ODOT
MATERIALS &
INSPECTION

Drilled Shaft Inspector Training Manual

2022-2023

INSERT TAB

Geotechnical Design Report

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OR217: OR10 – OR99W Southbound
Beaverton-Tigard Highway
Multnomah/Washington County
Key 18841

February, 2021
Revised June, 2021

Oregon Department of Transportation
Region 1 Tech Center
Geo/Hydro/Hazmat Unit

1.0 EXECUTIVE SUMMARY

The purpose of this report is to provide a summary of the geologic conditions as well as geotechnical design recommendations for the southbound (SB) portion of this corridor widening project. The overall project alignment contains portions designed by ODOT staff as well as a consultant team lead by DOWL Engineers (DOWL).

The OR217 Southbound Widening project includes: entrance and exit ramp widening at the SW Allen Blvd. and SW Denny Rd. interchanges, a proposed southbound collector distributor (CD) road between the SW Allen Blvd. and SW Denny Rd. interchanges, a proposed bridge structure over Fanno Creek to support the CD road, proposed mainline auxiliary lane from approximately MP 2.2 to 5.8, four proposed retaining walls, widening of the north SW Hall Blvd. bridge over OR217, and associated traffic structures.

New bridge structures and structural widening will use micropiles, driven piles and drilled shafts. Micropiles will be added to Bents 2 and 3 of the existing SW Denney Rd. exit structure. The structural widening of the northern SW Hall Blvd. bridge (Str. #09671) will be supported by a drilled shaft at the center bent and driven piles at the abutments. The new bridge across Fanno Creek (Str. #23235) will be founded on driven piles. The ramp structures will be founded on driven piles at the abutments, and the interior bents will be founded on drilled shafts. New traffic structures will be founded on drilled shafts.

Mechanically stabilized earth (MSE) and soil nail walls are used for the entrance and exit ramp embankment modifications for the mainline auxiliary lane. Wall types were selected based on existing conditions, proposed geometries, construction access, and anticipated construction schedule.

The proposed collector distributor (CD) road includes a proposed bridge across Fanno Creek. A seismic hazards analysis has been conducted and the proposed bridge will be subjected to relatively high ground motions and liquefaction during a design-level earthquake. Hydraulic analyses indicate the streambanks at the bridge site are susceptible to 14’ of scour.

The horizontal re-alignment of the cut slope south of the SW Hall Blvd. bridge (Str. #09671) will match the existing slope of 2H: 1V.

Geotechnical design recommendations for two of the proposed sign structures are provided in the August 2019 report by GRI titled, “Geotechnical Report, OR217 OR10-99W SB Auxiliary Lane Traffic Structures, Washington County, Oregon”.

Geotechnical recommendations for the southern portion of the project south of the Greenburg Rd. entrance ramp gore point and the northbound half of the project are contained in the draft design report prepared by Shannon & Wilson titled, “Geotechnical Report OR217 NB Auxiliary Lane” dated July, 2020.

2.0 PROJECT AND SITE DESCRIPTION

2.1 General

The purpose of the overall project is to improve mainline safety and operations for approximately 3.5 miles of southbound and northbound OR217 between OR10 and OR99W (mile post 2.05 to 5.69) by installing an auxiliary lane, a two-lane connector distributor (CD) road, and associated entry and exit ramp modifications. R1 Geo work focuses on the southbound (SB) direction only and includes widening of the northern SW Hall Blvd. bridge over OR217 and traffic structures along SB OR217. The SB work will be combined with the planned auxiliary lane improvements along the northbound (NB) portion. The NB portion of the project is being delivered by a consultant team led by DOWL. The Vicinity Map, Figure 1, shows the general location of the project in Beaverton and Tigard, Oregon.

2.2 Project Description

OR217 (Beaverton-Tigard Hwy No. 144) is a four- to six-lane state highway with an annual average daily traffic (AADT) of approximately 100,000 to 115,000 vehicles. The mainline is predominantly comprised of two lanes in both the northbound (NB) and southbound (SB) directions, with intermittent third lanes in between entrances and exits. This project will connect the existing discrete auxiliary lanes into a continuous third lane.

At the north end of the project, the existing grade of the mainline starts at an approximate elevation of 220 feet and decreases to an elevation of 185 feet at the beginning of the SW Allen Blvd. exit ramp. This low area of the highway has chronically experienced flooding during heavy rain events. Continuing to the south, the existing mainline grade increases to an elevation of 207 feet, approximately halfway between SW Denney Rd. and the northern SW Hall Blvd. interchange structure. (SW Hall Blvd. IC). The elevation of the existing mainline grade continues to increase until reaching a maximum elevation within the project limits of approximately 225 feet before decreasing steadily to the low elevation within the project limits of approximately 172 feet near Ash Creek at the south end of the SB portion.

Site plans of the project area from north to south are shown on Figures 2 through 7. Figure 2 shows the SW Allen Blvd. exit ramp and associated explorations. The SB OR217 mainline at the SW Allen Blvd. exit ramp consists of two lanes and a wide shoulder. The SW Allen Blvd. exit ramp will be asymmetrically widened to include a third lane to the east of the existing two lanes, requiring proposed foundations to support the additional lane on the ramp structure. The embankment supporting the SW Allen Blvd. exit ramp will be widened to match with a MSE wall. The SW Allen Blvd. entrance ramp structure will be maintained at the existing width, while the eastern side of the embankment supporting the southern portion of the entrance ramp will be steepened to a final grade of 1.5H: 1V.

Figures 3 and 4 show the project areas from the SW Allen Blvd. entrance to Fanno Creek and from Fanno Creek to the SW Denney Rd. exit ramp, respectively. Between the SW Allen Blvd. and the SW Denney Rd. structures, the SB OR217 mainline is currently comprised of two through lanes with an acceleration/merge lane that ends at the SW Denney Rd. exit ramp. The project will install a separated two-lane CD road between the existing SW Allen Blvd. entrance ramp and the SW Denney Rd. exit ramp with no highway access. The new CD road will cross Fanno Creek on a new bridge. To accommodate the new CD road, the SW Denney Rd. exit ramp will be widened via MSE wall on the east side of the approach embankment and the widened abutment (Bent DA1) will be founded on driven piles. The exit ramp structure widening will require new column foundations to support the tapered widening at Bents DA2 and DA3. The two northern most bents for the SB SW Denney Rd. exit ramp (Bents DA4 and DA5) will not receive any additional load therefore no structural modifications are proposed.

Figure 5 shows the SW Denny Rd. entrance ramp to OR217 SB. The widened mainline and the new CD road will require modification of the SW Denney Rd. entrance ramp structure and approach embankment to include an additional lane on the ramp as well as below. The embankment at the southern terminus of the entrance ramp structure will require a retaining wall to simultaneously support the widened ramp structure and the cut for the mainline auxiliary lane widening. The ramp structure will be widened 17.4 feet to the east to accommodate the new travel lane.

Figures 6 and 7 show the SW Hall Blvd. interchange (SW Hall Blvd.) and the entrance ramp extending south towards the Ash Creek Culvert. The new auxiliary lane will require modification of the SW Hall Blvd. acceleration loop and the bridge abutment. A new retaining wall be constructed at the toe of the western SW Hall Blvd. bridge abutment underneath the structure for the new auxiliary lane. The north side of the SW Hall

Blvd. bridge over OR217 will be widened to provide space for pedestrian and bicycle facilities. South of the Hall Blvd. bridge structure, the slope to the west of the mainline will be cut back horizontally approximately 8 to 10 feet and the new cut graded at a 2H: 1V slope.

New approach embankments and some sliver widening will be required throughout the project alignment in order to provide the necessary roadway geometry.

New cantilever sign structures will be constructed and founded on drilled shafts.

New mast arm signal structures will be constructed and founded on drilled shafts

2.3 Geologic Setting

The project is located on the eastern margin of the Tualatin Basin. The basin is a northwest-trending structure bounded by the Portland Hills/Tualatin Mountains to the north and east, the Chehalem Mountains to the south, and the Coast Range to the west.

Locally, cuts and fills have modified the original ground surface within the project area. Recent alluvium is locally present in and surrounding stream channels. The underlying geologic units are the Willamette Formation, the Hillsboro Formation, and the Columbia River Basalt Group (Wilson, 1998; Ma, 2012).

The Willamette Formation is a 12,000 to 21,000 year old (Pleistocene) clayey to sandy silt deposited by the Missoula (Bretz) Floods. The Missoula Floods resulted when an advancing lobe of the Cordilleran Ice Sheet blocked the Clark Fork River in Idaho and created a lake that extended back into western Montana. The ice dam would periodically collapse, generating repeated massive floods. The floodwaters filled the Willamette Valley to an elevation of about 400 feet. More than 90 flood events have been recognized in the Willamette Valley, with over 20 of these floods entering the Tualatin Valley through gaps in the southeast margin of the basin (O'Connor, 2001; Wilson, 1998). Numerous liquefaction dikes have been exposed in road cuts in the Tualatin Valley. The Willamette Formation is up to about 120 feet thick and mantles slopes up to an elevation of about 375 feet in the Tualatin Valley (Madin et al., 2008).

The Hillsboro Formation consists of clay, silt, and sand and is late Miocene to Pleistocene (5 million to 15 thousand years) in age. It ranges in thickness from a few feet to over 1,400 feet and fills the Tualatin Basin.

The Hillsboro Formation sediments were derived from erosion of the highlands surrounding the basin (Madin et al., 2008).

The bedrock unit is the Columbia River Basalt Group (CRB). The CRB is a series of Miocene-age (17 to 6 million years old) flood basalts erupted from vents in northeastern Oregon and southeastern Washington. CRB mapped in the vicinity of the project ranges from about 16.5 to 14.5 million years old. The depth to the top of the CRB varies from a few feet to over 1,000 feet. The CRB is not exposed in the project area but was encountered at depths of 7 to 30 feet in borings in the vicinity of SW Hall Blvd. The depth to the CRB may be 450 feet and 300 feet at the Fanno and Ash Creek crossings, respectively (Madin, 1990).

2.4 Seismic Setting

The seismicity of the region is the result of subduction of the Juan de Fuca oceanic plate beneath the North America continental plate in the Cascadia Subduction Zone (CSZ). The oblique, northeastward subduction of the Juan de Fuca plate induces northward translation and clockwise rotation of the Cascadia fore-arc blocks at the west edge of the North America plate (Wells and McCaffrey, 2013). This complex combination of plate movements and deformations results in three different mechanisms for generating earthquakes that could potentially affect this site: interface (or subduction zone) earthquakes at the inclined interface between the Juan de Fuca and North American plates, intraslab (or intraplate) earthquakes within the subducting portion of the Juan de Fuca plate, and shallow crustal earthquakes within the North American crustal plate.

The Cascadia Subduction Zone (CSZ) is located off the coast of northern California, Oregon, Washington and southern Vancouver Island. The closest portion is approximately 120 miles west of the project site. The CSZ has the potential to produce earthquakes with Moment Magnitudes (M_w) greater than 9.0. The potential for damage from subduction zone earthquakes is great because of the combination of strong ground shaking, long duration of shaking, and the wide area that is affected. Research on regional seismicity suggests the mean recurrence interval for interface earthquakes is approximately 240 years with a standard deviation of 130 years on the southern portion of the CSZ (ending at about Cape Blanco on the Oregon coast) and about 500 to 530 years with a standard deviation of 210 years for interface earthquakes extending the full length of the CSZ (Goldfinger et al., 2012). There have been no significant interface (subduction zone) earthquakes in the roughly 200 year historical period. The most recent interface earthquake, approximately M_w 9, occurred on January 25, 1700 (Personius, 2006).

Intraplate (intraslab) earthquakes occur at depths of roughly 20 to 40 miles, within the subducted portion of the Juan de Fuca Plate. Intraplate earthquakes could occur anywhere beneath the Coast Range or

Willamette Valley, although current research indicates that the likelihood is small (Wong, 2005). Intraslab earthquakes, such as the 1967 M_w 6.7 earthquake between Tacoma and Seattle and the 2001 M_w 6.8 Nisqually earthquake, have occurred historically in the Puget Sound area. However, they are historically rare in Oregon.

Crustal earthquakes are the most common in Oregon. Crustal earthquakes occur at depths less than 20 miles along relatively smaller, younger faults occurring locally within the continental plate. Magnitudes of crustal earthquakes rarely exceed M_w 6, but earthquakes with magnitudes approaching M_w 7 are possible. No Quaternary faults (faults with evidence of rupture within the last 1.6 million years) are known within the limits of the project. There are five known Quaternary faults within six miles of the project site.:

- Portland Hills Fault
- Oatfield Fault
- Canby-Molalla Fault
- Beaverton Fault Zone
- Bolton Fault

Of these, only the Portland Hills Fault is considered to contribute to the USGS seismic deaggregation used to develop earthquake ground motions for engineering design.

2.4.1 Portland Hills fault (USGS 877)

The Portland Hills fault consists of a series of northwest-trending faults that form the northeastern margin of the Tualatin Mountains. The faults associated with this structural zone vertically displace the Columbia River Basalt Group by 1,130 feet, and appear to control thickness changes in late Pleistocene sediment (Mabey, 1993). Geomorphic lineaments suggestive of Pleistocene deformation have been identified within the fault zone, but none of the fault segments has been shown to cut Holocene deposits (Cornforth and Geomatrix Consultants, 1992; Balsillie, 1971). The fact that the faults do not cut Holocene sediments is most likely a result of the faulting being related to a time of intense uplift of the Oregon Coast Range during the Miocene, and little to no movement along the faults during the Holocene. Based on contemporary seismicity in the vicinity of the fault, seismic reflection data suggesting that the fault cuts late Pleistocene layered strata, and observation of folded sediments of the Pleistocene Willamette Formation (12,000 to 21,000 year old) (Wong, 2001; Madin, 2001), the Portland Hills fault is considered active, with a slip rate of less than 0.2 mm per year (Personius and Haller, 2017).

2.4.2 Oatfield fault (USGS 875)

The Oatfield fault consists of a 29-kilometer-long steeply dipping reverse fault that forms escarpments in Miocene Columbia River Basalt in the Tualatin Mountains. No fault scarps or displacement of surficial deposits have been described, but exposures within tunnels show offset of Boring Lava, indicating Quaternary activity. The slip rate for the Oatfield fault has been calculated to be about 0.1 mm per year based on the tunnel exposures. Given the very low slip rate and lack of displacement of surficial deposits, this fault is considered to have a very long recurrence interval (Personius, 2002).

2.4.3 Canby-Molalla fault (USGS 716)

The Canby-Molalla fault is a right-lateral strike-slip fault located within the Willamette Valley. The Canby-Molalla fault appears to offset Pleistocene Willamette Formation deposits, and seismic reflection surveys suggest Holocene deformation of sediments. The fault has little geomorphologic expression, but is considered active, with a slip rate of less than 0.2 mm per year (Personius, 2002).

2.4.4 Beaverton fault zone (USGS 715)

The Beaverton fault zone consists of an east-west striking normal fault that forms the southern margin of the Tualatin basin. This fault offsets Miocene Columbia River Basalt, but is covered by thick sequences of Pleistocene Willamette Formation deposits. As a result, no fault scarp is present at the surface, and the Beaverton fault zone is not present on most geologic maps of the area. Yeats (1996) indicates that the Beaverton Faults displace post-Columbia River Basalt sediments; however, the age and nature of deformation is not known. The Beaverton fault is considered active, but with a long recurrence interval (Personius, 2002).

2.4.5 Bolton fault (USGS 874)

The Bolton fault is a northwest-trending reverse fault, with a length of about 9 kilometers in the subsurface. There is no evidence that the Bolton fault has been active since the late Pleistocene; however, the fault is classified as potentially active because of the limited exposures and uncertainties in the relationships between local scarps and late Pleistocene Missoula flood deposits (Geomatrix, 1995). On this basis, a long recurrence interval is assigned to the Bolton Fault (Personius, 2002).

3.0 EXISTING STRUCTURE DATA

Reproductions of the available plan sheets for the existing structures are provided in Appendix D and summarized below.

3.1 SW Allen Blvd. Structure (#16134)

The overpass structure supporting Allen Boulevard as it crosses OR217 was originally constructed in the early 1980s. As-built information indicates the 12-bent structure is constructed of reinforced concrete and is supported on a combination of square and octagonal concrete piles, as well as steel pipe piles. The bottom elevation of the pile caps is between 170 and 175 feet, just below the grade of the OR217 mainline. Pile spacing is about 3 feet center-to-center and the piles were driven to a depth of 30 to 70 feet below ground surface (BGS), depending on location and pile as recorded in pile record books.

Subsurface information provided on the Geotechnical Data Sheets indicates the subsurface conditions are comprised of predominantly fine-grained silts and clays of various relative densities or stiffness. Groundwater observed within these explorations was recorded to be at or very near the original ground surface (approximate elevation 180 feet). These materials are similar to those encountered in borings completed for this project (K18841).

3.2 Fanno Creek (#09457 & #09457A)

OR217 crosses Fanno Creek north of the SW Denney Rd. structure on a three-span bridge originally built in 1968 and widened to three lanes in each direction in 1977. The original structure had an out-to-out width of 89.5 feet and was widened to a width of 125.7 feet on the north side and 142.3 feet on the south side. Both the original structure and the widened portion are founded on precast pre-stressed concrete piles driven to 50-ton bearing per available as-built information. The as-built plans also display a variable center to center pile spacing of 10.2 feet left of the center line for the two exterior bents, and 9.8 feet for right of the center line. The piles for the interior bents are noted to have a closer spacing of 4.3 to 4.5 feet.

3.3 SW Denney Rd. Structure (#16143)

The overpass structure was originally constructed in the late 1970s. The 14-bent structure is constructed out of reinforced concrete and is supported on a combination of battered and vertical octagonal and square pre-stressed concrete piles. Pile spacing appears to be consistent at approximately 3 feet center to center for the free-standing columns, and approximately 8 feet 2 inches for Bent DR-1, the western most abutment. Piles were driven to depths of 30 to 50 feet BGS based on location and type of pile as recorded in the pile record books.

3.4 SW Hall Blvd. (#09671)

This reinforced concrete box girder structure was originally constructed in the late 1960's. This structure consists of three bents. The exterior abutment bents are founded on steel H-piles driven to end bearing on the underlying basalt. The interior bent is founded on two 15-foot square by 3.5 feet thick shallow footings bearing on weathered basalt. The bottom of the existing foundations is listed as 187 feet.

The piles are in groups of four, with a center-to-center spacing of 12 feet along the face of the abutment. Average pile tip elevations for Bent 1 and Bent 3 are recorded as 180.5 and 192.8 feet, respectively, on as-built plans. Based on a designed bottom of pile cap elevation of 199 feet at Bent 1, piles are approximately 18 to 20 feet in length.

