC pavements, sidewalks, or embankment structural fill shall have all existing AC and base rock removed and be cleared and grubbed of all trees, stumps, brush, and other debris and/or deleterious materials. The site shall then be stripped and cleared of all vegetation, sod, and organic topsoil encountered. The stripped materials and unacceptable, loose, on-site fill soils removed must be hauled from the site or stockpiled for use in landscape areas only (such as landscape mounds). This material shall not be used in structural fill or trench backfill.

If encountered, abandoned utility lines, storm drains, underground tanks or other items which provide void space beneath the surface must be removed or effectively plugged. Movement of surface and/or groundwater through these old conduits can create the potential for piping of soils (the removal of soil fines by water seeping into the void spaces or through conduits), resulting in subsidence of the surface or settlement of structures and paved areas.

Holes or depressions resulting from the removal of underground obstructions or excavations for old fill that extend below the finish subgrade and will be beneath roadways or sidewalks shall be cleared of all loose material and dished to provide access for compaction equipment. These areas shall then be backfilled and compacted with approved structural fill, as described later in this report.

It is recommended that grubbing and stripping of the site, debris removal and backfill and compaction of depressions below finish subgrade be observed by the geotechnical engineer or representative from The Galli Group.

8.1.2 Subgrade Densification

After removal of all vegetation, organic soil, and deleterious materials, and when the subgrade has been cut to grade, the exposed subgrade shall be redensified by numerous passes with a heavy vibratory roller. The upper 12 inches of the subgrade shall be redensified by several passes and must achieve at least 95% of the Maximum Dry Density as determined by laboratory test method ASTM D-698 (Standard Proctor) or must successfully pass a proofroll, as described in the following section. This densification shall be accomplished under all areas of the site, including asphalt areas, concrete sidewalks and any new embankment fill areas.

8.1.3 Subgrade Proofrolling

The exposed subgrade throughout the site which will support roadways, fills, driveways, and sidewalks shall be proofrolled (after grubbing and stripping and over-excavation where required) under the observation of a representative from The Galli Group. The proofrolling may be accomplished with a loaded dump truck. Proofrolling shall be discontinued if it appears the operation is pumping moisture up to the surface or otherwise disturbing the in-place soils. *When proofrolling, a successful test is when the tires of a loaded or partially loaded truck do not deflect the soils more than ⅜ inch.*

Where subgrade soils are disturbed or do not demonstrate a firm, unyielding condition when proofrolled, the soil shall be redensified or aerated and redensified, or replaced with imported granular fill. The imported fill material shall be compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM Test Method D-698 (Standard Proctor). All soft and/or unstable areas shall be over-excavated and backfilled with granular structural fill.

We recommend our firm observe proofrolling of the subgrade after excavations are complete and prior to placement of structural fill. After completion of site stripping, excavation to subgrade, redensification and proofrolling, the contractor must take care to protect the subgrade from disturbance due to construction equipment, especially during very wet weather.

8.2 UTILITY AND SITE EXCAVATIONS

During the construction of the project, we anticipate excavations will be required for construction/extension of drainage/utility installations. Excavations will likely encounter the medium dense and medium stiff fill, and the native, dense, clayey Sand.

Excavations. Medium to large dozers and excavators should have no difficulty in removing the existing fill materials and excavating trenches into the native soils up to 10 feet (if required) across most of the project site. We did not evaluate the ease of excavation at this site beyond 10 feet. Trench excavations during dry weather should stand in shallow trenches (less than 4 feet) in the existing fill and native soil areas. *However, these are likely to have some sloughing or rockfall off the excavation sidewalls.* Surface water runoff, seepage or wet weather and long-term dry weather may cause these upper fill soils to slough into the trench.

Note: If deeper (6 to 10 feet) trenches or excavations are required, these will likely require some form of shoring measures or temporary cut slopes (see below) to effectively and safely install and backfill the utilities at these deeper locations.

8.3 CUTS AND FILLS

Permanent cuts and fills could be required for this site, depending on the final design/finished grades of the project. These must be constructed at proper inclinations and be of the recommended materials to remain stable.

8.3.1 Temporary Cut Slopes

During dry weather, temporary cut slopes may be cut at 1.0H:1V or flatter in all materials encountered. During wet weather, the contractor must be prepared to flatten temporary cut slopes in the fill soils and/or upper native soils to 1.5H:1V or flatter. Some minor sloughing of the excavation face may occur.

8.3.2 Permanent Cut Slopes

Permanent cut slopes are very unlikely on this project. Any new permanent cut slopes shall be excavated at the following inclinations:

Existing sandy Silt or silty Sand Fill	3.5H:1V
Native silty Sand and sandy Silt	2.5H:1V

8.3.3 Fill Slopes

Permanent fill slope inclinations shall be constructed as follows.:

Onsite clayey Sand and sandy Silt	3.5H:1V
Imported Angular Crushed Rock	1.75H:1V

All such fills shall be placed and compacted as Structural Fill as described later in this report. In order to decrease surface sloughing and erosion of all fill these must be overbuilt and then cut back to a compacted fill face.

8.3.4 Fill on Steep Slopes

All fills placed on native slopes or existing fill slopes steeper than 10% shall be placed and configured as shown on *Figure 3- Fill on Steep Slope Cross Section*. This requires a key trench across the toe and level benches cut back up the slope. Place and compact the fill in level lifts as Structural Fill. As noted, drainage beneath the fill (at least in the key area) may be required by the geotechnical engineer at the time of excavation based on the location and site/soil conditions. It is critical, in order to decrease long-term settlements beneath all areas and to have adequate strength, that these fills be placed and compacted properly.

Note: Compaction of the fill being placed, even for landscape purposes as “waste” soils, is critical to its stability and to the stability of adjoining areas. Our personnel must inspect and verify the key and bench cuts, the drainage installation (if needed) and all fill placement and compaction that will support (vertically or laterally) any portion of the structures or that are on slopes greater than 10%.

Please note, that while we have commented on the anticipated stability of the soil in trenches and cuts, we are not responsible for job site safety. The contractor is at all times responsible for job site safety, including excavation safety. We recommend all local, state and federal safety regulations be adhered to.

8.4 STRUCTURAL FILL PLACEMENT AND COMPACTION

8.4.1 Beneath Structures

Structural fill is defined as any fill placed and compacted to specified densities and used in areas that will be under structures, pavements, sidewalks and other load-bearing areas. Structural fill will be required to backfill beneath pavements and sidewalks on this project.

Structural Fill Materials. Ideally, and particularly for wet weather construction, structural fill must consist of a free-draining, angular, granular material (non-expansive) with a maximum particle size of six inches. The material should be reasonably well-graded with less than 5 percent fines (silt and clay size passing the No. 200 mesh sieve). During dry weather, any organic-free, non-expansive, compactable granular material, meeting the maximum size criteria, is acceptable for this purpose. Locally available crushed rock and jaw-run crushed "shale" have performed adequately for most applications of structural fill. *The on-site fill materials which are reasonably clear of organics and debris may be utilized as structural fill for certain applications for most areas beneath structural fill sections.* See *Section 8.6.1* for subgrade preparation and undocumented fill re-use requirements and see *Section 9.0* for structural fill specifications.

Note: *It is the contractor's responsibility to understand the impending weather and plan for use of structural fill that will be capable of being compacted properly and remain stable under the expected construction traffic in all weather that could arise during the project construction.*

Structural Fill Placement. Structural fill shall be placed in horizontal lifts not exceeding 8 inches loose thickness (less, if necessary, to obtain proper compaction) for heavy compaction equipment and four inches or less for light and hand-operated equipment. Each lift must be compacted to a minimum of 95 percent of the maximum dry density, unless otherwise specified, as determined by the Standard Proctor test, (ASTM D698/AASHTO T99). Compaction shall be by mechanical means; "jetting" or water settling will not be allowed.

To facilitate the earthwork and compaction process, the earthwork contractor must place and compact fill materials at or slightly above their optimum moisture content. If fill soils are on the wet side of optimum, they can be dried by continuous windrowing and aeration or by intermixing lime or Portland Cement to absorb excess moisture and improve soil properties. If soils become dry during the summer months, a water truck must be available to help keep the moisture content at or near optimum during compaction operations.

Fill Placement Observation and Testing Methods. The required construction monitoring of the structural fill utilizing standard nuclear density gauge testing and standard laboratory compaction curves (ASTM D-698 specified) is not applicable to larger jaw run shale (2" or above) or larger crushed rock. The high percentage of rock particles greater than ¾'s of an inch in these materials causes laboratory and field density test results to be erratic and does not provide an adequate representation of the density achieved. Therefore, construction specifications for this type of material typically specify method of placement and compaction coupled with visual observation during the placement and compaction operations.

For these larger rock materials, we recommend the 8-inch lift be compacted by a minimum of 3 passes with a heavy vibratory roller. One "pass" is defined as the roller moving across an area once in both directions. The placement and compaction shall be observed by our representative. After compaction as specified above is completed, the entire area shall be proofrolled with a loaded dump truck to verify density has been achieved. All areas which exhibit movement or compression of the rock material under proofrolling shall be reworked or removed and replaced as specified above. A successful proofroll is when there is less than ¼" deflection below the tires of a loaded truck.

Nuclear Density Testing of Fill. Field density testing by "nuclear" methods would be adequate for verifying compaction of 2-inch to ¾-inch minus crushed base rock, Decomposed Granite and other materials 2 inches or smaller in size. Therefore, typical specifications would suffice. Testing shall be accomplished in a systematic manner on all lifts as they are placed. Testing only the upper lifts is not adequate.

8.4.2 Non-Structural Fill

Any waste soil, organic strippings or other deleterious soil would be considered non-structural fill. These materials may make reasonable landscape soils and lawn topsoil material. This material may be placed in landscape areas and waste soil areas such as berms with slopes at 3.5H:1.0V or flatter. It shall not be placed under structures, sidewalks, roadways, parking areas or as part of a structural fill slope. It is recommended that when these soils are used, they be given a moderate level of compaction (90 to 92 percent) to help seal them from surface water.