4.0 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

4.1 General

Three phases of subsurface exploration have been completed for this project. The first phase consisted of a series of geotechnical borings made between August and October 2017. The second phase was conducted to supplement the first and consisted of additional borings and cone penetration tests (CPTs) made between August and October 2018. The third phase consisted of a series of geotechnical borings made in May 2019. All borings were performed by Western States Soil Conservation (WSSC) of Hubbard, OR and the CPT work was conducted by Oregon Geotechnical Explorations (OEC) of Keizer, OR. The following sections document the phases of exploration and the laboratory testing of collected samples.

4.2 2017 Phase 1 Explorations

R1 Geo advanced thirty-one borings along the SB project alignment, labelled as TB18841-01 through TB18841-32 (including secondary borings 9A and 10A). Three additional borings, labelled TB18841-33 through TB18841-35, were made near the southern SW Hall Blvd. overcrossing structure in anticipation of the bridge replacement project. Each boring was logged by R1 Geo Staff, in accordance with the ODOT Soil and Rock Classification Manual. A summary of the Phase 1 exploration locations are presented in Appendix A, Table A-1. The borings were advanced using hollow stem auger, mud-rotary, and rock coring drilling methods. Standard Penetration Tests (SPT) were performed at 2.5- to 5-foot intervals. Undisturbed samples were taken using Shelby tubes at selected depths. Sample designations, depth intervals, and recovery values are indicated on the summary boring logs provided in Appendix A. Rock hardness shown on the boring logs and Geotechnical Data Sheets is based on field classification methods only.

4.3 2018 Phase 2 Explorations

To supplement the first phase of exploration, a second phase included eight additional exploratory borings and three cone penetrometer tests (CPTs). The borings were logged and the CPTs observed by a consultant (GRI) under supervision by R1 Geo staff. A summary of the Phase 2 exploration locations is presented in

Appendix A, Table A-2. The borings were advanced using hollow stem auger, mud-rotary, and rock coring drilling methods. SPTs were performed at 2.5- to 5-foot intervals. Undisturbed samples were taken using Shelby tubes at selected depths. Sample designations, depth intervals, and recovery values are indicated on the summary boring logs provided in Appendix A. Rock hardness shown on the boring logs and Geotechnical Data Sheets is based on field classification methods only.

The CPT's were terminated at a relatively shallow depth of approximately 40 feet bgs due to operator concern that the soils were stiff enough to damage the probe. The CPT's included seismic shear wave velocity measurement, as well as pore pressure dissipation testing. Shear wave velocity was utilized in seismic site class determination, but due to the relatively limited depth range were only utilized to confirm and refine the SPT data. The data gathered in the upper 40 feet at the SW Allen Blvd., Fanno Creek, and SW Denney Rd. structures were utilized in refining the analysis discussed in Section 6.

4.4 2019 Phase 3 Explorations

A third phase of explorations was performed in May 2019, and included nine exploratory borings and one test pit. Each exploration was logged by R1 Geo Staff, in accordance with the ODOT Soil and Rock Classification Manual. A summary of the Phase 3 exploration locations is presented in Appendix A, Table A-3. The borings were advanced using hollow stem auger, mud-rotary, and rock coring drilling methods. Standard Penetration Tests (SPT) were performed at 2.5- to 5-foot intervals. Sample designations, depth intervals, and recovery values are indicated on the summary boring logs provided in Appendix A. Rock hardness shown on the boring logs and Geotechnical Data Sheets is based on field classification methods only.

4.5 Laboratory Testing

Collected samples were submitted to the ODOT Materials Laboratory as well as Benchmark Geo Labs, of McMinnville, OR for testing. Laboratory tests included standard classification tests such as Atterberg limits and grain size analyses, standard physical properties tests such as unit weight, moisture content, and specific gravity determinations, and tests to determine engineering properties such as consolidation parameters, and shear strength through triaxial and cyclic direct simple shear (CDSS) testing. The results of the laboratory tests are summarized in Appendix B.

5.0 SUBSURFACE CONDITIONS

5.1 General

The subsurface explorations made along the project alignment indicate the subsurface materials and conditions are relatively consistent, except for the area surrounding SW Hall Blvd. In general, subsurface conditions can be summarized as medium stiff, fine-grained Fill and Recent Alluvium over underlying medium stiff to stiff, fine-grained soils of the Willamette Formation. In turn, the Willamette Formation is underlain by the older and generally stiffer alluvium of the Hillsboro Formation. The above units are underlain at depth by Columbia River Basalt throughout most of the project area. In the area surrounding SW Hall Blvd., the Columbia River Basalt is located at a relatively shallow depth.

5.2 Subsurface Conditions from As-Builts

Subsurface information provided on the Foundation Data Sheet for the SW Allen Blvd. overcrossing and ramp structures indicates the subsurface conditions are predominantly fine-grained silts and clays of various relative densities or stiffness. Groundwater observed within these explorations was recorded to be at or very near the original ground surface (approximate elevation 180 feet).

Subsurface information provided on the Foundation Data Sheet for the existing mainline bridge over Fanno Creek indicates the subsurface profile is comprised of various types of fine-grained soils with varying amounts of silt and clay. No bedrock was encountered within the depths explored to 100 feet BGS. These materials are similar to those encountered in borings completed for this project (K18841).

Subsurface information provided on the Foundation Data Sheets for the Denney Rd. exit and entrance ramp structures indicates the subsurface materials are composed of medium stiff to stiff silts and clays. Some decomposed rock at depth is noted on the Foundation Data Sheets, but no evidence of decomposed rock was encountered in similar borings completed for this project.

Subsurface information provided on the Foundation Data Sheets for the SW Hall Blvd. interchange structure indicates the subsurface materials are composed of gray, damp to wet, slightly plastic, fine sandy silt and clay loam within the abutments. The as constructed plans indicate badly weathered and broken basalt with alluvium sand filler.

5.3 Subsurface Units

For the purposes of further discussion, generally listed from the ground surface downward, the subsurface units encountered in the explorations have been grouped based on their geologic significance, physical characteristics, and engineering properties as follows:

1. Fill
2. Recent Alluvium

3. Willamette Formation
4. Hillsboro Formation
5. Columbia River Basalt

The following provides a general description of each of these units. More detailed descriptions are provided on the individual explorations logs provided in Appendix A.

5.3.1 Fill

Engineered fill is present along the highway alignment as entrance and exit embankments and where stream channels were realigned during the initial highway construction. The fill is typically soft to very stiff, low to medium plasticity clay or silt with varying amounts of sand and gravel. In a few locations, medium dense gravel with varying amounts of sand and low to medium plasticity clay and silt was encountered. Measured natural moisture contents and SPT N-values for the fill are typically in the range of 6 to 36% and 2 to 52 blows per foot (bpf), respectively.

Asphaltic concrete (AC) thicknesses in paved roadway areas ranges from 9 to 12 inches. The thickness of the underlying dense graded aggregate base course ranges from about 1 to 2 feet.

5.3.2 Recent Alluvium

Recent alluvium is present within and surrounding the stream channels. This material is predominantly non-plastic to medium plasticity, very loose to medium dense/soft to very stiff silt and clay with varying amounts of fine to coarse sand. Some high plasticity clay and medium to high plasticity gravelly clay/clayey gravel were also encountered. Measured natural moisture contents and N-values within this unit are typically in the range of 15 to 67% and 0 to 38 bpf, respectively. This unit generally represents the loosest or softest, and wettest materials encountered by the subsurface explorations within the project area.

5.3.3 Willamette Formation

The Willamette Formation mantles most of the project area, occurring at the ground surface, and below areas of fill, and/or recent alluvium. This deposit consists of rhythmically bedded, non-plastic to low plasticity silt and clay, with varying amounts of fine sand. Individual beds may be on the order of 1 to 10 feet thick and the overall thickness of the deposit is generally between 8 and 43 feet within borings that penetrated through the deposit. The Willamette Formation soils extended the full depth explored in several borings, which were terminated at depths ranging from 31.5 and 51.5 feet BGS. Natural moisture contents and N-values within this unit are typically in the range of 19 to 48% and 1 to 35 bpf, respectively. The Willamette Formation is generally denser or stiffer than the younger Recent Alluvium, but not as dense or stiff as the underlying Hillsboro Formation.

5.3.4 Hillsboro Formation

The Hillsboro Formation typically underlies the Willamette Formation in the project area. This unit was not present in explorations completed near SW Hall Blvd. Where encountered, the Hillsboro Formation sediments extended the full depth explored in each boring, ranging from approximately 36.5 to 121.5 feet BGS. This unit consists of low to high plasticity, stiff to hard clay to clayey sand with minor interbeds of non-plastic to low plasticity silt to sandy silt. Natural Moisture Contents and N-values are typically in the range of 20 to 64% and 2 to 64 bpf within this unit, respectively. This unit is relatively dense and/or stiff and can represent a significant bearing unit beneath the Willamette Formation and above the bedrock of the underlying Columbia River Basalt.

5.3.5 Columbia River Basalt

The Columbia River Basalt (CRB) is significantly older than the overlying units and unconformably underlies the project area. The CRB encountered in the subsurface explorations for this project is typically brown to black, predominantly decomposed to moderately weathered, with close to very close fracture spacing. The hardness of the CRB encountered in the borings ranges from extremely soft (R0) to medium hard (R3). The surface of the CRB exhibits a weathering horizon consisting of decomposed basalt that remolds to very dense/very hard, non-plastic to low plasticity silt or medium stiff to hard, medium to high plasticity clay, with varying amounts of sand and gravel. Core recovery, rock hardness, and Rock Quality Designations (RQD's) are provided in Table A-5 in Appendix A.

5.4 Groundwater

Groundwater levels will fluctuate seasonally with precipitation and stream levels and will be at or near the ground surface during the wet season and lowest at the end of the dry season. The levels of Fanno and Ash Creeks may be considered as the seasonal lower elevation bounds of the local unconfined aquifer. As previously indicated, at the north end of the project, the existing grade of the mainline starts at approximate elevation 220 feet and decreases to an elevation of 185 feet at the beginning of the SB SW Allen Blvd. exit ramp. This area of the project has chronically experienced flooding during heavy rain events.

During the subsurface investigations, groundwater levels were measured in some of the explorations that utilized hollow stem augers for drilling. The groundwater measurements are provided in Table A-6. These measurements were taken shortly after drilling ceased and probably do not represent the static water level.

Groundwater levels were also interpreted from CPT pore water pressure data. These levels are noted on the logs but are specifically indicative of groundwater levels at the time the explorations were made. A broader, but less reliable, interpretation of permanent and seasonal groundwater levels may be inferred from sample descriptions. Within the uppermost portion of the Willamette Formation, brown soils (fully oxidized) typically lie above the seasonally high groundwater level, soils mottled brown and gray (partially oxidized) typically lie within the zone of seasonal groundwater levels, and predominately gray soils (un-oxidized) typically lie below the seasonally low groundwater table Groundwater levels were also inferred based on the descriptions of samples taken from within explorations that utilized mud rotary drilling methods.

For the purposes of engineering analyses, R1 Geo has chosen the design groundwater depth to be at the ground surface for the Allen and Denney Rd. structures, at the ordinary high water levels of Fanno and Ash Creeks, and at the contact of the shallow bedrock at SW Hall Blvd.

5.5 Geotechnical Data Sheets

Geotechnical Data Sheets have been prepared that summarize the information collected from the subsurface explorations on a structure by structure basis for the purposes of further discussion and engineering design.

6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

6.1 General

The project includes; 4 new retaining walls of varying heights and different types, driven pile, drilled shaft and micropile supported bridge foundations, and drilled shaft foundations for six sign structures. The following sections of this report provide geotechnical conclusions and design recommendations for earthwork, seismic design criteria including liquefaction and slope stability considerations, retaining walls, bridge foundations, and sign structure foundations.

6.2 Earthwork

6.2.1 Site Preparation

All soils with vegetation should be cleared and grubbed in accordance with Section 00320 of the most recent Oregon Standard Specifications for Construction (OSSC).

6.2.2 Wet Weather Construction

The subgrade for the corridor is predominantly composed of sensitive, fine-grained soils that can be easily damaged and over softened by construction traffic. Equipment traffic on native soils should be minimized during the wet weather construction months which generally run from October 1 to April 1. Clearing and grubbing should be completed with one pass of a smooth blade to the required depth. Once proposed roadway subgrade elevation is achieved that meets project performance requirements, compaction of the native soils should be omitted and an embankment geotextile placed on the prepared surface. For areas experiencing temporary construction traffic volume during wet weather construction, a minimum of 2-ft of stone embankment material should be placed using dump and spread methodology, and a layer of drainage geotextile should be installed before construction traffic is allowed.

6.2.3 Permanent Cuts and Fills

R1 Geo evaluated the proposed cuts and fills required for this project using the slope stability software SLOPE/W produced by Geo-Slope International (Geo-Slope International, 2012). Permanent cuts in fine grained soils should be no steeper than 2H: 1V. Permanent fill angles can be up to 2H: 1V with common fill and can be up to 1.5H: 1V using stone embankment material. All materials should be in accordance with the most recent OSSC and project Special Provisions. All existing slopes should be benched in accordance with the sliver and embankment fill standard details provided by the project.

6.2.4 Use of On-site Material

On site material may be reused as long as proper moisture content can be achieved and maintained. This material will likely be highly moisture sensitive and will be difficult to meet standard compaction requirements if placed during wet weather or at any time the material is above the optimum moisture content. Material placement and compaction methods will require the observation and approval of the project Engineer. All earthwork should be constructed in accordance with Section 00330 of the OSSC.

6.2.5 Designated Fill Sites for Contaminated Soils

Based on discussions with the R1 HazMat and R1 Roadway, R1 Geo understands the project will generate a significant amount of non-clean fill from excavations within the project limits. The non-clean soils will be placed at designated fill sites. The non-clean soils should only be placed in the designated fill sites and should not be used as general borrow material. R1 Geo anticipates the non-clean soils will consist of fine-grained, moisture sensitive soils that are easily softened and lose strength under construction traffic and/or compactive effort, especially when overly wet. We recommend the non-clean soil should be placed and compacted in accordance with Section 00330 of the most recent OSSC. Embankments constructed using non-clean soil should be constructed with slopes no steeper than 3H: 1V.

6.3 Seismic Design

6.3.1 Strong Ground Motions

The 2019 ODOT Bridge Design Manual (BDM) (ODOT, 2019) and the 2018 ODOT Geotechnical Design Manual (GDM) (ODOT, 2018) require all new bridges and retaining structures to be designed to withstand seismic loads in accordance with the most current edition with interims of the 2017 AASHTO Guide Specifications for LRFD Seismic Bridge Design (AASHTO) (AASHTO, 2017. Based on AASHTO guidance, bridges shall be designed for Life Safety performance due to a 1,000-year return interval earthquake (7% probability of exceedance in 75-years). AASHTO and ODOT indicate that deformations of bridge approach fills are acceptable for 1,000-year return period event as long as they do not result in bridge collapse. Additionally, ODOT requires that bridges be designed for an Operational criterion during a full rupture of the Cascadia Subduction Zone (CSZ), with an approximate 500-year return interval. The Operational criterion states that bridges shall be able to carry emergency vehicles immediately following the earthquake.

R1 Geo analyzed the foundations for the retrofitted structures for the AASHTO Strength I, Service I, and Extreme 1 limit states. The foundations at the new Fanno Creek Bridge have been designed to the Strength I, Service I, and Extreme Event 1 and 2 limit states. Table 6-1 provides bedrock ground motion parameters for the various structures that have been adjusted for local soil conditions.

Table 6-1 Site Adjusted Ground Motion Parameters

Location	**SW Allen Blvd., SW Denney Rd., Fanno Creek Bridge**		**SW Hall Blvd.**	
Site Class:	E		D	
Criteria	**Operational**	**Life Safety**	**Operational**	**Life Safety**
Peak Ground Acceleration, PGA	0.19	0.27	0.17	0.27
Short Period Acceleration, S_s	0.38	0.59	0.35	0.59
Long Period Acceleration, S_1	0.34	0.22	0.20	0.22
F_{PGA}	N/A	1.68	N/A	1.33
F_a	N/A	1.55	N/A	1.33
F_v	N/A	3.20	N/A	2.16
A_s (F_{PGA} * PGA)	0.19	0.46	0.17	0.36
S_{DS} (F_a * S_s)	0.38	0.92	0.35	0.78
S_{D1} (F_v * S_1)	0.34	0.70	0.20	0.47

For the Life Safety event, ODOT uses the anticipated ground accelerations as published in the 2014 USGS Hazard Maps. Probabilistic hazard curves were generated using the three point spectrum tool as developed by the Bridge Design group. See Appendix E for the applicable response spectra.

The ground motion parameters for the Operational criterion requires a deterministic response spectrum. R1 Geo utilized the maps and the program developed by ODOT and Portland State University (PSU, 2018) to define the ground motion parameters as well as the deterministic response spectrum. R1 Geo generated 18 point response curves adjusted for site specific soil profile using shear wave velocities. Shear wave velocity was determined using correlations with SPT data since the CPT exploration was terminated at relatively shallow depths. For full results, see Appendix E.

6.3.2 Seismic Induced Liquefaction

Liquefaction susceptibility was evaluated using both the Bray and Sancio (2006) and Boulanger and Idriss (2006) methods to screen fine-grained soils for liquefaction potential. Bray and Sancio's research proposes that soils with a plasticity index (PI) less than 18 and a natural moisture content to liquid limit ratio (w/LL) greater than 0.8 are susceptible to liquefaction during intense shaking events. Boulanger and Idriss propose that soils with a PI greater than or equal to 7 behave "clay-like" during seismic events and are less susceptible to liquefaction, while fine-grained soils with a PI less than 7 show "sand-like" behavior and are more susceptible to liquefaction. Both screening methods for evaluating liquefaction susceptibility recognize cyclic strain softening or cyclic mobility may occur in soft soils with a high PI.

R1 Geo evaluated the factor of safety against liquefaction utilizing the simplified SPT methods (Youd, et. al, 2001). In addition, the factor of safety against liquefaction as well as anticipated magnitude of displacement was calculated using the SPTLiq analysis tool published by Dr. Keven Franke at BYU.

At the Allen Blvd. structure complex and the new bridge at Fanno Creek, liquefaction screening analysis indicated the soils to be susceptible to liquefaction. The free field seismic induced liquefaction settlement at the Allen Blvd. exit ramp is anticipated to be approximately 4 inches, and the displacement at the Fanno Creek bridge is estimated to be between 2.7 and 4.6 inches. Due to the magnitude of anticipated free field vertical settlement, liquefaction induced down drag is anticipated to develop for the depth above the lowest liquefiable layer. R1 Geo included the additional liquefaction induced load and loss of resistance of axial and lateral capacity discussed later in this report for the Fanno Creek bridge. The down drag load should be included in the Strength 1 loading condition for the Fanno Creek bridge. The down drag load at SW Allen

Blvd. is not recommended to be included in the project loading conditions. R1 Geo believes it is a more efficient use of project funds for the widened structure foundations to perform similarly to the existing structures in the event of a design level earthquake. A geotechnical design deviation has been prepared for this project that provides additional discussion.