8.5 UTILITY LINE RECOMMENDATIONS

Below we have provided general recommendations for utility construction for the project. Recommendations are based upon the requirements in Section 8-9 of the City of Klamath Falls Public Works Standards, observations from our field investigation and experience on other projects with similar subsurface conditions.

Trench Excavation. Trenches will be required across the site for utility installation of various kinds. As discussed earlier, all soils encountered should be able to be excavated with most excavators. Trench excavation should be moderately easy in all areas of the site. *Sideslopes of trenches deeper than 48 inches will likely ravel and collapse due to the sand and gravel materials.* Therefore, trench boxes or temporary cut slopes will likely be required for deeper trench excavations.

Trench Backfill and Compaction. The new utility lines will require trench backfill and compaction. The pipes need to be adequately supported and the trenches need to be backfilled and compacted properly to minimize potential subsidence of the surface or damage to utility lines or the overlying foundations or pavement sections.

In our experience, utility trench backfill has been the source of the majority of post-construction fill settlement problems in paved areas. These are also areas which cause early pavement failure due to inadequate subgrade support.

Pipe Bedding. The bottom of the trench must be shaped out of acceptable bedding materials (refer to manufacturer's recommendations) to fit the pipe base prior to placement of the pipe. It is critical to the long-term performance of the pipe that the bottom and haunches be fully supported by a dense bedding which decreases pipe distortion from load. Finer crushed rock materials (such as ¾-inch minus crushed rock) usually provide the best bedding material.

Pipe bedding shall be compacted to 95% of ASTM D-698 (Standard Proctor) or to that which is specified by the pipeline designer. Cement-treated pea-gravel or sand/cement slurry (with at least 200 pounds of cement per cubic yard) will solidify and would typically not require compaction after placement and also makes good bedding material. Care must be taken to make sure the pipe does not "float" up in the fluid mix prior to it "setting".

Pipe Zone Material. All of the lines shall be backfilled around and to approximately 12-inches (more, if required by manufacturer) above the pipe with an acceptable "pipe zone" material. This may consist of finer crushed rock, cement-treated pea gravel, sand/cement slurry, coarse sand with fine gravel, or other material acceptable to the client and pipeline designers. The pipe zone material shall be well compacted on each side of the pipe, and to at least 12 inches above the pipe. Mechanical means will typically be required to densify these materials to the required densities (unless a cement-treated material is used). Water settling is not allowed.

Density requirements for "pipe zone" backfill shall be per the manufacturer's specifications for the type of pipe being used (we recommend using 95% of the maximum dry density, as determined by ASTM D-698). Care shall be taken when compacting close to and immediately above the pipe so as to not damage the pipe.

General Trench Backfill. Above the “pipe zone” the backfill materials would typically consist of any compactable material that does not have excessive voids (such as gap-graded large gravels and cobbles), organics, expansive clay, debris or other deleterious material. Crushed rock, clean jaw-run shale and sand and gravel work well for general trench backfill.

Where laterals of any kind, or valving, extend upward from the lines, we recommend the trench areas adjacent to these items be backfilled with the “pipe zone” backfill materials. This will prevent the larger pieces of other backfill materials from damaging the valves and/or other equipment.

We strongly recommend that all general trench backfill be placed and compacted in the same manner as for general structural fill. Trench backfill beneath asphalt pavements but not under structures shall be compacted to at least 95 percent of the maximum dry density, as determined by ASTM Test Method D-698 (Standard Proctor). Trench backfill in landscape areas, that are not part of a cut or fill slope, may be compacted to at least 93 percent of the maximum dry density.

8.6 ASPHALTIC CONCRETE PAVEMENTS

The reconstructed roadway will consist of Hot Mix Asphaltic Concrete (HMAC) paved surfaces over crushed rock. The following sections provide recommendations for asphaltic concrete section design and construction over the redensified native and fill soil subgrades. The subject portion of Industrial Park Drive is underlain by Sand and clayey Sand soils. These subgrade soils, when prepared as recommended in *Sections 8.1.1 through 8.1.4,* should provide good support for the project.

The AC pavement design section provided below is proposed as an alternative to the City of Klamath Fall's Typical Roadway Sections for local and/or minor collector roads (Drawing Nos. 8-175 and 8-180). The following documentation has been provided to show that the proposed pavement design section will provide equivalent, long-term (20-year design life) support for the project and will not compromise public safety or increase maintenance cost to the City. The proposed section design was determined utilizing the Crushed Rock Equivalency (CRE) method, in accordance with the City of Medford's "Asphalt-Concrete Pavement Structure Design Guidelines (1998)".

8.6.1 Pavement Subgrade & Traffic Loading

A total of two (2) California Bearing Ratio (CBR) Analyses (ASTM D1883 - single point) have been accomplished on soils samples taken from borings B-4 and B-5 during our investigation (see *Appendix B* for test results).

A CBR value of 17 was determined for the B-4 gray-brown Sand fill soils. The CBR test on the B-5 orange clayey Sand native soils resulted in a CBR value of 11. This converts to R-values of 49 for the Sand fill soils and 40 for the native clayey Sands using the CBR to R-value correlations on the "Soil Support Correlations" chart (provided in *Appendix C*). Given the anticipated variability in the on-site native and fill soils subgrades, and from our experience on similar soils, we have elected to use the more conservative subgrade R-value of 40 for the roadway soil subgrades on this site. This assumes the soil subgrades have been properly prepared and assumes use of a woven geotextile support fabric under all AC areas.

We anticipate the traffic loading to consist of autos and pick-ups (Oregon Tech students and faculty, heavy). Occasional medium to heavy (3 axle) delivery trucks and trash truck traffic is anticipated for this roadway. Based on our review of the *Transportation Impact Analysis* memorandum provided by Kittelson & Associates (dated May 8, 2019) we have assumed Industrial Park Drive daily traffic to consist of 1,000 vehicles per day with 2% trucks, for the computation of the equivalent Axle Loading, or EAL. This produced a computed Traffic Index, or TI, of 6.3 for the roadway (see the Traffic Index Calculations in *Appendix C*). The TI value is based on the anticipated traffic numbers, axle loads from trucks and for a 20-year design life.

The following asphaltic concrete roadway section design was determined utilizing the Crushed Rock Equivalency (CRE) method. The computed Traffic Index, CBR lab test results and R-value correlation of the roadway subgrade soils were utilized to determine the Crushed Rock Equivalent depth needed using the "Street Structural Section Design Chart", attached in *Appendix C*. The Crushed Rock Equivalent for Industrial Park Drive was determined to be CRE = 14". See the Crushed Rock Equivalency Calculations in *Appendix C*.

8.6.2 Asphaltic Concrete Pavement Design

We have designed the asphaltic pavement structural support sections using the Traffic Index (TI), subgrade R-values listed above and by utilizing the Crushed Rock Equivalent Method with the following results.

Industrial Park Drive AC Pavement Section (TI = 6.3)

3” AC (Class B or Type II Dense Graded HMAC)
8” Base Rock (3/4” or 1” Minus Crushed Rock)
Woven Geotextile Support Fabric (ACF S200 or Equivalent)
Densely compacted subgrade - must pass proofroll inspection

We recommend all aspects of the subgrade preparations, aggregate base rock placement/compaction and AC paving along this portion of the roadway alignment be accomplished as recommended in the preceding and following sections of this report and in accordance with project plans and specifications and the applicable City of Klamath Falls and ODOT standards and recommendations.

8.6.3 General Recommendations

Subgrade Preparation. Subgrade preparation should begin with removal of debris and loose and disturbed soils. All debris and organic material should be disposed of properly and is not permitted as subgrade or fill material.

All finish subgrades should be shaped to a uniform surface running reasonably true to the established line and grade described in the contract documents. Areas so specified must be redensified and/or backfilled with structural fill. It is important that dense, stable conditions of the subgrade be maintained until the subgrade is covered with the subbase aggregate. Subgrade preparation should include cleaning, redensification to at least 95% of ASTM D-698, and proofrolling (as described earlier in this report) to identify soft and disturbed subgrade areas.

After subgrade preparation is completed, the upper 12 inches of exposed subgrade prepared for the pavement structure should demonstrate a firm and unyielding condition as shown by proofrolling.

Soft or loose materials disturbed during the site preparation process, incapable of achieving the compaction criteria, should be removed to appropriate bearing materials prior to replacing with structural fill.

Geotextile Fabric Placement. When the subgrade soils have been properly prepared, the described subgrade areas shall be covered with the woven geotextile support fabric prior to placement and compaction of structural fill. We recommend a fabric such as ACF S200 or equivalent. The fabric shall be laid longitudinally with the direction of traffic. All ends and edges should be overlapped a minimum of 5 and 2 feet, respectively. Care must be taken to not damage the fabric. <u>It should be noted that construction trucks should not be allowed to “run” directly on top of the fabric until it is covered with rock</u>. We recommend covering the subgrade soils with <u>at</u> <u>least</u> 6 inches of crushed rock over the woven fabric, during construction, prior to light construction truck traffic traversing the area.

Wet Weather Construction. We recommend that for construction during very wet weather or on wet subgrades, all construction roads and drive lane subgrades should be covered with a <u>woven</u> geotextile support fabric (ACF 180, S200 or equivalent) and a <u>minimum</u> of 12 inches of imported granular 4-inch minus crushed rock. Compaction of the fill should not begin until a minimum of 8 inches of rock is placed above the fabric. Compact carefully so as not to disturb the subgrade. This should provide an adequate "haul road" working surface and help protect the subgrade from damage from construction traffic. Construction traffic should not be allowed to traverse the area until the minimum of 12 or more inches of compacted material has been placed and compacted over the support fabric.

Note: If construction traffic begins to “pump” the subgrade soils, “haul roads” with 18" or more of crushed rock over fabric shall be established. These are particularly helpful near the structure, where concrete trucks will be situated during building construction.

The excess rock on these "roads" may be pulled off and used in the AC areas when final rock placement takes place.

Materials. All materials used and construction techniques applied at the site must result in conditions as assumed for design of the pavement sections. We recommend materials used in the pavement support sections be as listed in *Section 9.0 - Materials Specifications* below.