The soils present at the area of the SW Hall Blvd. bridge (Str. #09671) were determined to be not susceptible using the methods described above. Consequently no liquefaction analyses were performed.

6.3.3 Residual Strength Determination

R1 Geo utilized the recommended procedure contained in section 6.4.1 of the GDM. The GDM determines the residual undrained strength ratio based on SPT blow count corrected for energy and fines content. The residual strength values were utilized in determining post seismic LPILE parameter input and post seismic stability of the foundations. In general, residual strengths were determined to be between 200 and 800 pounds per square foot (psf).

6.4 Retaining Walls

6.4.1 General

Four retaining walls will be constructed along the southbound alignment to accommodate the ramp and mainline widening. The four walls, labeled W1 through W4, are considered "Bridge Retaining Walls" according to the GDM. The new wall types will consist of mechanically stabilized earth (MSE) and soil nail. Three of the four walls (Wall 1, Wall 2, and Wall 4) will require a 2H: 1V back slope for fill conditions, while one will have a flat back slope and a moment slab supported guard rail along the top (Wall 3).

The following table provides a list of the four new retaining walls for the project labeled Wall 1 through Wall 4 and lists each by wall ID, location, beginning and endings stations, length, total height, and wall type. The stationing described below references the "C" alignment to provide project context but the length of each wall is measured along the wall control line.

Table 6-2 Summary of New Retaining Walls

Str #	**Wall ID**	**Location**	**Begin STA**	**End STA**	**Length (ft.)**	**Max Height (ft.)**	**Type**
23860	Wall 1	Allen Exit	219+33	221+33	203	15.5	MSE
23861	Wall 2	Denney Exit	248+12	248+92	79	6.75	MSE
23862	Wall 3	Denney Entrance	256+36	260+17	381	16.5	Soil Nail
23863	Wall 4	SW Hall Blvd	292+48	296+40	392	13.5	Soil Nail

The applicable borings for the design of the new retaining walls is listed in the following table. Also listed are the pertinent Site Plans that show the location of each wall with respect to individual boring locations.

Table 6-3 Retaining Wall Borings and Site Plans

Wall ID	**Corresponding Borings**	**Site Plan**
Wall 1	TB18841-12, -14, and -18	Figure 2
Wall 2	TB18841-11, and -13	Figure 4
Wall 3	TB18841-15, -16, and -18	Figure 5
Wall 4	TB18841-19, -20, and -44	Figure 8

6.4.2 Lateral Earth Pressures

Static analysis for the retaining walls lateral earth pressures was conducted in accordance with Section 15.3 of the GDM.

The walls were analyzed for seismic loading based on guidance contained in AASHTO and ODOT GDM. For level back slopes, the Mononobe-Okabe (MO) method of seismic lateral earth pressures was utilized. Where back slope conditions required a 2H: 1V slope the general limit equilibrium (GLE) method was utilized as detailed by AASHTO.

Anticipated ground motion parameters were developed based on the AASHTO General Procedure in tandem with the associated bridge structures. Factored peak ground acceleration was utilized for design ground acceleration in analysis. For Wall 1, 2, and 3, 1-2 inches of horizontal deflection was deemed acceptable by the project team under the 1000 year return interval no collapse criteria, consequently a reduction of the peak ground acceleration of 0.65 was utilized (FHWA, 2015). Due to the proximity of the existing and proposed bridge foundation at Wall 4, no reduction was applied.

6.4.3 MSE Walls

Wall 1 and Wall 2 will be constructed on level ground that is at or near proposed final grade. Wall 1 will support the SW Allen Blvd. exit approach embankment with a maximum total height of 15.5 feet at Sta “C” 221+12. Wall 2 will support the SW Denney Rd. exit approach embankment with a maximum total height of 6.5 feet at Sta “C” 248+92

6.4.3.1 MSE Wall Engineering Parameters

Wall 1 will be founded on fill composed of materials ranging from soft to stiff silt with trace sand and silty gravelly sand on the north end transitioning to medium stiff to very stiff clay and clayey sand on the south end.

Wall 2 will be founded on recent alluvium originating from Fanno Creek composed of soft to very stiff clay, silt and sand along the length of the wall.

Engineering properties utilized in each design are presented below. Parameters in Table 6-4 are based on the Strength 1 limit state.

Table 6-4 Engineering Properties for MSE Wall Design

	Wall 1 (Str #23860)	**Wall 2 (Str # 23861)**
Foundation soil unit density (pcf)	120	120
Foundation soil angle of internal friction (deg)	25	25
Foundation soil nominal bearing resistance (psf)	6450	5520
Retained soil unit weight (pcf)	130	130
Retained soil angle of internal friction (deg)	34	34
Reinforced soil unit density (pcf)	130	130
Reinforced soil angle of internal friction (deg)	34	34
Peak ground acceleration coefficient , PGA (g)	0.27	0.27
Long period spectral acceleration coefficient, S1 (g)	0.22	0.22
Site Class	E	E
Peak seismic ground acceleration coefficient modified by short period site factor, As (g)	0.46	0.46
Horizontal seismic acceleration coefficient, Kh (g)	0.23	0.23
Minimum length of soil reinforcement for stability (whichever is greater)	1.1H or 8 feet	0.8H or 8 feet

The bearing capacity shown above for Wall 1 is based on a foundation width of 16.5 feet. A chart with factored bearing capacity versus reinforcement length is available in Appendix F. The bearing capacity of Wall 2 is based on a foundation width of 8 feet. R1 Geo did not include a factored bearing capacity chart for Wall 2 since the height requirement does not generate a need for reinforcement lengths greater than 8 feet.

6.4.3.2 MSE Wall Settlement

Due to the compressible nature of materials at both locations, total settlement of 2 to 5 inches is anticipated. Differential settlement of 2.5 inches over a distance of 200 feet is anticipated for Wall 1. Differential settlement on the order of 2.5 inches over a distance of 80 feet is anticipated for Wall 2. This settlement will occur both during and after construction. R1 Geo estimates the soils underneath the walls will reach 90% consolidation within 4 months post construction. Installation of the architectural facing should be delayed until the majority of the settlement has occurred, as confirmed by R1 Geo based on evaluation of survey monitoring points installed on the structure.

6.4.3.3 MSE Global Stability

Global stability under static and seismic loading conditions were evaluated using SLOPE/W Version 8.4.1 (Geo-Slope International, 2012) utilizing cross sections representative of the critical design case. R1 Geo utilized a traffic surcharge pressure of 250 psf to account for live load on the ramp embankments. R1 Geo utilized reinforcement length of 1.1H for Wall 1 and 0.8H for Wall 2, where H is the total height of the wall in analysis. The GDM requires that bridge retaining walls be designed with static and seismic resistance factors of 0.65 and 0.9, which correspond to a factor of safety (FS) of 1.5 and 1.1, respectively. Global stability analysis results are presented below.

Table 6-5 MSE Wall Global Stability Analysis Results

Wall ID	**Critical Section Stationing**	**Analysis Case**	**Factor of Safety**	**Minimum Required Factor of Safety**
Wall 1	Sta “C” 221+12	Static	1.58	1.5
		Seismic	1.1	1.1
Wall 2	Sta “C” 248+92	Static	1.65	1.5
		Seismic	1.1	1.1

6.4.3.4 MSE Wall Drainage

Drainage design for the MSE retaining walls was based on regional groundwater being at or below the base of all wall excavations. A drainage detail is provided in the wall contract plans. Drainage at both locations shall consist of a minimum 6-inch perforated corrugated high density polyethylene pipe surrounded on all sides by at least 6 inches of granular drain backfill enclosed by drainage geotextile. Granular drain backfill will be 3/4'” – 1/2”. The pipe, granular drain backfill, and drainage geotextile will conform to the OSSC sections 02415.10, 00430.11, and 02320 respectively.

MSE wall construction should be conducted in accordance with Section 00596A of the OSSC.

6.4.4 Soil Nail Walls

Wall 3 is located along the proposed mainline alignment along the embankment supported portion of the SW Denney Rd, entrance ramp (Str. #23873) between the stationing listed in Table 6-2. Wall 3 will have a maximum exposed height of 16.5 feet at Sta “C” 256+36. Wall 3 will support the embankment widening at the top of the wall and allow space for the mainline auxiliary in front of the wall. A moment slab will be installed along the top of the SW Denney Rd. entrance ramp soil nail structure and an equivalent surcharge included in analysis. R1 Geo utilized a traffic surcharge pressure of 250 psf to account for live load on the ramp embankment. Wall 3 will have a staggered nail pattern to optimize design with a maximum horizontal spacing of 6 feet and maximum vertical spacing of 4 feet.

Wall 4 is located along the proposed mainline alignment at the location of the northern SW Hall Blvd. crossing structure (Str. #09671) between the stationing listed in Table 6-2. Wall 4 will have a maximum exposed height of 13.5 feet at Sta. “C” 294+75. Wall 4 will provide space for the mainline auxiliary lane in front of the wall underneath the existing structure accounting for the proposed widened portion of the structure. The nail layout accounts for the existing pile groups and calls for the nails to be installed between the pile groups and not within utilizing vertical rows and columns. .

R1 Geo utilized the FHWA Soil Nail Walls Reference Manual (FHWA, 2015) to evaluate the internal and external stability of each wall. Both soil nails were also modeled utilizing Snail, 2018 produced by the California Department of Transportation (CALTRANS, 2020). Outcome of these analysis indicate the proposed nail types, geometries, and facing details as shown below and on the appropriate contract plan sheets meet applicable minimum capacity demand ratios.

6.4.4.1 Soil Nail Engineering Parameters

Wall 3 will be installed into the existing ramp embankment fill that is comprised of clay to clay with trace sand that has low to medium plasticity, is medium stiff to very stiff, and contains fine to coarse grained sand.

Wall 4 will be constructed within fine grained alluvial flood deposits comprised of silt with trace sand to silty gravelly sand that has low to medium plasticity, is soft to stiff, and has fine to coarse grained gravel and sand. Decomposed to fresh basalt was encountered in the borings utilized in design, but based on investigation results and interpretation the basalt lies below the deepest portion of the nails. R1 Geo utilized the engineering parameters shown below for stability analysis.

Table 6-6 Soil Nail Engineering Parameters

Str. #	**Wall ID**	**Retained Soil Friction Angle (deg)**	**Bond Strength (psi)**
23862	Wall 3	30	10
23863	Wall 4	30	10

6.4.4.2 Soil Nail Stability

All soil nails will have a minimum borehole diameter of 6 inches and gravity grouted. Centralizers are required installed at the locations shown. All soil nails will be installed per the soil nail schedules contained in the project plans.

Corrosion protection will be Class-A encapsulation, consisting of a corrugated plastic sheathing (PVC 0.04-inch thick or HDPE 0.06-inch thick). Nails should be grouted in the shop and transported to the job site.

Global stability under static and seismic loading conditions were evaluated using SLOPE/W Version 8.4.1 (Geo-Slope International, 2012) utilizing cross sections representative of the critical design case. R1 Geo utilized a traffic surcharge pressure of 250 psf to account for live load on the ramp embankment for Wall 3. Any global resistance provided by the existing structure at Wall 4 was neglected from stability analysis.
Wall installation will require temporary unsupported near-vertical cuts of up to 4 feet exposed. Based on final soil nail locations, the temporary excavations should not exceed the maximum nail vertical spacing. A critical temporary stability scenario was analyzed at Wall 3 assuming a 4-foot tall unsupported excavation above it with three rows of nails installed. R1 Geo determined the resultant factor of safety was above 1.1. Full global stability analysis are included in Appendix F. Temporary stability at Wall 4 was not examined due to the support provided by the existing structure.

6.4.4.3 Soil Nail Testing

Verification and proof testing should be conducted in accordance with the GDM and Section 00598 of the project Special Provisions.

6.4.4.4 Soil Nail Drainage

The wall design assumes no hydrostatic forces act on the retained soil. To satisfy this condition, the final design includes geo-composite drainage strips centered between adjacent columns of nails. The strip drains will connect to header pipes installed under the proposed roadway barrier and connected to storm drains in the area.

6.5 Bridge Foundations

6.5.1 General

R1 Geo evaluated the standard types of bridge foundations available to the Agency and decided on deep foundations based on project conditions and discussions with the project team. The SW Allen Blvd., SW Denney Rd., and SW Hall Blvd. (Str. #23874, 23872, 23873, and 09671) structure modifications will be founded on driven piles at the abutments, and drilled shafts at the interior bents. Micropiles were selected for two bents at the SW Denney Rd. exit ramp (Str. #23872) due to the relatively low loads and low overhead clearance. The new Fanno Creek bridge (Str. #09671) will be founded on driven piles. The following table summarizes the location, type, and purpose of all of the proposed new structure foundations.

Table 6-7 Summary of Proposed Bridge Foundations

Structure	**Bent**	**Station**	**Type**	**Purpose**
SW Allen Blvd. Exit	AA1	221+10	Pipe Pile	Widen Structure
	AA2	221+94	Shaft	
	AA3	222+85		
	AA4	223+62		
Fanno Creek	Bent 1	243+81	Pipe Piles	New Structure
	Bent 2	244+24		
	Bent 3	244+76		
	Bent 4	245+19		
SW Denney Rd. Exit	DA1	249+12	Pipe Pile	Widen Structure
	DA2	249+88	Micropiles	
	DA3	250+69		
SW Denney Rd. Entrance	DB1	253+78	Shaft	Widen Structure
	DB2	254+38		
	DB3	255+09		
	DB4	255+75		
	DB5	256+36	Pipe Pile	
SW Hall Blvd.	Bent 1	294+69	H-Pile	Widen Structure
	Bent 2	295+37	Shaft	
	Bent 3	296+05	H-Pile	

To aid in visualization and project organization, the corresponding exploration for each structures are listed in Table 6-7.

Table 6-8 Bridge Structure Borings and Site Plans

Structure	**Corresponding Explorations**	**Site Plan**
SW Allen Blvd. Exit	TB18841-04, -05, -37, CPT18841-01	Figure A2/3

Fanno Creek	TB18841-09, -09A, -10, -10A, CPT18841-02	Figure A4
SW Denny Rd. Exit	TB18841-38, -39, -40, CPT18841-03	Figure A4/5
Denney Entrance	TB18841-41, -42, -43	Figure A5
SW Hall Blvd.	TB18841-19, -20, -21, -44, -47, -48, -49, TP18841-01	Figure A8

6.5.2 Analysis Methods and Set Up Time

R1 Geo utilized APILE v2015 produced by Ensoft, Inc. (Ensoft, 2015) to calculate factored axial capacity for driven pile foundations for appropriate limit states as discussed below. R1 Geo used the FHWA α-method detailed within the LRFD Design Specifications for cohesive soils, as well as the Nordlund/Thurman methods in cohesionless soils (AASHTO, 2017). R1 Geo assumed dynamic testing will be used to establish the driving criteria; therefore, a resistance factor of 0.65 was used. R1 Geo recommends two tests per bent.

Hammer type will impact the recommended set up period to allow the site soils to 'heal' and indicate true capacity. A one week set up time is recommended. Final set up time will be controlled in the project Special Provisions.

R1 Geo utilized SHAFT v2017 produced by Ensoft, Inc. (Ensoft, 2017) to calculate factored axial capacity for drilled shaft foundations using the beta method. R1 Geo utilized resistance factors of 0.50 for tip resistance, and 0.55 for side resistance in soils exhibiting sand like behavior, and 0.40 and 0.45 for tip and side resistance respectively in soils exhibiting clay like behavior. (AASHTO, Table 10.5.5.2.4-1). Calculated capacity with depth charts are displayed in Appendix F. The final performance of any drilled shaft is highly dependent on the quality of installation. R1 Geo recommends cross-hole sonic logging (CSL) testing be completed to ensure drilled shaft integrity. The presence of soil layers with higher sand content and high groundwater conditions will increase the hazard of caving soil. The contractor should have appropriate casing on site to ensure excavation stability.

6.5.3 Pile Acceptance Criteria and Drivability Analysis.

Based on the resistance factor utilized for design, the final capacity for the piles at Str.'s 23874, 23235, 23872, 23873, and 09671 will be determined through PDA testing with signal matching.

Driving stresses for the piles should be conducted using a wave equation analysis program (WEAP) with inputs as shown in SP00520. Driving stresses anywhere in the pile should be limited to 90% of the yield strength of the steel pile multiplied by the resistance factor described above.

6.5.4 Wing Wall and Abutment Lateral Earth Pressures

Bridge wing walls should be designed to active pressure when the wall can sustain sufficient deflection required to develop full active conditions. R1 Geo recommends designing the abutments and wing walls to at rest conditions.

Seismic stability of abutments and wing walls designed to at rest condition should utilize the full factored peak ground acceleration. Abutments and wing walls that can sustain 1-2 inches of displacement in a seismic event should use a design horizontal acceleration of half of the factored peak ground acceleration.

6.5.5 SW Allen Blvd, Exit Structure (Str. #23874)

6.5.5.1 Subsurface Conditions & Axial Capacity of Foundation Elements

At SW Allen Blvd (Str. #23874) the subsurface conditions are comprised of approximately 13 feet of fine grained fill overlying an irregular interbedded sequence of Alluvium, Willamette Formation, and Hillsboro Formation sands, silts, and clays based on TB18841-04, -05, and -37 as well as CPT18841-01. The Hillsboro unit extends beyond the bottom of the explorations. Groundwater was encountered at depths of approximately 18 feet bgs in TB18841-04 and -05 at the time of explorations in August, 2017. R1 Geo assumed the groundwater to be at the ground surface in design based on historic flooding in the area. ODOT Bridge Design Unit provided the loading for each limit states for this structure shown in the following table.

Table 6-9: Structure #23874 Anticipated Loads

Structure	**Bent Number**	**No. of Pile / Shaft**	**Strength 1** (kip/pile or shaft)	**Service 1** (kip/pile or shaft)	**Extreme 1*** (kip/pile or shaft)
SW Allen Blvd. Exit	AA1	3 pile	211	145	NP
	AA2	1 shaft	1260	917	NP
	AA3	1 shaft	1260	917	NP
	AA4	1 shaft	1260	917	NP

*Extreme Event 1 loads were not provided in project loading conditions

Based on the subsurface conditions and required loads shallow foundations are not a suitable foundation type at this site and both pile and drilled shaft foundations are recommended. Piles are recommended based on their economy and shafts are recommended for their high load carrying capacity. Pile foundations will develop resistance through skin friction in the silts, sands, and clay of the Willamette and Hillsboro formation. R1 Geo analyzed the driven piles based on long term effective strength parameters and the FHWA method of calculating side and tip resistance. R1 Geo recommends the use of dynamic testing to verify pile capacity during installation. As a result, a resistance factor of 0.65 was utilized for both end bearing and side resistance for the Strength 1 loading condition. R1 Geo utilized the following engineering parameters in analysis.