Drainage. Adequate provision should be made to direct surface water away from the pavement section and subgrade. Ponded water adjacent to the asphalt areas can saturate the subgrade resulting in loss of support. Therefore, we recommend the areas along the edge of the asphalt be well drained. All paved areas should be sloped and drainage gradients maintained to carry surface water to catch basins or ditches for transmission off the roadway and parking areas. Excessive landscape watering can also saturate the subgrade and decrease pavement life. Deep curbs, drip irrigation and/or use of dry-land plants will mitigate these affects.

Maintenance. Pavement life can be extended by providing proper maintenance and overlays as needed. Cracks in the pavement should be filled to prevent intrusion of surface water into the subbase. Asphalt pavements typically require seal coats or overlays after 10 to 12 years to maintain structural performance and aesthetic appearance.

9.0 MATERIALS SPECIFICATIONS

The following materials specifications shall apply to the materials used on this project. **Note:** All such materials to be used on the project must conform to the requirements specified in the ODOT Standard Specifications for Construction and be submitted for compliance testing or review, at least two weeks prior to use at the site.

Aggregate Base Rock (AB) Structural Fill

- Angular Crushed Rock (¾ or 1" Minus); R=85 or greater; Well Graded (No Gaps and at least 60% retained on the No. 4 sieve).
- Exceeds the fracture, durability and sand equivalent requirements outlined in Section 00641 of the Oregon Standard Specifications for Construction.
- Maximum passing the No. 200 sieve ≤ 5% Total; ≤ 2% Clay Size.
- Compacted to 95% of the maximum dry density as determined by ASTM D698 or AASHTO T-99.

Aggregate Subbase Rock (ASB) Structural Fill (over-excavations)

- Angular Clean Crushed (jaw run) hard "Shale" (4" Minus Jaw-Run) or Crushed Rock (2" to 4" Minus); R=50 or greater; Angular and Reasonably Well Graded.
- At Least 60% retained on the No. 4 Sieve.

- Exceeds the fracture, durability and sand equivalent requirements outlined in Section 00641 of the Oregon Standard Specifications for Construction.
- Maximum passing the No. 200 sieve ≤ 10% Total; ≤ 3% Clay Size.
- During wet weather; passing No. 200 sieve ≤ 5%.
- Compacted to 95% of the maximum dry density as determined by ASTM D698 or AASHTO T-99; initial lift may not attain 95% due to soft subgrade; Engineer to decide in the field.
- Care must be taken to avoid very silty subbase that will not support construction loads, especially when wet (will not meet specifications).

Embankment Fill/On-Site Soil (Acceptable for Structural Fill During Dry Weather)

- Reasonably well graded (not open work).
- Has at least 60% retained on the No. 4 sieve.
- Has no more than 30% passing No. 200 sieve.
- Passing No. 200 sieve must have less than 20% clay size.
- Use only as directed on this report

Note: Some fill materials will be difficult to nearly impossible to compact during wet weather. *The contractor must select the type of structural fill that will be able to be placed and compacted to specified conditions during the weather conditions that may take place during the construction schedule.*

Sand

- Clean washed sand or sand and gravel, less than 1% passing No. 200.
- Gravel to be rounded or subrounded (no fracture faces), 1" or less.
- Must have less than 30% gravel by weight.

Drain Rock (For drainage sections)

- Clean, washed, rounded or angular openwork drain rock.
- Gradation to be 1/4" and greater, sized to not move into and through perforations in the pipe.
- 1/4" to 3/4" clean crushed, 3/4" to 1" clean rounded rock, 1" to 2" clean angular rock are all acceptable.
- Clean means washed rock with NO coating of silt, clay or sand.

Note: All types may be used in all applications of drain rock that are not beneath Asphaltic Concrete paved areas. In all AC areas angular clean drain rock must be used for AC support.

Woven Geotextile Support Fabric

- Woven geotextile support fabric designed for separation of crushed rock and subgrade soil and for rock section support.
- Meet specifications as per ACF S200 woven support fabric.
- Overlap edges at least 2 feet and ends at least 5 feet.

- Align roll lengthwise with direction of traffic in all drive lanes.
- Pull tight full length and keep tight during placement of crushed rock above fabric.
- Do not drive on the fabric until it is covered with rock.

Asphaltic Concrete

- Level II, 1/2-inch Dense Graded HMAC
- PG 64-22
- The 3” AC may be placed in 1 lift if vibratory rollers are used.
- Compacted to between 92% and 95% of maximum density.
- Must have densification completed while temperature is above 185 degrees F.
- Do not over densify as this will significantly decrease frost heave protection of internal air voids.
- The contractor must provide a HMAC design mix for review and approval.
- All aspects of the asphaltic paving shall be accomplished in accordance with applicable ODOT standards and recommendations.

NOTE: These materials shall be used on this project as specified in this report and on project plans or specifications. Deviations from specified materials must be approved in writing by the geotechnical engineer, owner, and owner's other consultants/design engineers prior to use at the site.

10.0 LIMITATIONS

The analyses, conclusions and recommendations contained in this report are based on site conditions and assumed development plans as they existed at the time of the study, and assume soils, rock and groundwater conditions exposed and observed in the borings during our investigation are representative of soils and groundwater conditions throughout the site. If during construction, subsurface conditions or assumed design information is found to be different, we should be advised at once so that we can review this report and reconsider our recommendations in light of the changed conditions. If there is a significant lapse of time between submission of this report and the start of work at the site, if the project is changed, or if conditions have changed due to acts of God or construction at or adjacent to the site, it is recommended that this report be reviewed, in consideration of the changed conditions and/or time lapse.

This report was prepared for the use of the owner, the design and construction team, and the City of Klamath Falls for their review, and for the design and construction of the project. It should be made available to others for information and factual data only. This report should not be used for contractual purposes as a warranty of site subsurface conditions. It should also not be used at other sites or for projects other than the one intended.

We have performed these services in accordance with generally accepted geotechnical engineering practices in Oregon, at the time the study was accomplished. No other warranties, either expressed or implied, are provided.

THE GALLI GROUP
GEOTECHNICAL CONSULTING

Mel Galli III

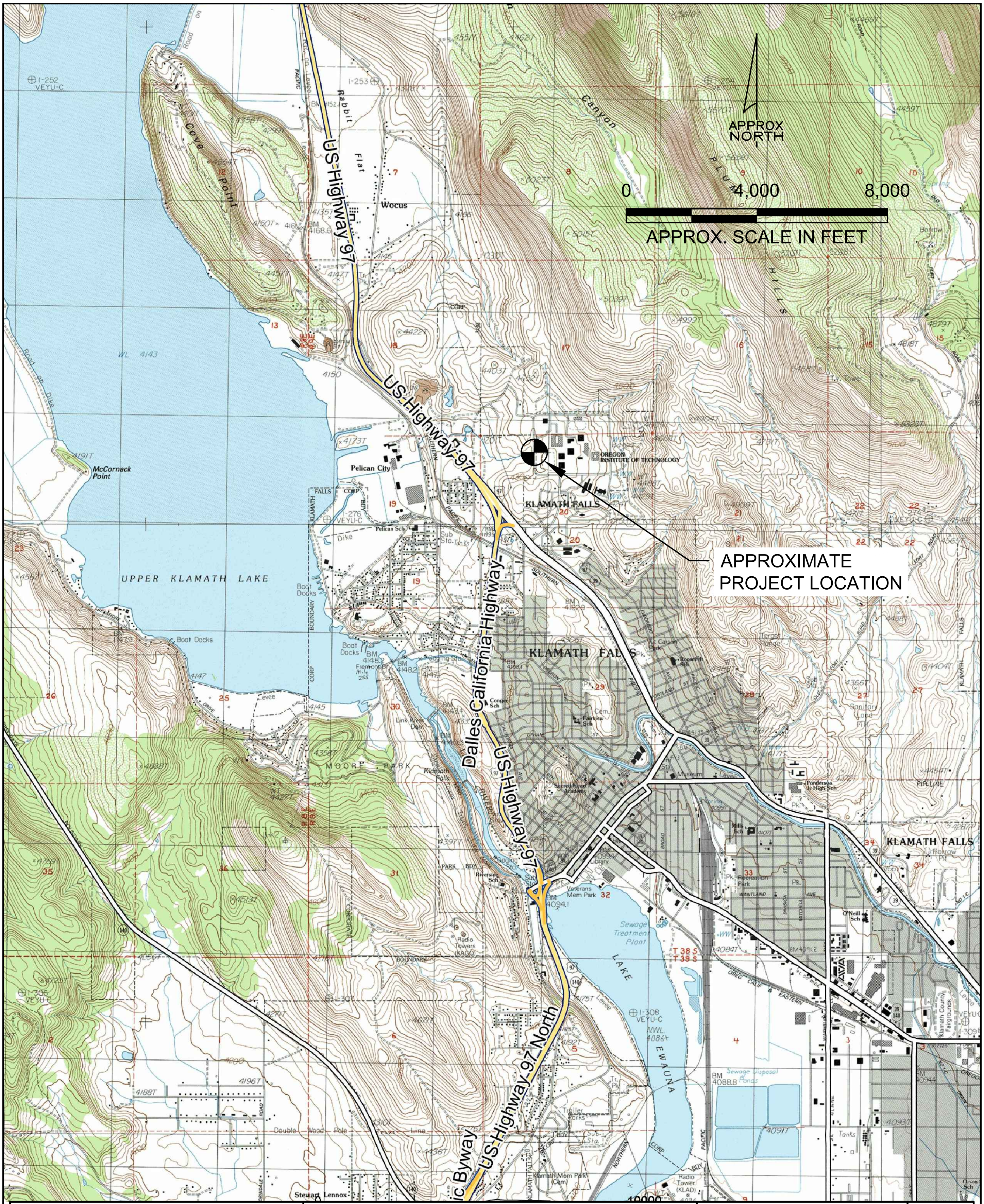
Melvin. Galli III, P.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
84454PE
OREGON
JANUARY 12, 2016
MELVIN JOHN GALLI III
EXPIRES: 06/30/2025

Dennis Duru

Dennis Duru, M.Sc., P.E., C.E.G., R.G.
Senior Project Engineer, Engineering Geologist

CERTIFIED
OREGON
DENNIS C. DURU
E2797
ENGINEERING GEOLOGIST
Expires:
12/2023



THE GALLI GROUP
GEOTECHNICAL CONSULTING
612 NW 3rd Street
Grants Pass, OR 97526

VICINITY MAP

INDUSTRIAL PARK DRIVE IMPROVEMENTS
KLAMATH FALLS, OREGON

DATE: OCTOBER 2023
JOB NO: 02-6313-01
REV: 10/3/2023 6:34 AM
PREPARED BY: MG3
6313 OIT Indust Prk Dr - 01 - Vicinity.dwg

FIGURE:
1

LEGEND

B-1 ⊕	BORING NUMBER AND APPROXIMATE LOCATION

APPROX NORTH

0 200 400

SCALE IN FEET

AERIAL PROVIDED BY GOOGLE EARTHT

THE GALLI GROUP
GEOTECHNICAL CONSULTING
612 NW 3rd Street
Grants Pass, OR 97526

SITE PLAN WITH BORING LOCATIONS

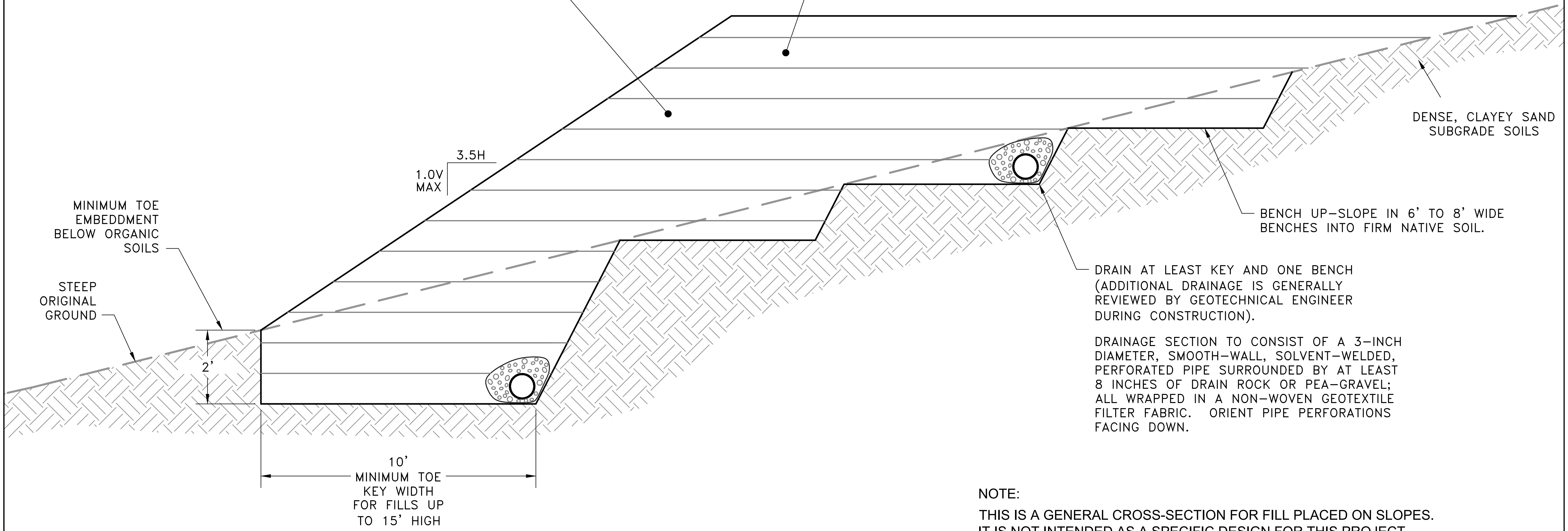
INDUSTRIAL PARK DRIVE IMPROVEMENTS
KLAMATH FALLS, OREGON

DATE: OCTOBER 2023
JOB NO: 02-6313-01
REV: 10/3/2023 7:43 AM
PREPARED BY: MG3
6313 OIT Indust Prk Dr - 02 - Site Plan.dwg

FIGURE: 2

STRUCTURAL FILL MATERIALS TO CONSIST OF APPROVED ON SITE SOILS AND ROCK (MAXIMUM SLOPE OF 3.5H:1V). OR IMPORTED CRUSHED ROCK (MAXIMUM SLOPE OF 1.75H:1V). IN NO CASE SHOULD THE ORGANIC TOPSOIL SOILS OR OTHER ORGANIC DEBRIS BE USED FOR STRUCTURAL FILL. PLEASE SEE FILL SLOPE RECOMMENDATIONS IN OUR DESIGN REPORT FOR RECOMMENDED FILL SLOPE ANGLES.

FOR AREAS BENEATH STRUCTURES AND ROADWAYS, PLACE AND COMPACT IN LEVEL LIFTS TO AT LEAST 98% OF THE MAXIMUM DRY* DENSITY PER ASTM D-698.



DRAIN AT LEAST KEY AND ONE BENCH (ADDITIONAL DRAINAGE IS GENERALLY REVIEWED BY GEOTECHNICAL ENGINEER DURING CONSTRUCTION).

DRAINAGE SECTION TO CONSIST OF A 3-INCH DIAMETER, SMOOTH-WALL, SOLVENT-WELDED, PERFORATED PIPE SURROUNDED BY AT LEAST 8 INCHES OF DRAIN ROCK OR PEA-GRAVEL; ALL WRAPPED IN A NON-WOVEN GEOTEXTILE FILTER FABRIC. ORIENT PIPE PERFORATIONS FACING DOWN.

NOTE:

THIS IS A GENERAL CROSS-SECTION FOR FILL PLACED ON SLOPES.
IT IS NOT INTENDED AS A SPECIFIC DESIGN FOR THIS PROJECT.

FOR ILLUSTRATION PURPOSES ONLY
NOT TO SCALE

THE GALLI GROUP
GEOTECHNICAL CONSULTING

612 NW 3rd Street
Grants Pass, OR 97526

FILL ON STEEP SLOPE
CROSS-SECTION

INDUSTRIAL PARK DRIVE IMPROVEMENTS
KLAMATH FALLS, OREGON

DATE: OCTOBER 2023
JOB NO: 02-6313-01
REV: 10/2/2023 4:05 PM
PREPARED BY: MG3
6258 OIT Student Housing - 06 - Slope Fill.dwg

FIGURE:
3

APPENDIX A

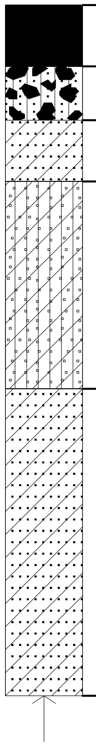
BORING LOG

THE GALLI GROUP
GEOTECHNICAL CONSULTANTS

BORING LOG
B-1

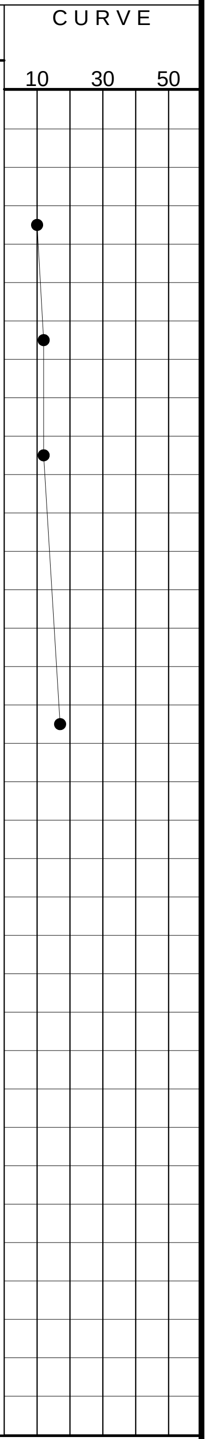
Project: Oregon Tech - Industrial Park Drive Improvements
Client: ZCS Engineering & Architecture
Location: Intersection "island"; See Figure 2, Site Plan with Boring Locations
Driller: TGG Blake/AJ
Drill Rig: ATV Mounted, 4" SSA
Depth To Water> Initial ▽ : none
At Completion ▼ : none

Project No.: 02-6313-01
Date: 09/07/2023
Elevation:
Logged By: Lyn Chand, PE



USCS	Description	Depth	Sample No. and Type	NMC	Standard Penetration Test N
FILL	Asphaltic Concrete, 3.5-inch core. Top Asphaltic Concrete, 3.25-inch core, middle.	0.8			
GM-SM	Asphaltic Concrete, 3.25-inch core, bottom, old and crumbly.	1.5	S-1	n/a	
SC	Base Rock, 3/4-inch minus, crushed rock . (FILL) Sample top - 6 inches	2.3	S-2	38.4 37.9	10
SC-SM	Medium dense, dark gray, clayey Sand, moist. (FILL) Sample middle - 10 inches		S-3	40.7	12
SC-SM	Stiff, orange-brown-gray, mottled, sandy, clayey Silt; moist. (FILL) Sample tip- 2 inches	5.0	S-4	27.7 49.5	12
SC	Stiff, dark brown and gray, clayey Silt; moist. (FILL) Medium dense, orange mottled, clayey Sand; with silt and trace gravel, moist. (Native)	9.0	S-5	40.3	17
	Bottom of Boring at 9.0 feet, due to auger refusal. No seepage or groundwater observed.				

Depth: 0, 2.5, 5, 7.5, 10, 12.5, 15, 17.5



Legend of Samplers: ▯ Grab sample ◩ SPT sample ‖ Shelby tube sample

Deep Fill Zones, Clayey and Gravelly soils lead to early auger refusal

This information pertains only to this boring and should not be interpreted as being indicative of the site.