Table 6-10 SW Allen Blvd. (Str. #23874) Engineering Design Parameters

Layer No.	**Depth (feet bgs)**	**Total Unit Weight (pcf)**	**Effective Soil Friction Angle (deg)**
1	13	120	30
2	40	120	32
3	100+	120	30

Drilled shafts will develop resistance through skin friction and end bearing in the Willamette and Hillsboro Formation R1 Geo analyzed a 6 foot diameter drilled shaft utilizing effective strength parameters in analysis. R1 Geo utilized resistance factors of 0.50 for tip resistance, and 0.55 for side resistance, respectively.

R1 Geo has calculated the minimum tip elevations for geotechnical axial capacity in the following table based on the loads provided by the Bridge Design Unit.

Table 6-11 SW Allen Blvd. (Str. #23874) Geotechnical Axial Capacity Elevations

Bent No.	**Reported Top of Shaft / Bottom of Pile Cap Elevation**	**Length (feet)**	**Geotechnical Capacity Tip Elevation**
AA1	193.17	81	112
AA2	185	82	103
AA3	185	82	103
AA4	190	82	108

The foundation lengths presented above are only applicable to the factored geotechnical axial capacity.

Based on the Service 1 axial loads provided by the Bridge Design Unit, R1 Geo anticipates the settlement for both the drilled shafts and driven piles to be less than 1 inch.

6.5.5.2 LPile Input Parameters

Static LPile input parameters are provided in Table 6-9 for the proposed SW Allen Blvd. Exit structure. Due to the homogeneity of the subsurface conditions, one table has been provided for the abutment and interior bents.

Table 6-12 SW Allen Blvd. Exit Static Pipe Pile Foundation LPile Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Soil Model**	**K (lbs./in3)**	**Soil Parameters**			
						γ' (pcf)	**Φ (degrees)**	**c (psi/psf)**	**E50**
1	1	13	13	Medium Clay below WT (Reese)	100	57.6	N/A	500	0.01
3	13	40	27	Sand (Reese)	50	57.6	32	N/A	N/A
4	40	101.5	61.5	Very Stiff Clay below WT (Reese)	1000	57.6	NA	3000	0.005

6.5.6 Fanno Creek Structure (Str. #23235)

6.5.6.1 Subsurface Conditions & Axial Capacity of Foundation Elements

R1 Geo encountered Alluvium at the location of the proposed structure extending down to approximately 60 feet bgs, overlying Willamette Formation to a depth of approximately 90 feet bgs based on explorations TB18841-09, -09A, -10, and -10A as well as CPT18841-02. R1 Geo encountered Hillsboro Formation underlying the Willamette Formation extending down to the bottom of the explorations. Groundwater was encountered between depths of 7 and 17 feet bgs during explorations at the time of explorations in August, 2017. R1 Geo assumed the groundwater to be at the ground surface in design based on historic flooding in the area. ODOT Bridge Design Unit provided the loading for each limit states for this structure shown in the following table.

Table 6-13 Structure #23235 Anticipated Loads

Structure	**Bent Number**	**No. of Pile**	**Strength 1** (kip per pile)	**Service 1** (kip/pile or shaft)	**Extreme 1** (kip/pile or shaft)
Fanno Creek	1 and 4	5	225	172	155
	2 and 3	7	300	220	194

Based on the subsurface conditions and required loads shallow foundations are not a suitable foundation type at this site pile foundations are recommended. Pile foundations will develop resistance through skin friction in the silts, sands, and clay of the Willamette and Hillsboro formation. R1 Geo analyzed the driven piles based on long term effective strength parameters and the FHWA method of calculating side and tip resistance. R1 Geo recommends the use of dynamic testing to verify pile capacity during installation. As a result, a resistance factor of 0.65 was utilized for both end bearing and side resistance for the Strength 1 loading condition. R1 Geo utilized the following engineering parameters in analysis.

Table 6-14 Fanno Creek (Str. #23235) Engineering Design Parameters

Layer No.	Depth (feet bgs)	Total Unit Weight (pcf)	Effective Soil Friction Angle (deg)
1	20	110	29
2	40	110	31
3	100+	110	33

Depth versus Resistance graphics are provided in Appendix F for the Strength 1 and Extreme Event 1 loading conditions utilizing a 24-inch outer diameter 0.75-inch wall thickness closed end pipe pile. Resistance charts were developed assuming a minimum center to center pile spacing of 3 pile diameters. If piles are spaced closer than 3 pile diameters, a group reduction factor should be applied to the nominal individual capacity of the pile. R1 Geo has provided the minimum tip elevations for geotechnical axial capacity in the following table based on the loads provided by the Bridge Design Unit.

Table 6-15 Fanno Creek (Str. #23235) Geotechnical Axial Capacity Elevations

Bent No.	Reported Top of Shaft / Bottom of Pile Cap Elevation	Length (feet)	Geotechnical Capacity Tip Elevation
1	188.8	65	123.8
2	191.1	75	116.1
3	192.1	75	117.1
4	189.3	65	124.3

The foundation lengths presented above are only applicable to the factored geotechnical axial capacity.

Based on the Service 1 axial loads provided by the Bridge Design Unit, R1 Geo anticipates the settlement for both the drilled shafts and driven piles to be less than 1 inch.

6.5.6.2 Liquefaction Induced Downdrag

The soils at this location are generally classified as more clay like based on the liquefaction screening as described in Section 6.3. R1 Geo interprets two discrete layers at approximately 10 feet deep and 25 feet deep, each approximately 5 feet thick that are susceptible to liquefaction. Liquefaction induced vertical settlement was calculated to be between 2.7 and 4.6 inches at each bent location. As described in Section 6.3 and in accordance with AASHTO downdrag was assumed to fully develop. R1 Geo determined the downdrag load (negative skin friction) to be 56 kips per pile, applied from the ground surface to a depth of 25 feet. A load factor of 1.05 should be applied to the downdrag load (AASHTO, Table 3.4.1-2). R1 Geo recommends this additional axial load be applied to the Strength 1 loading condition. Analysis outputs are contained in Appendix F. Seismic axial capacity of the Fanno Creek foundations was evaluated based on no resistance within the liquefiable layers. R1 Geo has provided a factored seismic axial capacity with depth chart in Appendix F.

6.5.6.3 Seismic Stability of Approach Embankments

The seismic slope stability for both approach embankments was evaluated using SLOPE/W based on the embankment geometry provided by the project team. The project will install approximately 5 feet of fill over the existing grade at the location of the bridge. Based on the slope stability analysis, the factor of safety utilizing the factored ground motions described above is over the 1.1 required for both the Operational and Life Safety design events. Analysis results are provided in Appendix F.

6.5.6.4 Scour

R1 Hydro designers report a design scour elevation at the Fanno Creek structure of 175 feet during the 100-year base design flood. The scoured condition results in a lack of support for the upper 14 feet BGS. Per Section 8.9.2 of the GDM (ODOT, 2018) the pile resistance during the 100 year base flood scour event should be evaluated with Strength 1 resistance factors. Factored axial capacity with depth charts for a 100 year scour condition are provided in Appendix F. Per discussions with R1 Hydro designers, the 500 year check flood elevation is within 2 feet of the 100 year elevation, as a result the same scour elevation of 175 feet was assumed. Per Section 8.9.2 of the GDM, pile resistance during the 500 year scour event should be evaluated with Extreme Event 2 resistance factors. Nominal axial capacity with depth charts for the Extreme Event load case are presented later within Appendix F based on the Extreme Event 1 liquefied condition, which controls over the 500 year scour event. Based on the analysis, the piles provide sufficient factored resistance under the given conditions.

6.5.6.5 LPile Input Parameters

Based on the relatively consistent subsurface conditions between the abutment and interior bents, one LPile profile is presented for both interior and exterior abutments. Static and post seismic LPile input parameters are provided on the proceeding tables.

Table 6-16: Fanno Creek Static LPile Parameters

Layer	From (ft. BGS)	To (ft. BGS)	Thickness (ft.)	Soil Model	K (lbs./in3)	Soil Parameters		
						γ' (pcf)	c (psf)	E50
1	0	25	25	Soft Clay	50	47.6	1200	0.007
2	25	75	50	Stiff Clay Below the Water table	150	47.6	1800	0.007
3	75	120	45	Stiff Clay Below the Water table	500	47.6	2000	0.007

Table 6-17: Fanno Creek LPile Post Seismic Parameters

Layer	From (ft. BGS)	To (ft. BGS)	Thickness (ft.)	Soil Model	K (lbs./in3)	Soil Parameters		
						γ' (pcf)	c (psf)	E50
1	0	25	25	Liquefied Soft Clay	10	47.6	600	0.02
2	25	75	50	Stiff Clay Below the Water table	150	47.6	1800	0.007
3	75	120	45	Stiff Clay Below the Water table	500	47.6	2000	0.007

6.5.7 SW Denney Rd. Exit Structure (Str. #23872)

6.5.7.1 Subsurface Conditions & Axial Capacity of Foundation Elements

At the SW Denney Rd. exit ramp (Str. #23872) the subsurface conditions are comprised of approximately 10 feet of fill overlying Alluvium to a depth of 30 feet, which in turn overlies Willamette Formation silts, sands, and clays to a depth of approximately 55 feet where R1 Geo observed the transition to Hillsboro Formation based on explorations TB18841-38, -39, -40 as well as CPT18841-03. Groundwater was encountered at a depth of 13 feet bgs in CPT18841-03 based on interpretation of pore water pressure at the time of explorations in August, 2017. R1 Geo assumed the groundwater to be at the ground surface in design based on historic flooding in the area. ODOT Bridge Design Unit provided the loading for each limit states for this structure shown in the following table.

Table 6-18 Structure #23872 Anticipated Loads

Structure	Bent Number	No. of Pile / Shaft	Strength 1 (kip/pile or shaft)	Service 1 (kip/pile or shaft)	Extreme 1* (kip/pile or shaft)
SW Denney Rd. Exit	DA1	4 pile	298	193	NP
	DA2	12 micropile	142	100	NP
	DA3	12 micropile	142	100	NP

*Extreme Event 1 loads were not provided in project loading conditions

Based on the subsurface conditions and required loads shallow foundations are not a suitable foundation type at this site and both pile and drilled shaft foundations are recommended. Piles are recommended based on their economy and shafts are recommended for their high load carrying capacity. Pile foundations will develop resistance through skin friction in the silts, sands, and clay of the Willamette and Hillsboro formation. R1 Geo analyzed the driven piles based on long term effective strength parameters and the FHWA method of calculating side and tip resistance in non-cohesive soils. R1 Geo recommends the use of dynamic testing to verify pile capacity during installation. As a result, a resistance factor of 0.65 was utilized for both end bearing and side resistance. R1 Geo utilized the following engineering parameters in analysis.

Table 6-19 SW Denney Rd. Exit (Str. #23872) Engineering Design Parameters

Layer No.	**Depth (feet bgs)**	**Total Unit Weight (pcf)**	**Effective Soil Friction Angle (deg)**
1	10	110	28
2	25	110	30
3	100+	110	31

Drilled shafts will develop resistance through skin friction and end bearing in the Willamette and Hillsboro Formation. R1 Geo analyzed a 6 foot diameter drilled shaft utilizing effective strength parameters in analysis, detailed previously. R1 Geo utilized resistance factors of 0.50 for tip resistance, and 0.55 for side resistance, respectively. R1 Geo has calculated the minimum tip elevations for geotechnical axial capacity in the following table based on the loads provided by the Bridge Design Unit.

Table 6-20 SW Denney Rd. Exit (Str. #23872) Geotechnical Axial Capacity Elevations

Bent No.	**Reported Top of Shaft / Bottom of Pile Cap Elevation**	**Length (feet)**	**Geotechnical Capacity Tip Elevation**
DA1	191.5	105	86.5

The foundation length presented above is only applicable to the factored geotechnical axial capacity.

Based on the Service 1 axial loads provided by the Bridge Design Unit, R1 Geo anticipates the settlement for both the driven piles to be less than 1 inch.

6.5.7.2 Micropile

The proprietary micropiles anticipated for the Denney Exit Ramp Structure Bents 2 and 3 will be designed by the contractor at the time of construction. Micropiles should be able to provide the required resistance identified in Table 6-18. Although the specific type of micropile will be selected by the contractor, for analysis Type B (pressure grouted through the casing during withdrawal) is assumed. R1 Geo recommends a 15 foot minimum unbonded length and a 15 foot minimum bond length.

6.5.7.3 LPile Input Parameters

Static LPile input parameters are provided in the following tables for the SW Denney Rd. exit structure.

Table 6-21: Structure #23872 Static LPile Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Soil Model**	**K (lbs./in3)**	**Soil Parameters**		
						γ' (pcf)	**c (psf)**	**E50**
1	0	20	20	Soft Clay	50	47.6	1200	0.007
2	20	75	55	Stiff Clay Below the Water table	150	47.6	1800	0.007
3	75	120	45	Stiff Clay Below the Water table	500	47.6	2000	0.007

6.5.8 SW Denney Rd. Entrance Structure (Str. #23873)

6.5.8.1 Subsurface Conditions & Axial Capacity of Foundation Elements

At SW Denney Rd. entrance (Str. #23873) the subsurface conditions are comprised of approximately 10 feet of fine grained fill overlying approximately 10 feet of Alluvium, which in turn overlies 10 to 30 feet of Willamette Formation silts and clays before transitioning to Hillsboro Formation based on explorations TB18841-41, -42, and -43. Groundwater was not encountered during the explorations since mud rotary was utilized and precludes the direct observation of groundwater at the time of drilling. R1 Geo assumed the groundwater to be at the ground surface in design based on historic flooding in the area. ODOT Bridge Design Unit provided the loading for each limit states for this structure shown in the following table.

Table 6-22 Structure #23873 Anticipated Loads

Structure	**Bent Number**	**No. of Pile / Shaft**	**Strength 1** (kip/pile or shaft)	**Service 1** (kip/pile or shaft)	**Extreme 1*** (kip/pile or shaft)
23873	DB1	1 shaft	827	658	NP
	DB2	1 shaft	297	213	NP
	DB3	1 shaft	452	320	NP
	DB4	1 shaft	427	302	NP
	DB5	4 pile	260	185	NP

*Extreme Event 1 loads were not provided in project loading conditions

Based on the subsurface conditions and required loads shallow foundations are not a suitable foundation type at this site and both pile and drilled shaft foundations are recommended. Piles are recommended based on their economy and shafts are recommended for their high load carrying capacity. Pile foundations will develop resistance through skin friction in the silts, sands, and clay of the Willamette and Hillsboro formation. R1 Geo analyzed the driven piles based on long term effective strength parameters and the FHWA method of calculating side and tip resistance. R1 Geo recommends the use of dynamic testing to verify pile capacity during installation. As a result, a resistance factor of 0.65 was utilized for both end bearing and side resistance for the Strength 1 loading condition. R1 Geo utilized the following engineering parameters in analysis.

Table 6-23 SW Denney Rd. Entrance (Str. #23873) Engineering Design Parameters

Layer No.	**Depth (feet bgs)**	**Total Unit Weight (pcf)**	**Effective Soil Friction Angle (deg)**
1	10	110	28
2	20	110	30
3	100+	110	32

Drilled shafts will develop resistance through skin friction and end bearing in the Willamette and Hillsboro Formation. R1 Geo analyzed a 6 foot diameter drilled shaft utilizing effective strength parameters in analysis, detailed previously. R1 Geo utilized resistance factors of 0.50 for tip resistance, and 0.55 for side resistance, respectively. R1 Geo has calculated the minimum tip elevations for geotechnical axial capacity in the following table based on the loads provided by the Bridge Design Unit.

Table 6-24 SW Denney Rd. Entrance (Str. #23873) Geotechnical Axial Capacity Elevations

Bent No.	**Reported Top of Shaft / Bottom of Pile Cap Elevation**	**Length (feet)**	**Geotechnical Capacity Tip Elevation**
DB1	200.5	70	130.5
DB2	200.5	33	167.5
DB3	200.5	50	150.5
DB4	200.5	41	159.5
DB5	203.0	72	131

The foundation length presented above is only applicable to the factored geotechnical axial capacity.

Based on the Service 1 axial loads provided by the Bridge Design Unit, R1 Geo anticipates the settlement for both the drilled shafts and driven piles to be less than 1 inch.

6.5.8.2 LPile Input Parameters

Static LPile input parameters are provided below for the proposed SW Denney Rd. entrance structure.

Table 6-25: Structure #23873 Static LPile Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Soil Model**	**K (lbs./in3)**	**Soil Parameters**		
						γ' (pcf)	**c (psi/psf)**	**E50**
1	0	20	20	Soft Clay	50	47.6	1200	0.007
2	20	75	55	Stiff Clay Below the Water table	150	47.6	1800	0.007
3	75	120	45	Stiff Clay Below the Water table	500	47.6	2000	0.007

6.5.9 SW Hall Blvd. Structure (Str. #09671)

6.5.9.1 Subsurface Conditions & Axial Capacity of Foundation Elements

R1 Geo observed two native units within the explorations advanced for this structure; Willamette Formation and decomposed to intact Columbia River Basalt. R1 Geo observed 20 to 35 feet of alluvial materials at the abutments and trace surficial fill, overlying decomposed to weathered basalt, overlying moderately jointed basalt. R1 Geo observed transition between alluvial materials and weathered basalt at elevations of 195 and 182 feet within borings TB18841-47 and -49 which correspond to Bent 3 and Bent 1, respectively. R1 Geo observed decomposed basalt that remolded to silty sand and sandy gravel approximately 5 feet bgs within TB18841-48 which was advanced in the A-lane of OR217 northbound. The depth of the transition between alluvium and weathered basalt corresponds to an elevation of 192.5 in TB18841-48. R1 Geo encountered weathered basalt in borings TB18841-19 and -44 at depths of approximately 10, and 30 feet below ground surface (bgs), respectively during Phase 1 explorations. These depths correspond to elevations of approximately 189.5 and 188 feet, respectively. Groundwater was observed between elevations of 176 and 184 in the vicinity of Bent 1 during Phase 1 and Phase 3 explorations. Groundwater was observed at elevation 190 in the vicinity of Bent 2 during Phase 3 explorations, and at elevation 203.5 at Bent 3 during Phase 3 explorations. R1 Geo assumed the groundwater to be at the contact between the alluvial material and the decomposed bedrock in design. ODOT Bridge Design Unit provided the loading for each limit states for this structure shown in the following table.

Table 6-26 SW Hall Blvd (Str. #09671) Anticipated Loads

Structure	**Bent Number**	**No. of Pile / Shaft**	**Strength 1** (kip/pile or shaft)	**Service 1** (kip/pile or shaft)	**Extreme 1*** (kip/pile or shaft)
09671	1	12 pile	175	130	NP
	2	1 shaft	2400	1642	NP
	3	12 pile	175	130	NP

*Extreme Event 1 loads were not provided in project loading conditions

Based on the subsurface conditions and required loads shallow foundations are not a suitable foundation type at this site and both pile and drilled shaft foundations are recommended. Piles are recommended based on their economy and shafts are recommended for their high load carrying capacity. R1 Geo analyzed an HP14x8.9 steel pile for the abutments and a 6-foot diameter drilled shaft for the interior bent foundation. R1 Geo utilized the following engineering parameters in analysis.