THE GALLI GROUP
GEOTECHNICAL CONSULTANTS

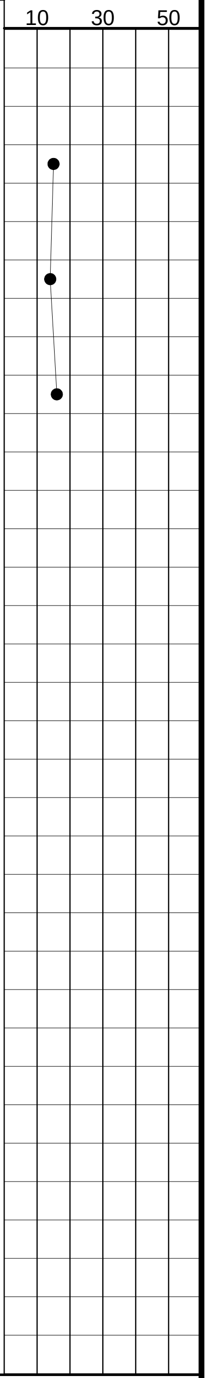
BORING LOG
B-2

Project: Oregon Tech - Industrial Park Drive Improvements
Client: ZCS Engineering & Architecture
Location: Center Median; See Figure 2, Site Plan with Boring Locations
Driller: TGG Blake/AJ
Drill Rig: ATV Mounted, 4" SSA
Project No.: 02-6313-01
Date: 09/07/2023
Elevation:
Logged By: Lyn Chand, PE

Depth To Water> Initial ▽: none At Completion ▼: none

Graphic Log	USCS	Description	Depth	Sample No. and Type	NMC	Standard Penetration Test N
	FILL	Gravel Surfacing with dark brown, silty Sand.	0 0.3			
	SC	Medium dense, orange mottled, clayey Sand; with silt and trace gravel, moist. (Native)				
				S-1	18.6	15
			2.5			
				S-2	46.8	14
				S-3	51.5	16
			5 5.5			
		Bottom of Boring at 5.5 feet. No seepage or groundwater observed.				
			7.5			
			10			
			12.5			
			15			
			17.5			

Standard Penetration Test CURVE



Legend of Samplers: ▯ Grab sample ◩ SPT sample ‖ Shelby tube sample

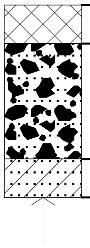
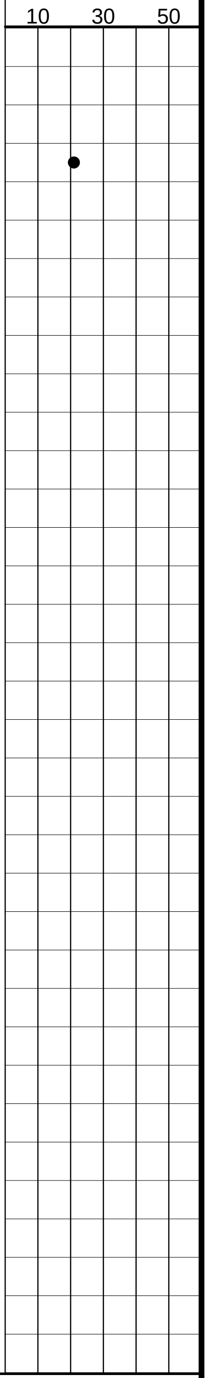
This information pertains only to this boring and should not be interpreted as being indicative of the site.

THE GALLI GROUP
GEOTECHNICAL CONSULTANTS

BORING LOG
B-3

Project: Oregon Tech - Industrial Park Drive Improvements
Client: ZCS Engineering & Architecture
Location: Center Median; See Figure 2, Site Plan with Boring Locations
Driller: TGG Blake/AJ
Drill Rig: ATV Mounted, 4" SSA
Depth To Water> Initial ▽ : none

Project No.: 02-6313-01
Date: 09/07/2023
Elevation:
Logged By: Lyn Chand, PE
At Completion ▼ : none

Graphic Log	USCS	Description	Depth	Sample No. and Type	NMC	Standard Penetration Test	
						N	CURVE
	FILL	Gravel Surfacing with dark brown, silty Sand. 0.5	0				
	GW-SW	3/4-inch minus crushed Rock over 4-inch minus crushed Rock. (FILL) 2.0		S-1 ▯	n/a		
				S-2 ◤	26.5	21	
	SC	Medium dense to dense, orange mottled, clayey Sand; with silt and trace gravel, moist. (Native) 2.5	2.5				
		Bottom of Boring at 2.5 feet due to auger refusal. No seepage or groundwater observed.					
			5				
			7.5				
			10				
			12.5				
			15				
			17.5				

Legend of Samplers: ▯ Grab sample ◤ SPT sample ‖ Shelby tube sample

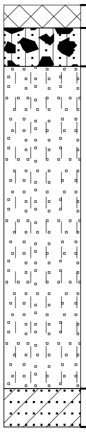
Auger refusal due to large 4-inch minus crushed Rock. Unable to break apart, could not keep sampler vertical.

`This information pertains only to this boring and should not be interpreted as being indicative of the site.`

THE GALLI GROUP
GEOTECHNICAL CONSULTANTS

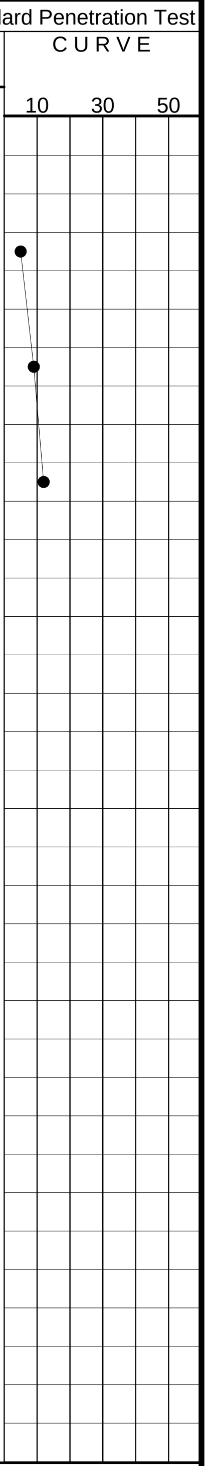
BORING LOG
B-4

Project: Oregon Tech - Industrial Park Drive Improvements	Project No.: 02-6313-01
Client: ZCS Engineering & Architecture	Date: 09/07/2023
Location: Middle of Center/Turn Lane; See Figure 2, Site Plan with Boring Locations	Elevation:
Driller: TGG Blake/AJ	Logged By: Lyn Chand, PE
Drill Rig: ATV Mounted, 4" SSA	
Depth To Water> Initial ▽ : none	At Completion ▼ : none



USCS	Description	Depth	Sample No. and Type	NMC	N
FILL	Asphaltic Concrete, 3.5-inch core.	0.3			
GM-SM	3/4-inch minus, crushed Rock. (FILL)	0.8			
SP-SM	Loose to medium dense, brown mottled, Sand; with gravel, silt and clay, moist. (FILL) Bulk Sample (S-4) from 1.0 to 4.0 feet, WSH: 45% Sand, 25% Gravel, 15% Silt, 15% Clay CBR = 17, R = 49	5.0	S-1 S-2 S-3	46.3 33.8 33.7	5 9 12
SC	Medium dense to dense, orange mottled, clayey Sand; with silt and trace gravel, moist. (Native- encountered in tip of S-3)	5.5			

Bottom of Boring at 5.5 feet.
No seepage or groundwater observed.



Legend of Samplers: ☐ Grab sample ◩ SPT sample ▯ Shelby tube sample

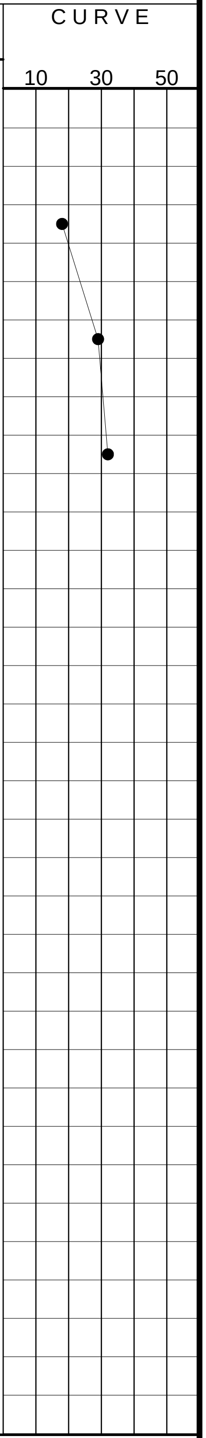
This information pertains only to this boring and should not be interpreted as being indicative of the site.

THE GALLI GROUP
GEOTECHNICAL CONSULTANTS

BORING LOG
B-5

Project: Oregon Tech - Industrial Park Drive Improvements
Client: ZCS Engineering & Architecture
Location: Center Median; See Figure 2, Site Plan with Boring Locations
Driller: TGG Blake/AJ
Drill Rig: ATV Mounted, 4" SSA
Project No.: 02-6313-01
Date: 09/07/2023
Elevation:
Logged By: Lyn Chand, PE
Depth To Water> Initial ▽ : none
At Completion ▼ : none

Graphic Log	USCS	Description	Depth	Sample No. and Type	NMC	Standard Penetration Test N
☒	FILL	Gravel surfacing. dark brown, silty Sand. 0.5	0			
▨	SC	Medium dense to dense, orange mottled, clayey Sand; with silt and trace gravel, moist. (Native) Bulk Sample (S-4) from 1.0 to 3.0 feet. WSH - 50% Sand, 30% Clay, 15% Silt, 5% Gravel CBR = 11, R = 40				
				S-1 ◪	43.8	18
			2.5	S-2 ◪	40.4	29
				S-3 ◪	40.7	32
		5.5	5			
		Bottom of Boring at 5.5 feet. No seepage or groundwater observed.				
			7.5			
			10			
			12.5			
			15			
			17.5			



Legend of Samplers: ▯ Grab sample ◪ SPT sample ⌶ Shelby tube sample

APPENDIX B

LABORATORY TEST RESULTS

THE GALLI GROUP
Geotechnical Consulting
612 Northwest Third Street,
Grants Pass, Oregon 97526

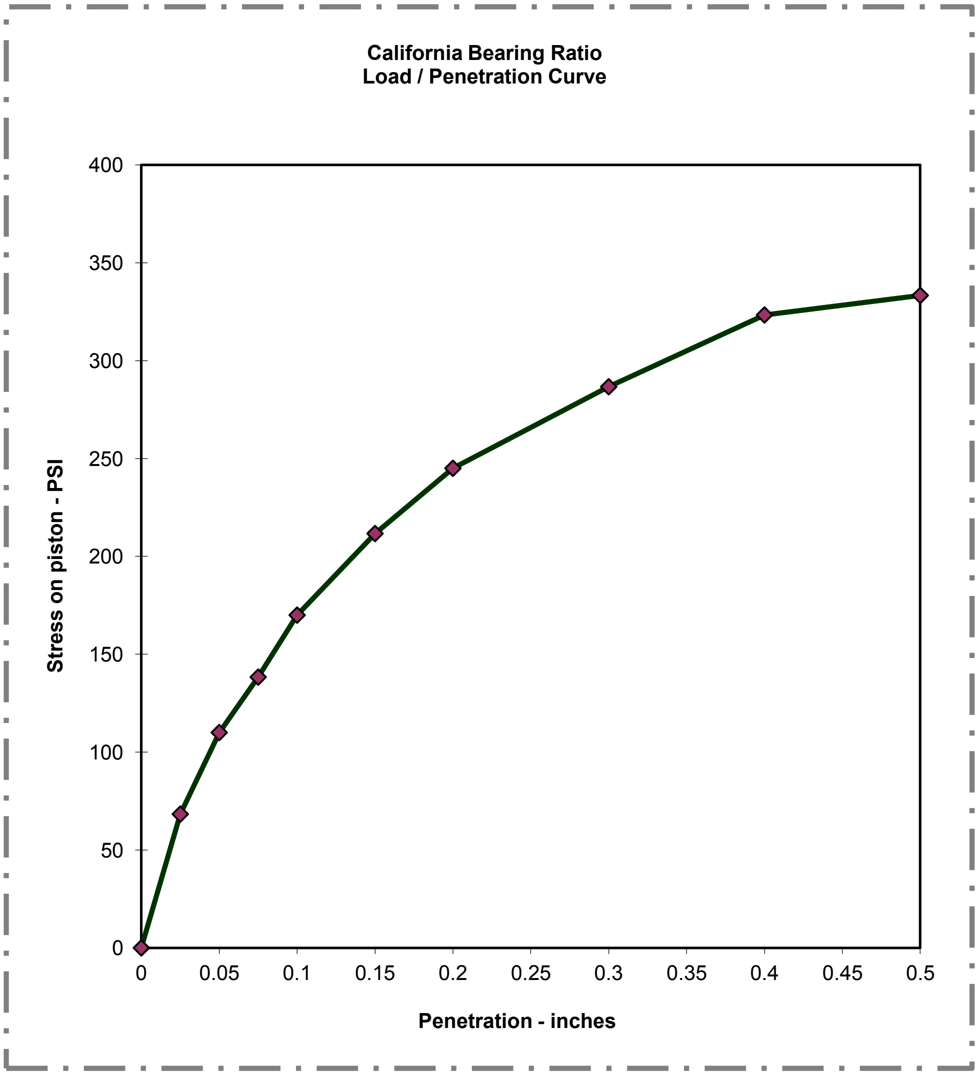
California Bearing Ratio (CBR)
ASTM D1883

Client:	ZCS Engineering & Architecture	Date:	9/16/2023
Project:	Oregon Tech - Industrial Park Drive	Date Sampled:	9/7/2023
Test Details:	1 Point CBR at existing moisture	Job No.:	02-6313-01
Soil Type:	Gray-brown, Sand; with gravel, silt and clay (FILL)	Sample:	B-4/S-4

CBR Value: **17** **EQUIVALENT TO** **R-VALUE = 49** (see "Soil Support Correlations", Appendix C)

Compacted utilizing ASTM D698 (Standard Proctor) methods

Tested Dry Density:	93.2 pcf	(@ 95% of Maximum Dry Density, est.)
M/C:	25.7 %	(existing)
Surcharge on sample:	12.6 pounds	
Sample soaked:	170 hours	
Swell:	0.5 %	
Average moisture of sample after soaking:	26.0%	
Moisture after soaking- upper 1" of sample:	27.7%	



6313cbr Industrial Park Drive 09.16.23 b-4,s-4AR.xlsx

By: Ken Perry/Lyn Chand

THE GALLI GROUP
Geotechnical Consulting
612 Northwest Third Street,
Grants Pass, Oregon 97526

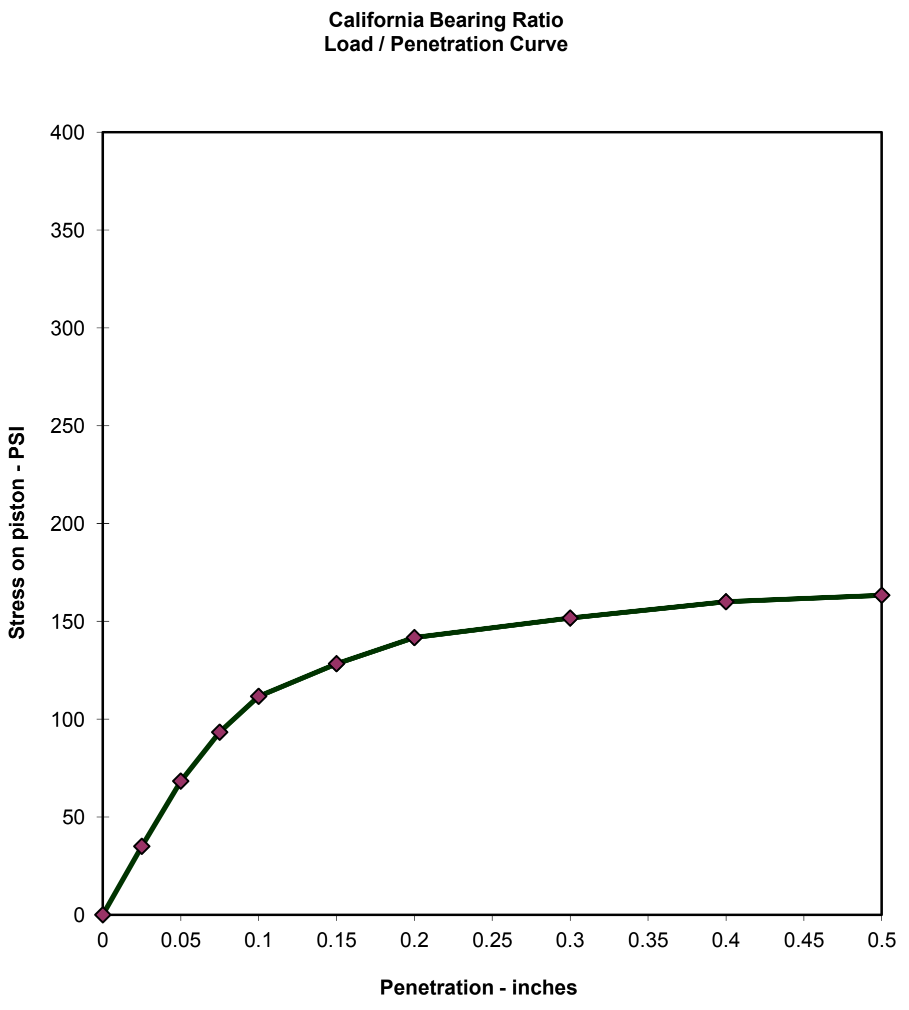
California Bearing Ratio (CBR)
ASTM D1883

Client: ZCS Engineering & Architecture
Project: Oregon Tech - Industrial Park Drive
Test Details: 1 Point CBR at existing moisture
Soil Type: Orange, clayey Sand; with silt and trace gravel

Date: 9/16/2023
Date Sampled: 9/7/2023
Job No.: 02-6313-01
Sample: B-5/S-4

CBR Value: 11 **EQUIVALENT TO** **R-VALUE = 40** (see "Soil Support Correlations", Appendix C)

Compacted utilizing ASTM D698 (Standard Proctor) methods
Tested Dry Density: 75.2 pcf (@ 95% of Maximum Dry Density, est.)
M/C: 37.0 % (existing)
Surcharge on sample: 12.6 pounds
Sample soaked: 170 hours
Swell: 1.8 %
Average moisture of sample after soaking: 42.0%
Moisture after soaking- upper 1" of sample: 40.1%