Table 6-27 SW Hall Blvd. (Str. #09671) Abutment Engineering Design Parameters

Layer No.	**Depth (feet bgs)**	**Total Unit Weight (pcf)**	**Effective Soil Friction Angle (deg)**
1	35	110	30
2	100+	150	45

Table 6-28 Table 6 27 SW Hall Blvd. (Str. #09671) Interior Bent Engineering Design Parameters

Layer No.	**Depth (feet bgs)**	**Total Unit Weight (pcf)**	**Effective Soil Friction Angle (deg)**
1	25	110	38
2	100+	150	45

R1 Geo utilized the software program SHAFT 2017 produced by Ensoft, Inc. in order to calculate the factored bearing capacity of shafts. This program has not been updated with recent guidance surrounding shafts socketed into jointed rock as contained in the 8th edition of the AASHTO LRFD code. As a result, SHAFT 2017 artificially limits the factored end bearing capacity of shafts. Calculations for determining the factored end bearing capacity according to AASHTO are presented in Appendix F. R1 Geo has calculated the minimum tip elevations for geotechnical axial capacity in the following table based on the loads provided by the Bridge Design Unit.

Table 6-29 SW Hall Blvd (Str. #09671) Geotechnical Axial Capacity Elevations

Bent No.	**Reported Top of Shaft / Bottom of Pile Cap Elevation**	**Length (feet)**	**Geotechnical Capacity Tip Elevation**
1	203.0	25	178
2	196.0	35	161
3	214.0	23	191

The foundation lengths presented above are only applicable to the factored geotechnical axial capacity. Per guidance contained in AASHTO, the design length for contract plans is typically the depth to rock. Since the bearing unit is basalt and has closely spaced joints, fractures, and differential weathering, pile embedment of 3 to 5 feet into the basalt is possible, and R1 Geo assumed an embedment depth of 4 feet in the lengths presented above.

The piles are anticipated to be point bearing piles on rock in accordance with AASHTO. The geotechnical capacity of the elements is assumed to therefore be the factored structural capacity of the H-piles. The structural section should be capable of safely accommodating the driving stress associated with embedment into the weathered basalt. Appropriate resistance factors should be applied to the structural section to accommodate for potential tip damage during installation. R1 Geo recommends utilizing a reinforced tip shoe to reduce the potential for pile tip damage. Pile spacing similar to the existing bridge structure is appropriate.

Based on the Service 1 axial loads provided by the Bridge Design Unit, R1 Geo anticipates the settlement for both the drilled shafts and driven piles to be less than 1 inch.

6.5.9.1 LPile Input Parameters

Static LPile parameters for the SW Hall Blvd. structure are presented in Table 6-16 through 6-18. All tables reference 0 as the bottom of the proposed pile cap elevation. .

Table 6-30 Bent 1 Static LPile Parameters

Layer	**From (ft.)***	**To (ft.)**	**Soil Model**	**K (lbs./in3)**	**Rock and Soil Parameters**						
					γ' (pcf)	**Φ (deg)**	**Unconfined Compressive Strength (psi)**	**GSI**	**Modulus of Rock Mass (ksi)**	**RQD (%)**	**Strain Factor k-rm**
1	0	20	Sand (Reese)	50	47.6	30	--	--	--	--	--
2	20	25	Weak Rock	--	72.6	--	500	--	10	10	.0001
3	25	40.5	Massive Rock	--	150	--	10000	35	25	10	.0005

Table 6-31 Bent 2 Static LPile Parameters

Layer	From (ft.)	To (ft.)	Soil Model	K (lbs./in3)	Rock and Soil Parameters						
					γ' (pcf)	Φ (deg)	Unconfined Compressive Strength (psi)	GSI	Modulus of Rock Mass (ksi)	RQD (%)	Strain Factor k-rm
1	0	3	Sand (Reese)	50	47.6	30	--	--	--	--	--
2	3	26	Weak Rock	--	72.6	--	500	--	10	10	.0001
3	26	45	Massive Rock	--	150	--	10000	35	25	10	.0005

Table 6-32 Bent 3 Static LPile Parameters

Layer	From (ft.)*	To (ft.)	Soil Model	K (lbs./in3)	Rock and Soil Parameters						
					γ' (pcf)	Φ (deg)	Unconfined Compressive Strength (psi)	GSI	Modulus of Rock Mass (ksi)	RQD (%)	Strain Factor k-rm
1	0	12.5	Sand (Reese)	50	47.6	30	--	--	--	--	--
2	12.5	18	Weak Rock	--	72.6	--	500	--	10	10	.0001
3	18	30	Massive Rock	--	150	--	10000	35	25	10	.0005

6.6 Traffic Structure Foundations

Six cantilever sign structures are proposed for this project. Five mast arm signal structures are also proposed. The structures will be supported on drilled shaft foundations. R1 Geo utilized loads provided by the R1 Bridge unit in design of the sign foundations. R1 Geo utilized loads from ODOT standard drawing TM651 for the signal foundations. Cantilever sign structure recommendations will be addressed in Section 6.6.2. Mast arm signal structures will be addressed in Section 6.6.3

R1 Geo outsourced a portion of the traffic structure exploration and design Geotechnical Resources, Inc. of Beaverton, OR conducted the investigation and analysis for signs S1 and S6 (Str's. #23238 and #23243) and prepared the report entitled "Geotechnical Report, OR217 OR10-99W SB Auxiliary Lane Traffic Structures, Washington County, Oregon" dated August, 2019.

6.6.1 Subsurface Explorations

Subsurface investigations were conducted in order to provide anticipated shaft lengths for the proposed structures based on locations provided by R1 Traffic. Subsurface data is included in Appendix A. The structure number, stationing, and pertinent details are contained below.

Table 6-33: Sign and Structure Analysis Details

Sign/Signal ID	Structure/Pole Number	Stationing Along "C" Alignment	Foundation Type	Reported Foundation Diameter (ft.)	Designer	Associated Exploration
Sign 2	23239	271+32	Shaft	5	ODOT	TB18841-S04
Sign 3	23240	282+27	Shaft	5	ODOT	TB18841-S05
Sign 4	23241	300+38	Shaft	5	ODOT	TB18841-45
Sign 5	23242	338+58	Shaft	5	ODOT	TB18841-50
SW Denney Entrance Ramp	11	260+64	Shaft	42	ODOT	CPT18841-04
SW Hall Blvd. and Cascade Ave. Intersection	13	292+56	Shaft	42	ODOT	N/A
	16	291+33	Shaft	42	ODOT	TB18841-S01
	20	291+96	Shaft	42	ODOT	TB18841-S02
	21	293+14	Shaft	42	ODOT	TB18841-S03

R1 Geo assumes support for traffic structures will be achieved through drilled shafts following ODOT Standard Details and Drawings. Foundation length was estimated using the guidance contained in the most recent edition of the GDM.

6.6.2 Sign Structure LPile Inputs

LPile parameters for sign structures S1 and S6 are included in the Geotechnical Report submitted to ODOT by authorized consultant GRI dated November 1, 2018. The tables below present soil input parameters for use in sign structure foundation design.

Table 6-21 Structure #23239 LPILE Parameters

Layer	From (ft. BGS)	To (ft. BGS)	Thickness (ft.)	Model Soil Type	K (pci)	Soil Parameters			
						γ' (pcf)	c (psf)	Φ (degrees)	E50
1	0	30	30	Stiff Clay w/Free Water (Reese)	500	57.6	1000	---	0.007
2	30	40	10	Stiff Clay w/Free Water (Reese)	1000	57.6	2000	---	0.005
3	40	45	5	Sand (Reese)	60	57.6	NA	30	---
4	45	51.5	6.5	Stiff Clay w/o Free Water (Reese)	2000	57.6	4000	---	0.004

Table 6-22 Structure #23240 LPILE Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Model Soil Type**	**K (pci)**	**Soil Parameters**			
						γ' (pcf)	**c (psf)**	**Φ (degrees)**	**E50**
1	0	15	15	Soft Clay (Matlock)	100	57.6	750	---	0.01
2	15	51.5	36.5	Stiff Clay w/Free Water (Reese)	500	57.6	1500	---	0.007

Table 6-23 Structure #23241 LPILE Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Model Soil Type**	**K (pci)**	**Soil Parameters**			
						γ' (pcf)	**c (psf)**	**Φ (degrees)**	**E50**
1	0	10	10	Sand (Reese)	20	57.6	---	25	0.007
2	10	15	5	Soft Clay (Matlock)	1000	57.6	2000	---	0.020
3	15	20	5	Sand (Reese)	125	57.6	---	32	---
4	20	36	16	Strong Rock (Vuggy Limestone)	4000	150	---	---	0.004

Table 6-24 Structure #23242 LPILE Parameters

Layer	**From (ft. BGS)**	**To (ft. BGS)**	**Thickness (ft.)**	**Model Soil Type**	**K (pci)**	**Soil Parameters**			
						γ' (pcf)	**c (psf)**	**φ (degrees)**	**E50**
1	0	15	15	Stiff Clay w/Free Water (Reese)	500	57.6	1500	---	0.05
2	15	30	15	Sand (Reese)	20	57.6	---	25	---
3	30	35	5	Stiff Clay w/Free Water (Reese)	500	57.6	1500	---	0.005
4	35	51.5	16.5	Sand (Reese)	125	57.6	---	30	---

6.6.3 Signal Pole Foundations

Table 6-25 provides recommended minimum embedment depths. Foundation recommendations are based on the standard loading conditions from ODOT Standard Drawing TM651 and associated foundation diameters based on Standard Drawing TM653. Minimum embedment depths for the signal poles were determined using Brom's Simplified Method (ODOT, 2020 and AASHTO, 2013).

Table 6-25 Minimum Embedment Depths for Mast Arm Signal Structures

Location	**Pole No.**	**Pole Type**	**Standard Maximum Base Reactions per TM651**			**Foundation Diameter per TM653 (in)**	**Minimum Embedment Depth (ft)**
			Axial (kips)	**Shear (kips)**	**Moment (kip-ft)**		
Denney	11	SM4	4.51	9.00	173.46	42	16
Hall and Cascade	13	SM3L	4.39	8.80	176.51	42	16
	16	SM5L	7.34	10.56	241.17	42	17
	20	SM5L	7.34	10.56	241.17	42	17
	21	SM5L	7.34	10.56	241.17	42	17

If the assumptions for the size of mast arm signal poles are changed, this office should be contacted to provide an updated design for inclusion in the contract plans. Pole foundations should be constructed in accordance with Section 00963 Signal Support Pole Drilled Shafts of the *2021 Oregon Standard Specifications for Construction* and its Special Provisions. Depending on the time of construction ground conditions could be saturated and caving and heaving may occur. We recommend using temporary casing during construction.

7.0 SPECIAL PROVISIONS

Special Provisions for geotechnical elements are included in the contract documents. Special Provisions are intended to supplement and clarify the most recent Oregon Standard Specifications for Construction. The anticipated Special Provisions for geotechnical elements in the project are, Special Provision 00330 for Earthwork, Special Provision 00512 for Drilled Shafts, Special Provision 00520 for Driven Piles, Special Provision 00515 for Micropiles, Special Provision 00596A for Mechanically Stabilized Earth Retaining Walls, Special Provision 00598 for Soil Nail Retaining Walls.

8.0 LIMITATIONS

Variations in soil conditions may exist and groundwater levels may fluctuate periodically. The nature and extent of any variations in subsurface materials or conditions may not become evident until construction. If subsurface conditions different from the conditions stated in this report are identified or encountered during construction, promptly advise Region 1 Geo/Hydro/Hazmat so we may observe these conditions and revise our design recommendations if necessary. Any interpretation or evaluation of the information provided by this report by individuals outside of ODOT is done so at that individual's sole risk.

9.0 SIGNATURES

Prepared by: Michael Zimmerman, C.E.G	
CERTIFIED OREGON MICHAEL J. ZIMMERMAN E1897 ENGINEERING GEOLOGIST EXPIRES: 12-01-2021	
Sections: 2.3, 2.4, 4.0, and 5.0	
Reviewed by: Michael Tardif, C.E.G.	
Prepared by: Max. Gummer, P.E.	Palo Giscombe, P.E.
REGISTERED PROFESSIONAL ENGINEER 82,711 OREGON DECEMBER 09, 2013 MAX ALEXANDER GUMMER RENEWS: 06-30-2023	REGISTERED PROFESSIONAL ENGINEER 92,012 OREGON MAR. 14, 2017 PALO GISCOMBE RENEWS: 06-30-2021
Sections: 1.0, 2.1, 2.2, 3.0, 6.1, 6.3, 6.4, 6.5, Structures: 23235, 23873, 09671, 23862, 23863	Sections: 6.4.3, 6.5.3, 6.5.5, 6.6 Structures: 23872, 23874, 23860, 23861, 23239, 23240, 23241, 23242

INSERT TAB

Drill Logs

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Hole No. **TB18841-01**

Project **OR217 SB: Allen Blvd to OR99W**
Purpose **Wall**
E.A. No.

Highway **OR217 (Hwy #144)**
County **Washington**
Key No. **18841**

Hole Location Northing: **155,287.40** Easting: **317,994.61**
Start Card No.

Equipment **CME850**
Driller **WSSC**
Bridge No.

Project Geologist **M. Zimmerman**
Recorder **Giscombe**
Ground Elev. **187.50 ft**

Start Date **August 3, 2017**
End Date **August 3, 2017**
Total Depth **31.50 ft**
Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance	Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 15.00** **CLAY with some gravel and sand to Clayey GRAVEL with some sand; CH, SC, GC; gray to brown; medium to high plasticity; damp to moist; fine gravel, fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Drilling with 4" i.d. HSA		
	U1	100%	--					Shelby Tube 200 psi for 18" and 500 psi for last 6"		
5	N1	86%	5-12-15		18					
	U2	100%	--					Shelby Tube 250 psi		
10	N2	100%	0-1-2		52					
15	N3	92%	2-6-9		27	**15.00 - 20.00** **CLAY to Sandy CLAY, CL, gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
20	N4	100%	0-1-2		34	**20.00 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**			8/3/17 ▽ Measured during drilling	
25	N5	100%	1-3-4		32					
30	N6	100%	5-12-10		30					
								BOH Backfilled with bentonite chips		
35										

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-02**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,151.83** Easting: **318,037.69**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **195.39 ft**
Start Date **August 2, 2017** End Date **August 2, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 15.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Drilling with 4" i.d. HSA		
5	N1	72%	1-3-6		21					
10	N2	64%	1-1-3		24					
15	N3	86%	5-10-9		18	**15.00 - 20.00** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
20	N4	100%	2-3-5		31 31	**20.00 - 20.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	U1	25%	--			**20.50 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Shelby Tube 250 psi for 24" Measured during drilling	8/2/17 ∇	
25	N5	100%	1-2-3		36					
30	N6	94%	3-4-4		31					
								BOH Backfilled with bentonite chips		
35										

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-03**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,109.11** Easting: **318,105.85**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **188.42 ft**
Start Date **August 3, 2017** End Date **August 3, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 3.70** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Drilling with 4" i.d. HSA		
	N1	89%	3-6-9		21 19	**3.70 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
5	N2	89%	5-11-14		19					
	N3	83%	1-3-3		24 24	**5.00 - 7.50** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
10	N4	100%	2-2-4		30	**7.50 - 8.50** **CLAY with some gravel and sand to Clayey GRAVEL with some sand; CH, SC, GC; gray to brown; medium to high plasticity; damp to moist; fine gravel, fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
15	N5	100%	1-2-3		33	**8.50 - 31.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		4 inch sand lens observed		
	U1	0%	--					Shelby push: 250 psi 18'-19', 300 psi 19'-20'	8/3/17 ∇ Observed during drilling	
20	N6	100%	1-3-3		34					
25	N7	100%	3-6-6		31				8/3/17 01:00 ∇ Measured during drilling	
30	N8	100%	4-5-5		35 38					
								BOH Backfilled with bentonite chips		
35										

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-04**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,722.93** Easting: **317,695.00**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **186.18 ft**
Start Date **August 28, 2017** End Date **August 28, 2017**	Total Depth **101.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance	Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Ground surface: grassy/gravelly. Drilling with 4" i.d. HSA		
	N1	90%	4-7-11		19					
5	N2	93%	2-2-2		27	**5.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	U1	38%	--					Shelby Tube. 500 psi to 650 psi for 2'		
10	N3	100%	1-2-2		35					
	U2	40%	--						8/28/17 09:00 ∇	
15	N4	100%	1-3-7		34 33	**15.00 - 35.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Observed during drilling		
	N5	100%	2-6-9		31					
20	N6	100%	2-6-8		31					
25	N7	100%	6-9-13		27					
30	N8	100%	7-5-6		31			Switched to mud rotary drilling		
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100%	2-2-3	31	**35.00 - 40.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
40	N10	100%	7-10-16	26	**40.00 - 45.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		Observed during drilling	8/29/17 12:00 ▽	
45	N11	100%	6-7-11	28	**45.00 - 55.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
50	N12	100%	6-6-11	33					
55	N13	100%	7-9-13	28	**55.00 - 65.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
60	N14	100%	6-8-8	30					
65	N15	100%	17-15-17	26	**65.00 - 70.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N16	100%	12-14-18	31	**70.00 - 75.40** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
75	N17	100%	8-20-24	21 27	**75.40 - 80.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
80	N18	100%	13-22-22	25	**80.00 - 95.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
85	N19	100%	15-18-22	25					
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90									
	N20	100%	11-18-24	21					
95									
	N21	100%	12-16-21	22	**95.00 - 100.00** **CLAY to CLAY with some sand; CH; Green, gray, brown; High plasticity; Damp to moist; Stiff to hard; Fine to coarse grained sand; Noncemented, Lensed. (Hillsboro Formation)**				
100									
	N22	100%	9-13-20	31	**100.00 - 101.50** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		BOH Backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-05**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,639.58** Easting: **317,733.25**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **186.67 ft**
Start Date **August 29, 2017** End Date **August 30, 2017**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.70** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Ground surface: grassy/gravelly. Drilling with 4" i.d. HSA		
	N1	93%	4-5-8		20					
5										
	N2	100%	2-2-3		28 27	**5.70 - 12.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	U1	95%	--					Shelby Tube 500-800 psi for 2'.		
10										
	N3	100%	2-2-4		29					
	N4	100%	1-3-5		32 30	**12.50 - 30.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Observed during drilling	8/29/17 ▽	
15										
	N5	100%	2-1-3		34					
	U2	32%	--					Shelby Tube. 600-900 psi for 1.7 '		
20										
	N6	100%	3-4-10		29			Switched to mud rotary		
25										
	N7	100%	8-11-9		27					
30										
	N8	100%	7-10-7		28	**30.00 - 40.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100%	2-2-4	30					
40	N10	100%	21-15-12	28 25	**40.00 - 40.80** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)** **40.80 - 55.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
45	N11	100%	6-8-14	20 27					
50	N12	100%	6-6-7	33					
55	N13	100%	10-10-12	30	**55.00 - 60.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
60	N14	100%	7-10-15	29	**60.00 - 75.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
65	N15	100%	14-12-15	25					
70	N16	100%	9-12-15	26					
75	N17	100%	11-16-20	27	**75.00 - 80.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
80	N18	100%	5-8-10	26	**80.00 - 95.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
85	N19	100%	7-10-35	34					
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N20	100%	14-20-25	31					
95	N21	100%	10-15-18	21	**95.00 - 100.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
100	N22	100%	12-17-21	31	**100.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		BOH Backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-06**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **154,776.09** Easting: **318,240.84**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **185.42 ft**
Start Date **August 28, 2017** End Date **August 28, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 7.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨	Surface: grassy slope. Drilling with 4" i.d. HSA 07:40		▨
	N1	67%	8-5-5	19		▨			▨
5	N2	100%	0-2-4	28		▨			▨
	N3	100%	0-2-4	49	**7.50 - 10.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▩			▨
10	N4	100%	0-1-4	31	**10.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			▨
	U1	50%	--			▨	Shelby tube: 350 psi 13-15'		▨
15	N5	100%	0-2-4	19 33	**15.00 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**	░		8/28/17 ∇ Observed during drilling	▨
20	N6	67%	2-6-8	27		░			▨
25	N7	100%	1-5-6	35		░	Very slow dilatancy	8/28/17 01:00 ∇ Measured during drilling	▨
30	N8	100%	0-0-1	33		░			▨
							BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-07**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **154,561.32** Easting: **318,359.85**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **186.33 ft**
Start Date **August 28, 2017** End Date **August 28, 2017**	Total Depth **36.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 9.50** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: grassy slope. Begin 4" i.d. HSA		
	N1	67%	3-4-5		34					
	N2	100%	1-2-3		31					
	U1	100%	--					Shelby Tube: 300 PSI: 7.5-9.5'		
10	N3	100	0-1-2		31	**9.50 - 15.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N4	100%	0-1-2		27	**15.00 - 30.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
20	N5	100%	1-4-3		31					
	N6	100%	0-1-1		31				8/28/17 ▽ Observed during drilling	
									8/28/17 01:00 ▽ Measured during drilling	
30	N7	100%	0-0-0		26	**30.00 - 36.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
	N8	100%	5-7-8		28					
40								BOH Backfilled with bentonite chips		

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-08**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **154,282.15** Easting: **318,530.49**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **187.57 ft**
Start Date **August 29, 2017** End Date **August 29, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 7.50** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: grass, start 4" i.d. HSA.		
	N1	67%	6-6-7	33					
5	N2	100%	2-5-4	28					
	N3	100%	1-1-1	30	**7.50 - 10.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
10	N4	100%	1-4-5	26 31	**10.00 - 15.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	U1	100%	--				Shelby Tube: 250 psi, 300 psi for last 0.5'		
15	N5	100%	0-3-4	27	**15.00 - 20.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**			8/29/17 ∇	
20	N6	100%	1-3-3	21	**20.00 - 30.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Observed during drilling		
								8/29/17 01:00 ∇	
25	N7	100%	0-3-3	25			Measured during drilling		
30	N8	100%	0-0-2	25	**30.00 - 31.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-09**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,788.08** Easting: **318,688.23**		Start Card No.
Equipment **CME55**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **185.99 ft**
Start Date **August 23, 2017** End Date **August 24, 2017**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 10.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Ground surface-grassy. Drilling with 4" i.d. HSA		
	N1	47%	5-8-6		21					
5	N2	100%	3-4-5		22					
								Measured during drilling	8/23/17 ∇	
	U1	40%	--					Shelby Tube, 300 psi for 2ft.		
10	N3	100%	0-0-3		20 31	**10.00 - 10.30** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)** **10.30 - 18.80** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	U2	0%	--					Shelby Tube, no recovery, 250-350 psi for 2 ft.		
15	N4	100%	3-4-6		27					
	U3	53%	--					Shelby Tube, 0.4 ft of recovery, 450 for 0.5 ft. 800 for 0.25 ft.		
	N5	100%	5-8-13		28	**18.80 - 30.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20										
25	N6	100%	5-6-6		29			Switched to mud rotary		
30	N7	100%	4-5-11		32	**30.00 - 35.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N8	100%	8-18-20	30	**35.00 - 40.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
40	N9	100%	6-8-10	34	**40.00 - 50.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
45	N10	100%	5-9-8	29					
50	N11	100%	8-10-14	27	**50.00 - 55.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
55	N12	100%	6-8-10	28	**55.00 - 65.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
60	N13	100%	7-9-11	30					
65	N14	100%	7-9-14	28	**65.00 - 90.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N15	100%	7-15-24	25					
75	N16	100%	8-15-15	20					
80	N17	100%	23-32-32	27			After tripping out material sticks to drill rod @ depth		
85	N18	100%	7-9-10	33					
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N19	100%	12-13-17	30	**90.00 - 100.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
95	N20	100%	8-14-20	29					
100	N21	100%	13-19-24	25	**100.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		BOH Backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-09A**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,792.77** Easting: **318,715.84**		Start Card No.
Equipment **CME55**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **187.32 ft**
Start Date **August 22, 2017** End Date **August 23, 2017**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Ground surface-grassy, drilling with 4" i.d. HSA		
	N1	67%	4-5-5		26			Organics present		
5	N2	93%	3-3-5		27	**5.00 - 7.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N3	97%	3-5-6		26	**7.50 - 10.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
10	N4	100%	1-2-1		34	**10.00 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	U1	100%	--					Shelby Tube 200psi to 300 psi		
15	N5	100%	1-3-3		31					
	N6	100%	3-6-9		21					
20	N7	100%	4-6-7		31 19				8/22/17 ∇ Observed during drilling	
25	N8	100%	3-5-8		28	**25.00 - 35.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Switched to mud rotary		
30	N9	100%	6-8-9		49					
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N10	100%	4-9-12	31	**35.00 - 50.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
40	N11	100%	8-12-12	33					
45	N12	100%	14-15-17	22					
50	N13	100%	8-13-17	23	**50.00 - 60.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
55	N14	100%	8-10-18	31					
60	N15	100%	6-9-14	28	**60.00 - 85.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		More granular than previous sample		
65	N16	100%	8-11-19	32 33 34					
70	N17	100%	15-20-25	27					
75	N18	100%	7-12-17	27 28					
80	N19	100%	16-20-25	26					
85	N20	100%	9-19-20	28	**85.00 - 90.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained**				
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88					**sand; noncemented; lensed. (Hillsboro Formation)**				
90	N21	100%	9-13-15	33 32	**90.00 - 100.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
95	N22	100%	8-13-15	31					
100	N23	100%	13-18-22	28	**100.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		BOH Backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-10**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,706.65** Easting: **318,698.00**		Start Card No.
Equipment **CME80**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **McNamara**	Ground Elev. **188.83 ft**
Start Date **August 28, 2017** End Date **August 29, 2017**	Total Depth **101.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
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Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance	Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 7.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨	Stated mud rotary drilling with 4 7/8" tricone.		
	N1	61%	6-3-2		23					
5	N2	72%	2-2-2		25					
	N3	89%	1-2-1		43	**7.50 - 12.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥			
10	U1	0%	--					Shelby Tube. 150 psi for 12" and 250 psi for 12-24". Let sit for 10 min.		
	N4	111%	1-2-2		31	**12.50 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			
15	N5	89%	3-3-4		28	**15.00 - 20.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▧	Driller switched to 47/8 " spade bit @ 16.5'		
	U2	13%	--					Shelby Tube. 400 for 12" and 600 from 12-24"		
20	N6	105%	5-8-7		28	**20.00 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨	Micaceous	8/28/17 ∇	
25	N7	100%	6-7-11		31	**25.00 - 30.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥	Observed during drilling		
30	N8	105%	5-7-7		30	**30.00 - 35.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▧			
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	111%	8-11-12	24	**35.00 - 45.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
40	N10	105%	8-7-10	25					
45	N11	105%	9-9-9	27	**45.00 - 50.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Driller reams hole to 40'. Micaceous decomposed basalt fragments		
50	N12	105%	9-14-15	26	**50.00 - 55.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		Micaceous		
55	N13	111%	8-9-12	28	**55.00 - 60.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		Micaceous. Driller states slight rig chatter at 48'-55' twice		
60	N14	122%	8-10-11	33	**60.00 - 65.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
65	N15	72%	9-16-17	25	**65.00 - 70.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N16	89%	10-13-18	35	**70.00 - 80.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
75	N17	133%	7-8-28	31			Organic odor		
80	N18	117%	7-10-11	32	**80.00 - 90.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		Possible volcanic ash or decomposed pumice parting		
85	N19	133%	13-15-13	28 30					
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N20	122%	18-15-19	28	**90.00 - 95.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
95	N21	117%	10-13-18	25	**95.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
100	N22	133%	10-12-13	34					
							BOH. Back-filled hole with bentonite grout and chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

Hole No. **TB18841-10A**

Project **OR217 SB: Allen Blvd to OR99W**
Purpose **Bridge Foundation**
E.A. No.

Highway **OR217 (Hwy #144)**
County **Washington**
Key No. **18841**

Hole Location Northing: **153,711.59** Easting: **318,731.78**
Start Card No.

Equipment **CME 850**
Driller **WSSC**
Bridge No.

Project Geologist **M. Zimmerman**
Recorder **McNamara**
Ground Elev. **189.32 ft**

Start Date **August 30, 2017**
End Date **August 31, 2017**
Total Depth **101.50 ft**
Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Ground surface: grassy median. Mud rotary drilling w/ 3-7/8 bit spade. Driller states silty gravel to 2.5' (Gravel cuttings). Organics are roots and decomposed plant matter		
	N1	78%	5-2-2		25					
5	N2	83%	3-3-5		30	**5.00 - 7.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N3	100%	4-3-5		27 33	**7.50 - 8.50** **CLAY with some gravel and sand to Clayey GRAVEL with some sand; CH, SC, GC; gray to brown; medium to high plasticity; damp to moist; fine gravel, fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Micaceous		
10	U1	0%	--					Shelby Tube. 100-150 psi for 2'	8/30/17 ▽ Observed during drilling	
	N4	100%	3-2-2		31 29	**8.50 - 12.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Micaceous		
15	N5	100%	2-3-2		32	**12.00 - 12.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N6	100%	4-6-7		32	**12.50 - 25.60** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Buried soil horizon at 18.0'. Micaceous		
20	U2	0%	--					Shelby Tube. 100-150 psi for 20-21' and 500-650 psi for 21-22'		
25	N7	100%	5-7-10		33 30	**25.60 - 30.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Micaceous		
30	N8	105%	7-10-11		31 26	**30.00 - 30.80** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
						30.80 - 35.00 **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse**				
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	111%	5-6-9	29	**grained sand; noncemented; lensed. (Alluvium)** **35.00 - 40.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
40	N10	117%	7-7-9	28	**40.00 - 45.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		Driller states a "cuttings collar" keeps building up due to clay. He plans to mix a new batch of mud at 50'.		
45	N11	111%	9-11-16	27	**45.00 - 55.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
50	N12	111%	7-11-16	21			Micaceous		
55	N13	105%	9-11-13	28	**55.00 - 60.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		Root traces? Black mottling		
60	N14	133%	9-10-11	32	**60.00 - 65.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
65	N15	133%	9-15-17	28	**65.00 - 75.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N16	117%	10-13-16	31			White nodules (hard) and possible ash layer in shoe (71.3-71.5')		
75	N17	133%	7-10-12	31	**75.00 - 80.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
80	N18	128%	7-8-13	29	**80.00 - 85.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		White nodules and white partings (decomposed ash and pumice)		
85	N19	133%	13-24-34	33	**85.00 - 90.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained**				
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88					**sand; noncemented; lensed. (Hillsboro Formation)**				
90	N20	100%	10-19-25	32	**90.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
95	N21	122%	12-16-15	23					
100	N22	100%	17-30-27	26					
							BOH. Hole filled w/ bentonite grout and chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-11**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,495.87** Easting: **318,803.56**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **198.31 ft**
Start Date **September 6, 2017** End Date **September 6, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 1.00** **Asphalt Concrete (Pavement)**	■	Surface: Asphalt concrete. Started 4" i.d. HSA		▨
	N1	100%	4-6-8		20	**1.00 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**	▦			▨
5	N2	100%	2-3-4		22	**5.00 - 7.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥			▨
	N3	100%	0-2-4		29	**7.50 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			▨
10	N4	100%	1-4-4		31		▨	Water table encountered between 10' and 15'		▨
							▨	Observed during drilling	9/6/17 ∇	▨
15	N5	100%	1-2-2		34	**15.00 - 25.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥			▨
20	N6	100%	1-2-5		32 36		▥			▨
							▥	Measured during drilling	9/6/17 01:00 ∇	▨
25	N7	100%	1-3-5		27	**25.00 - 31.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			▨
30	N8	100%	2-5-7		24		▨			▨
								BOH Backfilled with bentonite chips		
35										

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-12**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,794.51** Easting: **317,684.28**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **186.15 ft**
Start Date **July 31, 2017** End Date **July 31, 2017**	Total Depth **36.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 15.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: grassy. 4" i.d. HSA Shelby Tube: 250psi (18") and 350 psi for last (6")		
	U1	100	--						
	N1	83%	2-4-5	25 23					
	U2	100	--						
10	N2	100	2-3-5	29					
	N3	100%	1-3-4	32	**15.00 - 25.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**			7/31/17 ▽ Observed during drilling	
20	N4	100%	3-4-5	36					
	N5	100%	4-4-4	34	**25.00 - 35.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
30	N6	100%	1-2-4	34					
	N7	100%	4-3-5	32	**35.00 - 36.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		BOH Backfilled with bentonite chips		
40									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-13**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,328.64** Easting: **318,805.75**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **199.32 ft**
Start Date **September 5, 2017** End Date **September 5, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.00** **Asphalt Concrete (Pavement)**	■	Surface: Asphalt concrete. Begin 4" i.d. HSA		
	N1	100%	4-5-6	19	**1.00 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**	▩			
5	N2	100%	2-1-2	31	**5.00 - 7.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥			
	N3	100%	1-3-4	30	**7.50 - 20.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			
10	N4	100%	1-2-3	31		▨			
15	N5	100%	0-2-6	30		▨	Observed during drilling	9/5/17 ▽	
20	N6	100%	2-2-6	30	**20.00 - 25.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			
25	N7	100%	3-5-8	26	**25.00 - 31.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨	Measured during drilling	9/5/17 01:00 ▽	
30	N8	100%	5-8-12	28		▨			
							BOH Backfilled with bentonite chips		
35									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-14**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **156,124.48** Easting: **317,541.52**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **191.03 ft**
Start Date **July 31, 2017** End Date **August 1, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 10.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Surface: AC. 4" i.d. HSA		
	N1	92%	4-7-8		19			Brick in sample		
5	N2	94%	4-5-6		22					
	U1	50	--							
10	N3	92%	6-8-9		23	**10.00 - 15.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
15	N4	100%	0-2-3		54	**15.00 - 21.00** **CLAY with some gravel and sand to Clayey GRAVEL with some sand; CH, SC, GC; gray to brown; medium to high plasticity; damp to moist; fine gravel, fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	U2	0%	--					Shelby 200 psi - No recovery.		
20	N5	100%	3-4-3		48 31	**21.00 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Gradational contact observed within field sample		
25	N6	100%	0-1-1		48	**25.00 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Observed during drilling Minor organics observed within field sample	7/31/17 ∇	
30	N7	100%	3-6-5		33					
								BOH Backfilled with bentonite chips		
35										

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-15**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,585.30** Easting: **318,796.79**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **201.99 ft**
Start Date **August 8, 2017** End Date **August 8, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 1.30** **Asphalt Concrete (Pavement)**		Surface: Asphalt concrete 16". Drilling with 4" i.d. HSA		
						1.30 - 10.00 **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
	U1	100%	--					Shelby Tube: 200 psi for 2.0'		
5	N1	89%	2-2-3		23					
	U2	23%	--					Shelby Tube: 250 psi for 2.0 '		
10	N2	100%	1-3-3		33	**10.00 - 15.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
15	N3	100%	3-7-11		26	**15.00 - 30.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20	N4	100%	3-5-6		28					
25	N5	100%	3-4-8		29			Measured during drilling	8/7/17 ▽	
								Shelby Tube: 250 for 1', 500-750 psi for 0.33'		
30	N6	100%	2-4-8		28	**30.00 - 31.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
								BOH Backfilled with bentonite chips		
35										

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Hole No. **TB18841-16**

Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,437.50** Easting: **318,761.61**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **211.30 ft**
Start Date **August 8, 2017** End Date **August 8, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.25** **Asphalt Concrete (Pavement)**		Ground Surface: Asphalt Concrete 1.25', drilling with 4" i.d. HSA.		
					1.25 - 20.00 **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
5	N1	93%	4-5-5	24					
10	N2	100%	2-3-4	24					
15	N3	100%	2-2-4	23					
20	N4	100%	6-7-8	26	**20.00 - 25.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Soil is twisted and broke up in split spoon		
	U1	100%	--				Shelby Tube. 150 psi to 700 psi after 1'		
25	N5	100%	5-6-6	30	**25.00 - 30.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
30	N6	100%	6-7-7	28	**30.00 - 31.50** **Decomposed BASALT, remolds to CLAY to Clayey SAND; CH to SC; medium to high plasticity; damp to moist; medium stiff to hard; fine to coarse grained sand; noncemented; lensed. (Columbia River Basalt)**				
							BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-17**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,294.01** Easting: **318,788.06**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **202.66 ft**
Start Date **August 8, 2017** End Date **August 8, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 1.00** **Asphalt Concrete (Pavement)**		Ground surface: Asphalt concrete. 4" i.d. HSA.		
						1.00 - 10.00 **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
5	N1	100%	3-5-7		29 31 29 31					
10	N2	100%	4-6-8		30	**10.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
15	N3	100%	3-4-5		30	**15.00 - 20.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20	N4	100%	5-7-10		23	**20.00 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
25	N5	100%	4-8-10		23	**25.00 - 30.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
30	N6	100%	9-12-13		25	**30.00 - 31.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		Observed during drilling BOH Backfilled with bentonite chips	8/7/17 ▽	
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DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-18**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,949.86** Easting: **317,574.90**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **197.06 ft**
Start Date **August 1, 2017** End Date **August 1, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.00** **Asphalt Concrete (Pavement)** **1.00 - 15.50** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: asphalt concrete (12"). Drilling with 4" i.d. HSA		
5	N1	100%	9-6-5	26					
10	N2	94%	3-7-5	22					
15	N3	100%	1-20-23	25 6	**15.50 - 20.00** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
20	N4	100%	2-3-6	29	**20.00 - 25.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
25	N5	100%	1-3-3	32 34	**25.00 - 25.30** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	U1	0%	--		**25.30 - 30.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		Shelby Tube. 150psi for 18" and 300 psi for final 6"	8/1/17 ▽ Observed during drilling	
30	N6	100%	2-4-5	36	**30.00 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		BOH Backfilled with bentonite chips		
35									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-19**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,830.65** Easting: **319,123.78**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **194.35 ft**
Start Date **August 9, 2017** End Date **August 9, 2017**	Total Depth **30.16 ft**	Tube Height