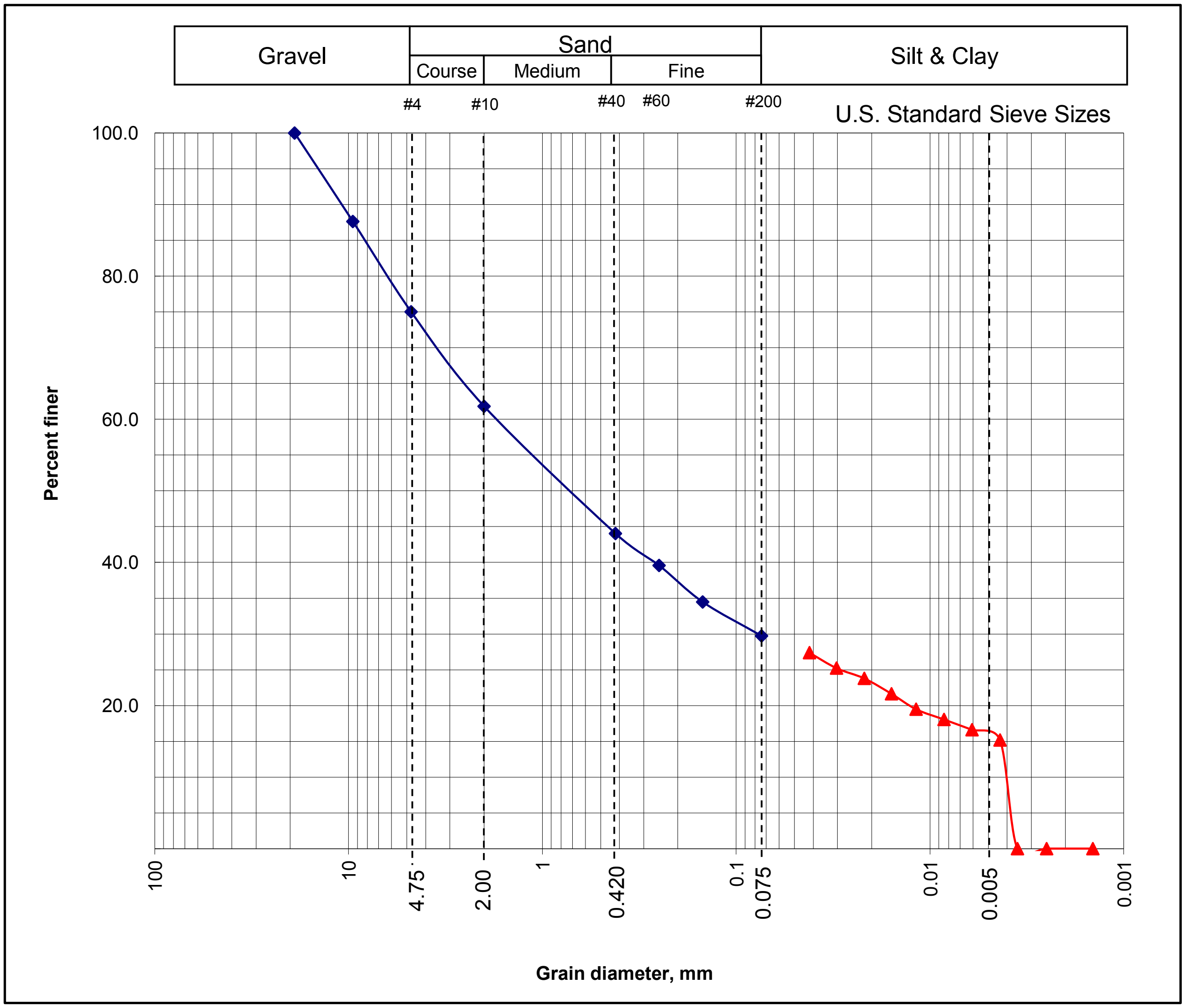
By: Aaron Reeser/LC

6313cbr Industrial Park Drive 09.16.23 b-5,s-4AR.xlsx

Washed Sieve and Hydrometer Analysis

(ASTM D1140 and ASTM D7928)

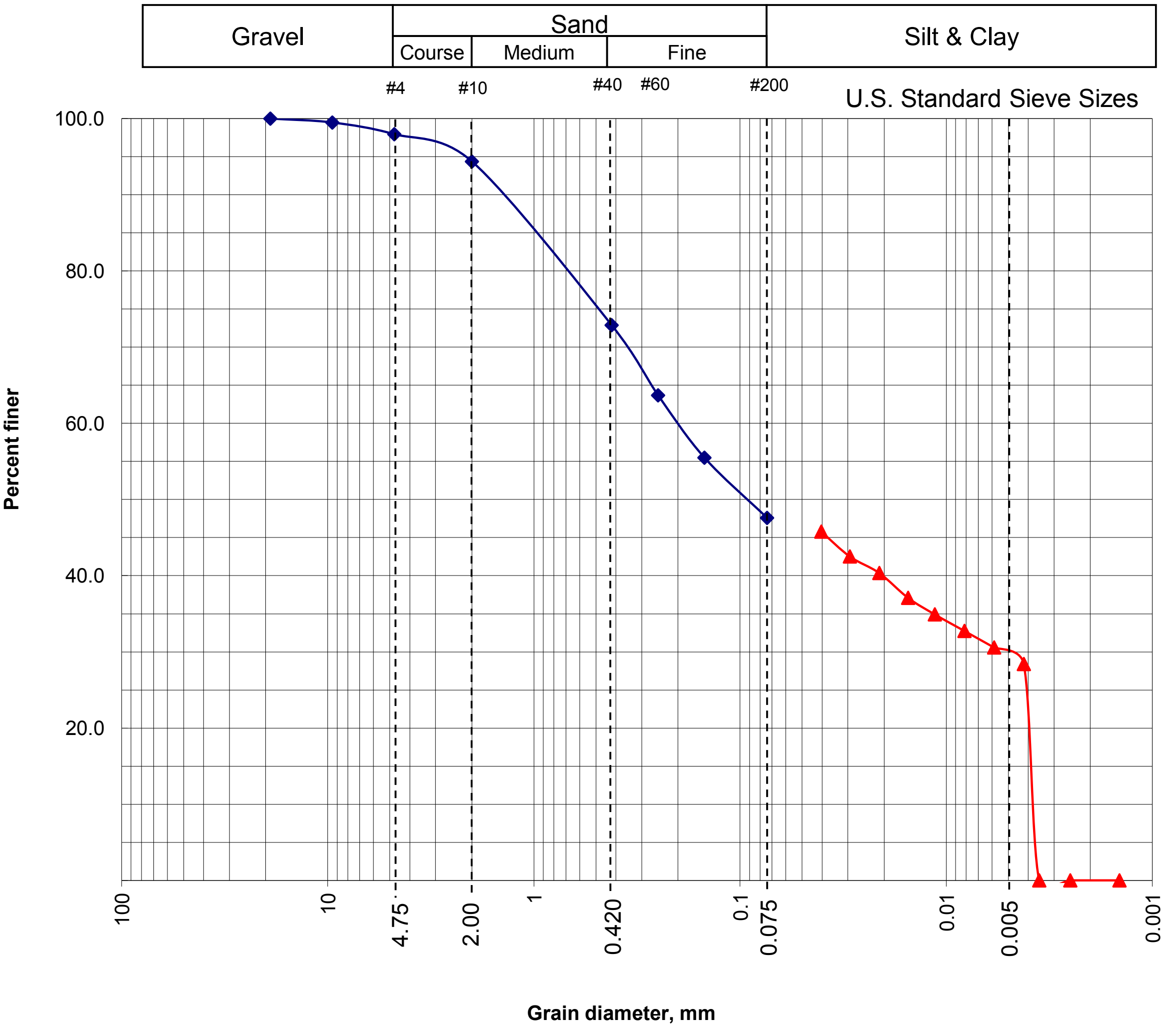
Client: ZCS Engineering and Architecture
Project: Oregon Tech - Industrial Park Drive
Job No: 02-6313-01
Date Tested: 9/14/2021
Date Sampled: 9/7/2021
Description of Soil: Gray/Brown, Sand; with gravel, silt and clay (FILL)
Boring No / Sample No: B-4 / S-4
Depth of Sample: 1.0' to 4.0'



Tested by: Aaron Reeser

Washed Sieve and Hydrometer Analysis
(ASTM D1140 and ASTM D7928)

Client: ZCS Engineering and Architecture
Project: Oregon Tech - Industrial Park Drive
Job No: 02-6313-01
Date Tested: 9/14/2021
Date Sampled: 9/7/2021
Description of Soil: Orange, clayey Sand; with silt and trace gravel
Boring No / Sample No: B-5 / S-4
Depth of Sample: 1.0' to 3.0'



Tested by: Aaron Reeser

APPENDIX C

ASPHALTIC CONCRETE DESIGN SECTION CALCULATIONS

THE GALLI GROUP
Geotechnical Consulting
612 Northwest Third Street,
Grants Pass, Oregon 97526

Project: Oregon Tech - Industrial Park Drive
Job No. 02-6313-01
Date: 9/29/2023

Industrial Park Drive Crushed Rock Equivalency (CRE) Calculations

(from City of Medford "Asphalt-Concrete Pavement Structure Design Guidelines (1998))

AC pavement section total CRE needed = 14"

(based on "Street Structural Section Design Chart",
where TI = 6.3 and existing subgrade R-value = 40)

Proposed Pavement Section:

3" min. AC
8" min. AB (3/4"-0" or 1"-0" compacted crushed rock)
woven geotextile support fabric
12" compacted subgrade

Where: 1" of AC = 2" CRE
1" of AB = 1" CRE

Proposed AC pavement section Total CRE = 3" AC(x2) + 8" AB(x1)

Total CRE = 14"

Project: Oregon Tech - Industrial Park Drive
Job No. 02-6313-01
Date: 9/29/2023

Industrial Park Drive Traffic Index (TI) Calculations

(from City of Medford "Asphalt-Concrete Pavement Structure Design Guidelines (1998)

$$EAL = (0.02)(VPD)(100 - \%Trucks) + (25.1)(VPD)(\%Trucks)$$

Where: VPD = 1000
%Trucks = 2.00

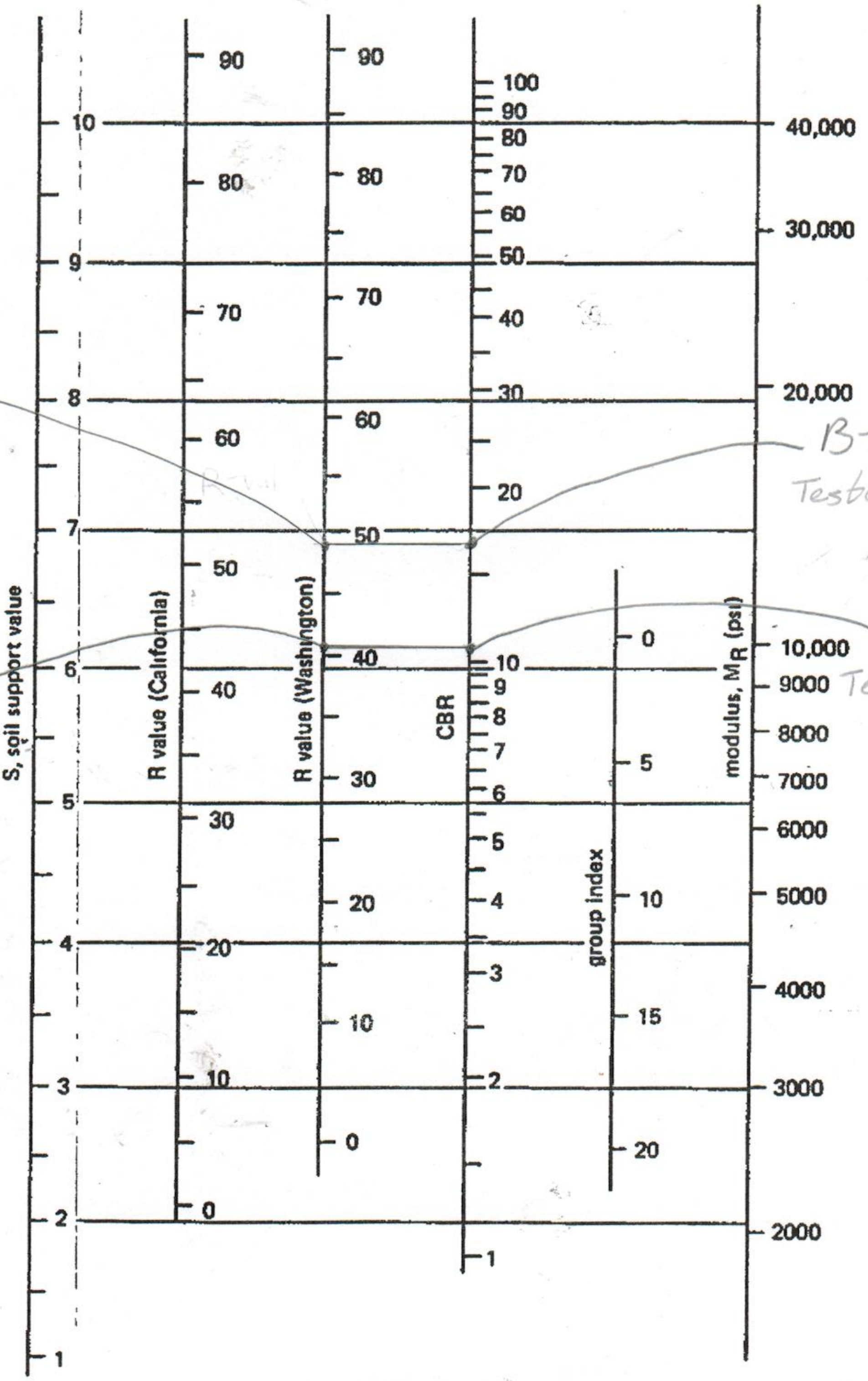
EAL = 52160

$$TI = 9.0(EAL/1{,}000{,}000)^{0.119}$$

TI = 6.3

Soil Support Correlations

Oregon Tech - Industrial Park Drive (02-6313-01)



B-4/S4
R val. = 49

B-4/S4
Tested CBR=17

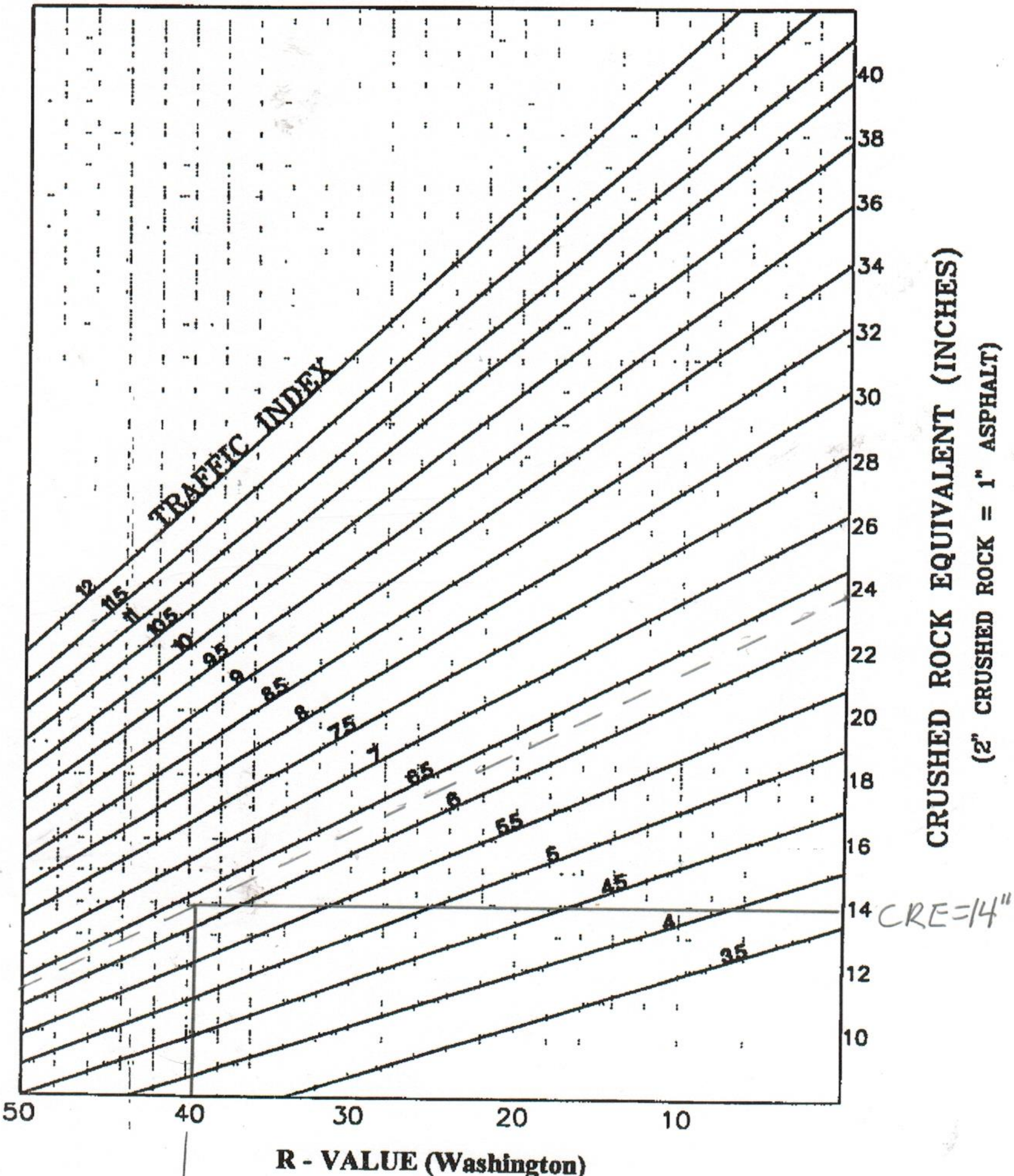
B-5/S4
R val. = 40

B-5/S4
Tested CBR=11

09/29/23

CITY OF MEDFORD
STREET STRUCTURAL SECTION DESIGN CHART
(CRUSHED ROCK EQUIVALENT METHOD)

Oregon Tech - Industrial Park Drive (02-6313-01)



CRE=14"

Existing Subgrade R-val. = 40

09/29/23

EXHIBIT B
ZCS ENGINEERING AND ARCHITECURE ELECTRONIC FILE HOLD HARMLESS AGREEMENT

[Please see attached.]

ZCS ENGINEERING
ARCHITECTURE

ELECTRONIC FILE HOLD HARMLESS AGREEMENT

Please review this form in its entirety, sign and return it to the ZCS contact listed below in order to receive access to the electronic files for the referenced project.

Provided will be electronic AutoCAD (CAD), Revit (Model), PDF (or other) files associated with this project following the acknowledgement of this electronic file disclaimer. It is our understanding these electronic files have been requested to coordinate and verify site design layout and/or Building Information Model (BIM) data. Unless otherwise specified, the electronic BIM data provided is intended to meet Level of Development (LOD) 200 and is for information only and not to be used for construction. It shall be understood that all data needs to be confirmed with the final permitted contract documents, all revisions and addendum, and verified with actual field conditions.

Note that by accessing the project electronic file(s) it shall be understood that the "Recipient" and any recipients of this data acknowledge the following TERMS AND CONDITIONS. Any reference to ZCS, Inc. (ZCS) shall include ZCS Engineering & Architecture and its sub-consultants.

1. Since the information set forth on the electronic files can be modified unintentionally or otherwise, ZCS reserves the right to remove all indicia of its ownership and/or involvement from each electronic display. This medium should not be considered a certified document. It shall be noted that approved/permitted contract document paper copies supersede any electronic files.

2. ZCS makes no representation as to the compatibility of these files with your computer hardware or software. Additionally, you also agree that the CAD file(s) & Model(s) may be subject to anomalies, errors, viruses, malware, or other unintended defects, and that ZCS has not reviewed or determined whether any such defects may be present in any electronic files. Use of these electronic files is solely at the risk of the Recipient.

3. All information in the electronic files is considered instruments of service of ZCS and its subconsultants and shall not be used for other projects, for additions to this project, or completion of this project by others. The information is being provided as a convenience. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to ZCS.

4. ZCS makes no representation regarding the accuracy, completeness, or permanence of electronic files (dimensions, building shape and size, surface information, profile/alignment data, layout of curbs, structures, planters, utilities, etc.). These electronic files are not construction documents nor are they as-built record drawings. The use of this data does not take the place of the typical shop drawing, submittal review and approval process. It shall be understood that all layout needs to be confirmed by a licensed Surveyor with the permitted contract documents.

5. Addenda information or revisions made after the date indicated on the electronic files may not have been incorporated. In the event of a conflict between the ZCS permitted contract document paper copies and the electronic files, the permitted contract document paper copies shall govern. It is the recipient's responsibility to determine if any conflicts exist or changes have been made after receipt of the information.

6. This data is not to be used in GPS controlled equipment. Upon request, the data can be advanced to a level adequate to be used in GPS controlled equipment. When using the files for GPS controlled construction equipment, it is the responsibility of the contractor, equipment operator, and their licensed Surveyor to verify the data has been accurately loaded into the equipment using the proper coordinate system, basis of bearings, and vertical datum matching the approved/permitted contract document paper copies. Special care shall be taken to ensure the proper units of measurement are being used (i.e. survey feet versus international feet).

The undersigned agrees to hold harmless, defend and indemnify ZCS from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney fees, arising out of or in any way connected with the provision of the CAD file(s) & Model(s) by ZCS or the use, modification, misinterpretation, misuse, or reuse by others of the CAD files(s) & Model(s) provided to the Recipient by ZCS.

Should you or your subcontractors (if applicable) identify any conflicts between the electronic files and either the permitted contract documents or actual site conditions, ZCS shall be notified immediately prior to progress of work.

By signing and returning this electronic file hold harmless agreement, you agree to be bound by these terms and conditions.

ZCS Job File Number: K-6345-23 | Project: OT Industrial Park Drive Improvements | ZCS Contact: Malia Waters

_________________________ | ___________________________ | _____________________ | __________
Company / Recipient Name | Representative Name & Title | Signature | Date