Test Type
"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.40** **Asphalt Concrete (Pavement)**		Ground surface: asphalt concrete 1.4', started drilling at 23:05 8/9/17		
					1.40 - 10.00 **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	N1	100%	9-11-11	19					
5									
	N2	100%	2-2-4	29					
	U1	0%	--				Shelby Tube: 200 psi for 2.0'. Tube was wet	8/9/17 ▽ Observed during drilling	
10	N3	100%	2-3-5	36	**10.00 - 15.00** **Decomposed BASALT, remolds to CLAY to Clayey SAND; CH to SC; gray, medium to high plasticity; damp to moist; medium stiff to hard; fine to coarse grained sand; noncemented; lensed. (Columbia River Basalt)**			8/9/17 01:00 ▽ Measured during drilling	
15	N4	67%	35-50/9"	24	**15.00 - 30.16** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; olive green, gray, white mottled; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**		Stopped auger (HSA) and changed to mud rotary		
20	N5	27%	50/3"	26			Drill chatter		
25	N6	11%	50/2"	22			Drill chatter, drills ok but has high blow counts		
30	N7	11%	50/2"	19			BOH Backfilled with bentonite chips. Driller says coring would wash out. The drill is cutting through with little pressure, chipping rock into flakes.		
35									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-20**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,591.80** Easting: **319,160.36**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **198.55 ft**
Start Date **August 10, 2017** End Date **August 10, 2017**	Total Depth **30.00 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.30** **Asphalt Concrete (Pavement)**		Ground surface: asphalt concrete (1.3'). 4" i.d. HSA.		
	N1	67%	5-10-3	16	**1.30 - 5.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
5	N2	100%	2-8-34	37	**5.00 - 7.50** **Decomposed BASALT, remolds to CLAY to Clayey SAND; CH to SC; green, gray, black, red, light yellow mottled; medium to high plasticity; damp to moist; medium stiff to hard; fine to coarse grained sand; noncemented; lensed. (Columbia River Basalt)**			8/10/17 ∇ Measured during drilling	
	N3	83%	25-34-50/3"	30	**7.50 - 15.10** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; gray brown, red, yellow mottled; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**		Switched to mud rotary Drilling chatter		
10	N4	100%	50/4"				Cuttings?		
15	N5	0%	50/1"		**15.10 - 30.00** **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**		Drill chatter, cuttings? Switched to coring		
	C1	80%	RQD = 28%						
20	C2	96%	RQD = 16%						
25	C3	98%	RQD = 12%						
	C4	100%	RQD = 0%						
30							BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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Hole No. **TB18841-21**

Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,447.99** Easting: **319,175.61**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **202.34 ft**
Start Date **August 30, 2017** End Date **August 30, 2017**	Total Depth **24.00 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.00** **Asphalt Concrete (Pavement)**		Asphalt concrete surface, Start 4" i.d. HSA.		
	N1	6%	25/4"		**1.00 - 10.80** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; brown-red, white, tan mottled; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**				
5	N2	17%	50/4"				Chatter at 5.0-5.3'. Smoother, but still hard beyond 5.3'		
	N3	33%	50/6"				Faster drilling from 9.5-10'		
10	N4	60%	15-50/5"				Wet zone of weathered rock	8/30/17 11:55 ▽ Observed during drilling	
					10.80 - 20.00 **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**				
15	N5	11%	50/3"				Wet zone of weathered rock		
20	N6	22%	50/4"		**20.00 - 24.00** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; brown; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**		Hit 20' at 12:52 PM		
	N7	11%	50/2"		**24.00 - 24.20** **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**		Auger refusal. Not efficient to switch to coring for 1 run. No water recovered from bottom of boring w/ bailer. Boring got very hot. BOH Backfilled with bentonite chips.		
25									
30									
35									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-22**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,117.23** Easting: **319,106.34**		Start Card No.
Equipment **CME 850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **224.12 ft**
Start Date **August 24, 2017** End Date **August 24, 2017**	Total Depth **30.80 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 10.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Surface: AC. Begin drilling 4" i.d. HSA		
	N1	100%	2-3-5						
5	N2	100%	1-3-4						
	N3	40%	1-1-2						
10	N4	100%	1-0-2		**10.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	U1	100%	--				200 psi up until 14.5' then refusal at 750 psi		
15	N5	100%	16-50/6"	20	**15.00 - 30.80** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; brown, red, black mottled; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**		Smooth drilling untill 18' Chatter until 19' Smooth drilling until 20'		
20	N6	69%	50/2"						
25	N7	69%	50/2"						
30	N8	45%	36-50/4"	44				8/24/17 ▽	
							BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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Hole No. **TB18841-23**

Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **147,904.81** Easting: **319,172.87**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **217.49 ft**
Start Date **August 13, 2017** End Date **August 13, 2017**	Total Depth **22.20 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 9.10** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Ground surface: grassy. 4" i.d. HSA		
	N1	87%	3-4-3	27					
5									
	N2	90%	2-2-3	27					
	U1	100%	--				Shelby Tube. 200 psi until no longer able to push shelby		
	N3	100%	50/4"		**9.10 - 15.25** **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**				
10									
15									
	N4	100%	50/3"		**15.25 - 22.20** **BASALT; brown to black; moderately weathered; soft (R2) to medium hard (R3); closely to very closely spaced joints. (Columbia River Basalt)**		Drill chatter/hard grinding Switched to core at 15.25'		
	C1	88%	RQD = 0%						
20									
	C2	100%	RQD = 14%						
							BOH Backfilled with bentonite chips		
25									
30									
35									

DRILL LOG

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		Hole No. **TB18841-24**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **156,495.38** Easting: **317,375.11**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **203.41 ft**
Start Date **July 30, 2017** End Date **July 31, 2017**	Total Depth **36.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.00** **Asphalt Concrete Pavement (Pavement)**		Ground surface: Asphalt concrete. 4" i.d. Hollow stem auger, top of embankment.		
					1.00 - 10.00 **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
	N1	86%	3-6-6	22					
10	N2	89%	3-5-9	23	**10.00 - 20.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
	N3	94%	2-6-6	21					
20	N4	100%	2-3-3	22	**20.00 - 36.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	N5	100%	2-3-6	32					
							Observed during drilling	7/30/17 ∇	
30	N6	100%	2-1-3	34					
	N7	100%	4-6-8	34					
							BOH Backfilled with bentonite chips		
40									

DRILL LOG

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		Hole No. **TB18841-25**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **147,706.91** Easting: **319,174.08**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **219.88 ft**
Start Date **August 13, 2017** End Date **August 13, 2017**	Total Depth **20.92 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 10.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**		Ground surface: soil/grass area. Started drilling with 4" i.d. HSA		
	N1	87%	2-2-3	29					
5	N2	100%	1-2-2	32					
	U1	20%	--					8/13/17 ∇ Observed during drilling	
10	N3	100%	1-1-2	34	**10.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
15	N4	100%	2-4-6	33 32	**15.00 - 20.00** **Decomposed BASALT, remolds to CLAY to Clayey SAND; CH to SC; green gray, yellow orange mottled; medium to high plasticity; damp to moist; medium stiff to hard; fine to coarse grained sand; noncemented; lensed. (Columbia River Basalt)**				
20	N5	98%	45-50/5"		**20.00 - 20.92** **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**		Auger refusal reached. BOH Backfilled with bentonite chips		
25									
30									
35									

DRILL LOG

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		Hole No. **TB18841-26**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,009.17** Easting: **321,686.98**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **171.01 ft**
Start Date **August 17, 2017** End Date **August 17, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 3.00** **Base/Shoulder Aggregate (Pavement)**		Started mud rotary drilling		
	N1	45%	11-6-7			**3.00 - 7.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
5	N2	100%	3-4-4		26					
								Observed during drilling	8/17/17 ▽	
	N3	67%	0-1-1		30	**7.50 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
10	N4	100%	1-1-2		31					
15	N5	50%	1-1-2		39	**15.00 - 15.75** **PEAT or very high organic content Silt or Clay. (Alluvium)** **15.75 - 20.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20	N6	100%	2-7-8		33	**20.00 - 31.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
25	N7	100%	2-3-6		38			Heavy organic odor		
30	N8	100%	6-9-17		31					
								BOH Backfilled with bentonite chips		
35										

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-27**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Culvert**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **142,952.90** Easting: **321,769.26**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **171.08 ft**
Start Date **August 15, 2017** End Date **August 15, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 3.00** **Base/Shoulder Aggregate (Pavement)**		Started mud rotary drilling. Surface: AC		
	N1	50%	10-3-5	22	**3.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Organic odor		
5	N2	100%	2-6-7	29					
	N3	67%	2-1-1	27					
10	N4	100%	0-0-0	32					
	U1	100%	--				Shelby Tube: 150 psi for 13'-14' and 150 to 350 psi for 14'-15'		
15	N5	100%	3-6-6	35	**15.00 - 31.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20							Observed during drilling	8/15/17 ▽	
	N6	100%	1-0-1	39					
25	N7	67%	1-3-4	36					
30	N8	100%	2-3-8	31					
							BOH Backfilled with bentonite chips		
35									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-29**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,201.10** Easting: **321,113.13**		Start Card No.
Equipment **CME 850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **193.26 ft**
Start Date **August 15, 2017** End Date **August 15, 2017**	Total Depth **51.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 10.00** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Surface: 0.9' AC. 4" i.d. HSA		
5	N1	37%	3-4-7	9			Drill Chatter		
10	N2	55%	2-9-10	20	**10.00 - 15.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Coarse gravel stuck in shoe opening, drill chatter		
15	N3	43%	10-17-35	10	**15.00 - 30.00** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Drill chatter		
20	N4	47%	8-6-9	14			Coarse gravel stuck in shoe, drill chatter		
25	N5	23%	7-18-4	33			Drill chatter		
30	N6	100%	3-3-5	32	**30.00 - 35.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Last 2-3 ft drilling became smoother Shelby Tube-Driller says hole may not be straight therefore possible issued obtaining U-1. 10 psi for 0.85 ft and 450 psi for last 1.15 ft		
	U1	0%	--						
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N7	100%	2-5-5	32 37	**35.00 - 51.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Observed during drilling	8/15/17 ▽	
40	N8	100%	3-2-7	36 33					
45	N9	100%	5-9-6	32					
50	N10	100%	4-13-12	33					
							BOH Backfilled with bentonite chips		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-29A**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Embankment**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,192.12** Easting: **321,170.84**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **214.50 ft**
Start Date **May 19, 2019** End Date **May 20, 2019**	Total Depth **61.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 0.50** **Asphalt concrete (Pavement)**		Mud rotary drilling methods Asphalt concrete (6 in.) over aggregate base (6 in).		
					0.50 - 25.00 **Clayey GRAVEL (GC) to 17.5 ft then some sand to sandy (GP-GM), brown and black, low to medium plasticity clay, medium to high plasticity silt, damp to wet, loose to medium dense, fine to coarse gravel, fine- to coarse-grained sand (Fill)**				
	N1	66	7-7-8	27					
5									
	N2	0	4-2-3						
	N3	0	3-8-12						
10									
	N4	100	10-11-9	35					
	N5	17	9-5-10	23					
15									
	N6	50	4-6-5	28					
	N7	50	5-4-4	42			Transition to clayey GRAVEL with some sand to sandy, GP-GM, at 17.5 ft		
20									
	N8	66	4-11-1	29					
25	N9	100	1-3-5	41	**25.00 - 30.00** **CLAY with trace sand, CL, gray, medium plasticity, medium stiff, fine- to medium-grained sand, homogeneous (Willamette Formation)**				
30	U1	100	--	36	**30.00 - 60.00** **SILT to SILT with trace to some sand, ML, gray, non-plastic to low plasticity, loose to medium dense where non-plastic, very soft to stiff where low plasticity, fine- to medium-grained sand, noncemented, homogeneous (Willamette Formation)**		TV = 0.05 tsf, 0.2 tsf		
	N10	100	4-5-5	37					
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N11	100	3-2-4	39			slight organic odor at 35 ft		
40	U2	100	'--	32			Shelby tube push: 250 psi for 6 in., 300 psi for 6 in., 500 psi for 6 in., 700 psi for 6 in. TV = 0.15 tsf, 0.1 tsf		
	N12	100	4-5-10	34					
45	N13	100	2-6-7	34					
50	U3	100	'--	31			Shelby tube push 0 psi for 6 in., 250 psi for 6 in., 500 psi for 12 in. TV = 0.15 tsf, 0.5 tsf		
	N14	100	4-5-8	34					
55	N15	100	3-6-5	36					
60	N16	100	3-6-7	34	**60.00 - 61.50** **CLAY with trace sand, CH, gray, high plasticity, stiff, fine- to medium-grained sand, noncemented, homogeneous (Hillsboro Formation)**		BOH, backfilled with bentonite chips Groundwater not observed		
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-30**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,171.26** Easting: **321,285.05**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **184.68 ft**
Start Date **August 14, 2017** End Date **August 14, 2017**	Total Depth **41.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 25.00** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Ground surface: asphalt concrete. 4" i.d. HSA. Drill chatter.		
5	N1	60%	5-5-5	12					
10	N2	43%	2-3-5	11			Coarse gravel caught in catcher Drill chatter 11.5'-15'		
15	N3	0%	50/.33				Difficult drilling. Decided to switch to mud rotary at 20'		
20	N4	13%	6-6-10				Switched to mud rotary drilling. Grinding and drill chatter stopped and started, then stopped. Alternating layers. Lost mud ~19.5'. Drill chatter. Constant mud loss (above 25 ft). Hole tight in granular section		
25	N5	60%	1-3-5	30	**25.00 - 30.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**			8/14/17 ▽	
30	N6	100%	4-3-4	35	**30.00 - 41.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**		Observed during drilling Fluid loss below auger section (~15 ft).		
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N7	0%	8-13-11						▨
40	N8	27%	8-17-9	30					▨
							BOH Backfilled with bentonite chips		
45									
50									
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-31**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,112.43** Easting: **321,485.00**		Start Card No.
Equipment **CME850**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **173.37 ft**
Start Date **August 14, 2017** End Date **August 14, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.00** **Asphalt Concrete (Pavement)**		Ground surface: Asphalt concrete. Begin drilling with mud rotary		
					1.00 - 15.00 **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
5	N1	47%	9-10-6				Drill chatter. Losing mud. Attempting to seal sides of borehole using bentonite chips.		
10	N2	60%	8-7-8	34					
							Driller got past gravels.		
15	N3	57%	2-3-2	38	**15.00 - 20.00** **CLAY with some gravel and sand to Clayey GRAVEL with some sand; CH, SC, GC; gray to brown; medium to high plasticity; damp to moist; fine gravel, fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20	N4	100%	1-3-2	34	**20.00 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
25	N5	20%	3-4-9	32	**25.00 - 31.50** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**			8/15/17 ▽ Observed during drilling	
30	N6	100%		33					
							BOH Backfilled with bentonite chips		
35									

DRILL LOG
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		Hole No. **TB18841-32**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Culvert**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **143,004.89** Easting: **321,882.01**		Start Card No.
Equipment **CME 75 (#5)**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **171.63 ft**
Start Date **August 31, 2017** End Date **August 31, 2017**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 1.50** **Asphalt Concrete (Pavement)**	■	Surface: asphalt concrete. Start 4" i.d. HSA.		▨
						1.50 - 7.50 **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			▨
5	N1	100%	1-2-3		23		▨			▨
								Observed during drilling	8/31/17 ∇	▨
	N2	100%	0-0-0		29	**7.50 - 12.00** **SILT to Silty SAND; ML to SM; gray to brown; nonplastic to low plasticity; damp to wet; very loose-medium dense/soft-very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▥			▨
10	U1	100%	--				▥	Shelby Tube: 350-400psi		▨
	N3	100%	0-4-6		26	**12.00 - 15.75** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**	▨			▨
15	N4	100%	2-6-8		29 27	**15.75 - 31.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**	⁙			▨
20	N5	100%	0-1-6		34		⁙	Measured during drilling	8/31/17 01:00 ∇	▨
25	N6	100%	0-0-1		43		⁙			▨
30	N7	100%	3-8-12		29		⁙			▨
								BOH Backfilled with bentonite chips		
35										

DRILL LOG

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		Hole No. **TB18841-36**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Structure Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **156,374.98** Easting: **317,412.18**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, Baumann**	Ground Elev. **199.80 ft**
Start Date **October 2, 2018** End Date **October 3, 2018**	Total Depth **51.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.50** **Asphalt Concrete, base aggregate, shoulder aggregate (Pavement)**				
	N1	33	3-6-7	20	**1.50 - 7.50** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
5									
	N2	56	2-3-4	26					
	N3	44	2-2-6	23	**7.50 - 15.80** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
10									
	U1	100	--	23					
	N4	56	3-5-8	22					
15									
	N5	72	3-2-2	28 27	**15.80 - 51.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
20									
	N6	100	2-3-5	33					
25									
	N7	100	1-3-6	36					
30									
	N8	100	2-2-7	39					
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	U2	100	--	35					
	N9	83	3-4-8	30					
40	N10	100	1-7-7	32					
45	N11	94	3-4-6	29					
50	N12	83	0-4-6	28					
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-37**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **155,581.12** Easting: **317,780.49**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, C. Martin**	Ground Elev. **185.50 ft**
Start Date **October 25, 2018** End Date **October 26, 2018**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 7.50** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: 1.7' AC and base agg. Mud Rotary		
	N1	44	1-2-2	26					
5									
	N2	50	2-3-2	27					
	U1	100	--		**7.50 - 12.50** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
10	N3	56	2-2-3	29					
	N4	67	2-3-4	30	**12.50 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
15									
	U2	100	--	32	**15.00 - 30.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	N5	100	1-1-2	36					
20									
	N6	78	2-2-2	35					
	U3	100	--	32					
25	N7	89	2-4-6	31					
30	N8	89	2-4-5	30	**30.00 - 40.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**		BOH Backfilled with bentonite chips		
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	89	0-1-3	30					
40	N10	78	6-7-10	26	**40.00 - 55.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
45	N11	89	4-7-8	27					
50	N12	100	3-5-7	33					
55	N13	100	6-8-10	27	**55.00 - 60.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
60	N14	100	8-12-16	24	**60.00 - 65.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
65	N15	100	7-9-13	30	**65.00 - 85.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N16	100	3-8-10	27					
75	N17	100	4-9-10	26					
80	N18	100	6-14-13	28					
85	N19	100	10-15-13	25	**85.00 - 90.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained**				
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88					**sand; noncemented; lensed. (Hillsboro Formation)**				
90	N20	100	6-11-13	26	**90.00 - 95.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
95	N21	100	5-14-18	24	**95.00 - 100.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
100	N22	100	7-12-13	23	**100.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-38**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,300.46** Easting: **318,786.94**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, C. Martin, G. Martin**	Ground Elev. **198.60 ft**
Start Date **October 24, 2018** End Date **October 24, 2018**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Surface: 1.5' shoulder agg. Mud rotary.		
	N1	67	3-7-8		20					
5	N2	83	5-2-2		24	**5.00 - 7.50** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
	N3	78	1-3-3		30	**7.50 - 20.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
10	N4	100	1-2-4		31					
	U1	92	--							
15	N5	100	2-7-6		26					
20	N6	100	2-3-4		28	**20.00 - 25.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
	U2	100	--		27					
25	N7	100	5-8-8		23	**25.00 - 30.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
30	N8	100	5-9-12		31	**30.00 - 35.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100	5-6-7	28	**35.00 - 40.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
	U3	100	--	27					
40	N10	100	5-13-13	26	**40.00 - 45.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		driller: soft zone 42'-43'		
45	N11	100	6-9-13	22	**45.00 - 50.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
50	N12	100	5-14-13	26	**50.00 - 55.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
55	N13	100	6-16-22	22	**55.00 - 70.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
60	N14	100	7-10-15	28					
65	N15	100	8-12-16	24					
70	N16	100	7-10-10	60 44	**70.50 - 80.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
75									
80	N17	100	6-10-11	33	**80.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
85									
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N18	100	9-10-14	64					
95									
100	N19	100	16-19-20	24					
							BOH Backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

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		Hole No. **TB18841-39**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,228.88** Easting: **318,780.83**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, G. Martin**	Ground Elev. **198.00 ft**
Start Date **October 22, 2018** End Date **October 23, 2018**	Total Depth **101.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 5.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Surface: grass. Mud rotary.		
	N1	67	7-9-6		19					
5	N2	22	3-2-3			**5.00 - 7.50** **Clayey, Sandy GRAVEL to GRAVEL with some Sand and Silt; GC to GP-GM; brown, black, tan, orange mottled; medium plasticity to nonplastic; damp; stiff/medium dense; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
	N3	100	2-3-3		31	**7.50 - 10.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
10	U1	0	--			**10.00 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N4	89	4-5-4		25					
15	U2	100	--			**15.00 - 25.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N5	100	2-4-4		26					
20	N6	100	0-1-3		32					
25	U3	80	--			**25.00 - 39.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N7	100	4-7-10		31					
30	N8	100	5-6-7		29					
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100	4-5-8	29					
	U4	75	--						
40	N10	100	4-8-10	28	**39.50 - 65.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
45	N11	100	7-9-11	24					
50	N12	100	4-5-8	30					
55	N13	100	6-9-19	28					
60	N14	100	3-8-11	29					
65	N15	100	8-14-21	22	**65.00 - 80.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
70	N16	100	8-14-16	35					
75	N17	100	4-9-14	37					
80	N18	100	6-10-13	34	**80.00 - 90.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
85	N19	100	2-10-15	32					
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N20	100	4-6-9	37	**90.00 - 95.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
95	N21	100	5-9-11	32	**95.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
100	N22	100	2-6-11	37					
							BOH Backfilled with tremied bentonite slurry/bentonite chips at top 1'		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-40**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **153,148.13** Easting: **318,780.51**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, G. Martin**	Ground Elev. **199.20 ft**
Start Date **October 17, 2018** End Date **October 19, 2018**	Total Depth **101.50 ft**	Tube Height

Test Type	Rock Abbreviations			Typical Drilling Abbreviations	
	Discontinuity	Shape	Surface Roughness	Drilling Methods	Drilling Remarks
"A" - Auger Core	J - Joint	Pl - Planar	P - Polished	WL - Wire Line	LW - Lost Water
"X" - Auger	F - Fault	C - Curved	Sl - Slickensided	HS - Hollow Stem Auger	WR - Water Return
"C" - Core, Barrel Type	B - Bedding	U - Undulating	Sm - Smooth	DF - Drill Fluid	WC - Water Color
"N" - Standard Penetration	Fo - Foliation	St - Stepped	R - Rough	SA - Solid Auger	DP - Down Pressure
"U" - Undisturbed Sample	S - Shear	Ir - Irregular	VR - Very Rough	CA - Casing Advancer	DR - Drill Rate
"T" - Test Pit				HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 10.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Start mud rotary drilling with 3-7/8" spade bit. 4"-thick heavily rooted zone at ground surface		
	N1	72	8-9-8	20					
5	N2	67	7-4-4	22					
	U1	0	--						
10	N3	89	1-3-3	27	**10.00 - 12.50** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
	U2	100	--		**12.50 - 27.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
15	N4	100	0-1-3	31					
20	N5	22	5-8-9	47					
25	U3	100	--	26					
	N6	100	4-7-11	28	**27.00 - 30.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
30	N7	100	6-11-10	26	**30.00 - 40.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N8	100	4-4-6	32			switch to 3-7/8" tri-cone bit at 35'		
40	U4	100	--		**40.00 - 45.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N9	100	4-8-11	23					
45	N10	100	5-6-11	27	**45.00 - 50.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
50	N11	100	7-8-9	27	**50.00 - 65.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
55	N12	100	0-8-7	27					
60	U5	100	--	23					
	N13	100	7-10-18	25					
65	N14	100	8-10-14	28 44	**65.00 - 66.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
					66.00 - 80.00 **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
70	N15	100	6-7-9	38					
75	N16	100	10-12-16	36			switch to 3-7/8" spade bit at 75'		
80	N17	100	10-18-20	28	**80.00 - 85.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
85	N18	100	12-12-13	35	**85.00 - 90.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand;**				
88									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88					**noncemented, lensed. (Hillsboro Formation)**				
90	N19	100	6-11-11	33	**90.00 - 100.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
95	N20	100	5-8-13	35					
100	N21	100	11-12-17	25	**100.00 - 101.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**		Backfilled with cement-bentonite grout. Top 1' backfilled with bentonite chips		
105									
110									
115									
120									
125									
130									
135									
140									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-41**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,781.99** Easting: **318,761.25**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, G. Martin**	Ground Elev. **201.50 ft**
Start Date **October 16, 2018** End Date **October 16, 2018**	Total Depth **91.50 ft**	Tube Height

Test Type
"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 7.50** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Start mud rotary drilling with 3-7/8" spade bit		
	N1	72	2-1-1	32					
	U1	0	--						
	N2	100	1-2-2	33	**7.50 - 32.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
10									
	U2	0	--						
	N3	100	0-2-5	23					
	N4	100	3-5-7	22					
	U3	100							
20									
	N5	100	4-14-18	23					
	N6	100	5-7-8	27					
30									
	U4	0	--						
	N7	100	10-14-11	28	**32.50 - 35.50** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	N8	100	5-15-20	26 25	**35.50 - 40.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
40									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
40	N9	100	16-17-17	24	**40.00 - 50.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
	N10	100	16-26-21	22					
50	N11	100	6-7-12	28	**50.00 - 60.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
	N12	100	8-12-18	32					
60	N13	100	10-17-21	31 38	**60.00 - 60.50** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)** **60.50 - 91.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
	N14	100	6-10-13	37					
70	N15	100	7-8-12	31					
	N16	100	8-8-11	40					
80	N17	100	2-7-17	37					
	N18	100	13-15-14	38					
90	N19	100	0-1-12	30					
							Backfilled with cement-bentonite grout. Upper 1' backfilled with bentonite chips.		
100									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-42**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,711.20** Easting: **318,763.10**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, Cook**	Ground Elev. **202.80 ft**
Start Date **October 12, 2018** End Date **October 15, 2018**	Total Depth **121.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 5.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**		Start mud rotary drilling with 4-7/8" tri-cone bit. 3"-thick heavily rooted zone at ground surface.		
	N1	72	2-2-4	29					
5	U1	100	--		**5.00 - 12.50** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	N2	100	0-0-3	32					
10	N3	100	0-1-3	25					
	U2	67	--		**12.50 - 17.50** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
15	N4	100	2-3-5	26					
	U3	100	--	24	**17.50 - 25.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
20	N5	67	3-4-8	24					
							driller indicated transition to stiffer material at 22'		
25	N6	100	2-5-6	32	**25.00 - 30.00** **CLAY to Sandy CLAY; CH; gray to brown, multicolored mottling; high plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
30	U4	100	--		**30.00 - 45.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	N7	100	5-8-10	26					
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Rock Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks Water Level/ Date	Backfill/ Instrumentation
35	N8	100	3-4-6	28			switched to 4-7/8" spade bit at 35'	
40	U5	91	--					
	N9	100	10-14-18	22				
45	N10	100	4-6-16	31	**45.00 - 71.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**			
50	N11	100	4-6-13	26				
55	N12	100	5-8-12	32				
60	N13	100	8-10-17	38				
65	N14	100	3-9-12	31				
70	U6	100	--	36				
	N15	100	6-10-20	39	**71.00 - 75.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**			
75	N16	100	2-3-7	44	**75.00 - 90.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**			
80	N17	100	6-10-17	42				
85	N18	100	4-6-8	37				
88								

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
88									
90	N19	100	14-23-26	22	**90.00 - 95.00** **SILT to Silty SAND; ML to SM; gray; nonplastic to medium plasticity; damp to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
95	N20	100	10-17-24	29	**95.00 - 100.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
100	N21	100	11-19-26	30	**100.00 - 105.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
105	N22	100	10-12-35	28	**105.00 - 110.00** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
110	N23	100	7-7-9	41	**110.00 - 115.00** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**				
115	N24	100	3-8-11	27	**115.00 - 121.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
120	N25	100	4-7-13	24					
							Backfilled with cement-bentonite grout. Upper 1' backfilled with bentonite chips.		
125									
130									
135									
140									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-43**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **152,645.21** Easting: **318,764.75**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, Cook**	Ground Elev. **204.10 ft**
Start Date **October 11, 2018** End Date **October 11, 2018**	Total Depth **71.50 ft**	Tube Height

Test Type
- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**		Start mud rotary drilling with 4-7/8" tri-cone bit. 3"-thick heavily rooted zone at the ground surface.		
	MCS1	67	6-12-13	24					
	MCS2	78	3-3-4	32	**5.00 - 30.00** **CLAY to Sandy CLAY; CL; gray to brown; low to medium plasticity; dry to wet; soft to very stiff; fine to coarse grained sand; noncemented; lensed. (Alluvium)**				
	MCS3	89	2-3-4	24					
10									
	U1	100	--						
	N1	89	4-6-9	23					
	U2	100	--						
	N2	78	4-4-3	26					
20									
	N3	89	7-11-14	24					
	N4	61	3-6-8	28					
30									
	N5	100	5-5-8	29	**30.00 - 60.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
	N6	100	8-15-16	21			driller indicated transition to stiffer soil / slower drilling at 34'.		
40									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
40	N7	83	3-4-10	28					
	N8	94	7-11-15	25					
50	N9	89	5-8-16	26					
	N10	94	11-18-13	31					
60	N11	100	4-11-13	33	**60.00 - 65.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	N12	89	6-10-16	29	**65.00 - 71.50** **CLAY to Clayey SAND; CL to SC; gray, brown, green, some mottling; low to medium plasticity; damp to wet; stiff to hard; fine to coarse grained sand; noncemented; lensed. (Hillsboro Formation)**				
70	N13	100	5-11-20	35					
							Finished drilling at 14:33. Backfilled with cement-bentonite grout. Upper 1' backfilled with bentonite chips.		
80									
90									
100									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-44**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Wall**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,759.00** Easting: **319,026.00**		Start Card No.
Equipment **CME 75 HT**	Driller **WSCC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, Baumann**	Ground Elev. **213.50 ft**
Start Date **September 30, 2018** End Date **October 1, 2018**	Total Depth **67.50 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.50** **Asphalt Concrete and base aggregate. (Pavement)**		Began mud rotary drilling. 5.5"-thick asphalt concrete pavement over 12"-thick crushed rock base course at ground surface.		
	N1	56	3-4-5	30	**1.50 - 5.00** **Predominantly CLAY w/trace Sand to Clayey SAND; CL to SC; gray, brown, rust mottled; low to medium plasticity; damp; medium stiff to very stiff; fine to coarse grained sand, trace to some fine gravel; noncemented; homogeneous. (Fill)**				
5	N2	72	2-3-4	30	**5.00 - 12.50** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	N3	56	4-5-5	22					
10	N4	72	2-3-4	30					
	N5	78	2-5-5	31	**12.50 - 15.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
15	N6	50	1-2-2	32	**15.00 - 25.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
	U1	100	--						
20	N7	94	1-0-1	37					
25	N8	100	0-1-1	38	**25.00 - 30.00** **CLAY to Sandy CLAY; CL; gray to brown; low plasticity; damp to wet; soft to very stiff; fine to medium grained sand; noncemented; lensed. (Willamette Formation)**				
30	N9	100	50/4"	19	**30.00 - 40.00** **Decomposed BASALT, remolds to Silty SAND to silty SAND with some gravel; SM; nonplastic to low plasticity; damp to moist; very dense/very hard; fine gravel, fine to coarse grained sand; weakly cemented; lensed. (Columbia River Basalt)**				
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N10	100	50/2"	21					
40	N11	100	50/3"		**40.00 - 58.00** **BASALT; brown to black; predominantly decomposed to moderately weathered; extremely soft (R0) to soft (R2); closely to very closely spaced joints. (Columbia River Basalt)**				
45	N12	100	50/2"						
50	N13	100	50/2"						
55	MCS1	0	100/1"						
58					**58.00 - 67.50** **BASALT; brown to black; moderately weathered; soft (R2) to medium hard (R3); closely to very closely spaced joints. (Columbia River Basalt)**		Driller indicated transition to Basalt at 58 feet		
60	N14	0	50/0"				N-14 SPT bouncing on rock		
65	C1	85	RQD = 58.7						
67.5							BOH. Backfilled with cement-bentonite grout. 6"-thick concrete over 12"-thick crushed rock at ground surface.		
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-45**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,235.09** Easting: **319,086.64**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer/Bush**	Ground Elev. **223.80 ft**
Start Date **May 22, 2019** End Date **May 23, 2019**	Total Depth **36.00 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance	Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 0.50** **Portland cement concrete (Pavement)**		Mud rotary drilling methods. Portland cement concrete (6 in.) over aggregate base (6 in.)		
						0.50 - 10.00 **SILT with up to trace sand, ML, brown, low plasticity, damp to wet, soft to medium stiff, fine- to medium-grained sand, noncemented, homogeneous (Alluvium)**				
	N1	100	2-4-4		32					
	N2	56	2-3-4		33					
	N3	100	1-2-2		36					
10	N4	100	0-1-1		43	**10.00 - 15.00** **CLAY with trace sand, CH, brown, medium plasticity, wet, soft, fine- to coarse-grained sand, noncemented, homogeneous (Alluvium)**		Driller indicates harder drilling at 13.5 ft		
	N5	78	26-41-50/3"		28	**15.00 - 20.25** **Sandy SILT to silty SAND with up to trace gravel, ML to SM, brown and gray with red mottling, low plasticity, very hard silt, medium dense sand, fine- to coarse-grained sand, fine gravel, low cementation (Decomposed Basalt)**				
20	N6	33	50/3"		34	**20.25 - 36.00** **BASALT, brown and dark gray, moderately weathered to predominately decomposed, soft to hard (R2 to R4), very closely to closely spaced fractures, zone of red baked paleosol from 28.5 to 29.0 ft (Columbia River Basalt)**		Switched to rock coring at 20.25 ft		
	C1	43		RQD = 0						
	C2	75		RQD = 0						
30	C3	75		RQD = 0						
	C4									
	C5	100		RQD = 0						
39								BOH, backfilled with bentonite chips Groundwater not observed		

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-46**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Structure Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **142,286.02** Easting: **322,799.66**		Start Card No.
Equipment **CME 75 HT**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **GRI, Baumann**	Ground Elev. **181.80 ft**
Start Date **October 3, 2018** End Date **October 4, 2018**	Total Depth **51.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 1.67** **Asphalt Concrete, base aggregate, shoulder aggregate (Pavement)**				
	N1	28	3-7-7		24	**1.67 - 7.00** **SILT w/trace Sand to Silty gravelly SAND; ML; brown; low to medium plasticity; damp to wet; soft to stiff; fine to coarse gravel and fine to coarse grained sand; noncemented; homogeneous. (Fill)**				
5										
	U1	75	--		26					
	N2	50	2-2-4		28	**7.00 - 50.00** **SILT to Sandy SILT; ML; gray; nonplastic to low plasticity; moist to wet; very loose-medium dense/soft-medium stiff; fine to medium grained sand; noncemented; homogeneous. (Willamette Formation)**				
10										
	N3	72	0-2-4		30					
	U2	100	--		33 30					
15	N4	83	1-2-3		32					
	U3	100	--		33 33					
20	N5	67	0-2-2		40					
25	N6	72	3-4-4		38					
30	N7	72	3-2-6		30					
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil Rock Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N8	100	0-3-4	30					
40									
	U4	100	--	29					
	N9	89	4-5-7	31					
45									
	N10	89	2-3-4	28					
50	N11	100	3-5-7	34	**50.00 - 51.50** **CLAY to CLAY with some sand; CH; green, gray, brown; high plasticity; damp to moist; stiff to hard; fine to coarse grained sand; noncemented, lensed. (Hillsboro Formation)**		BOH, backfilled with bentonite chips		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

			Hole No. **TB18841-47**
Project **OR217 SB: Allen Blvd to OR99W**		Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**		County **Washington**	Key No. **18841**
Hole Location Northing: **148,623.65**	Easting: **319,313.20**		Start Card No.
Equipment **CME 75**		Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**		Recorder **Giscombe**	Ground Elev. **225.50 ft**
Start Date **May 16, 2019**	End Date **May 16, 2019**	Total Depth **41.00 ft**	Tube Height

Test Type	Rock Abbreviations: Discontinuity	Shape	Surface Roughness	Typical Drilling Abbreviations: Drilling Methods	Drilling Remarks
"A" - Auger Core	J - Joint	Pl - Planar	P - Polished	WL - Wire Line	LW - Lost Water
"X" - Auger	F - Fault	C - Curved	Sl - Slickensided	HS - Hollow Stem Auger	WR - Water Return
"C" - Core, Barrel Type	B - Bedding	U - Undulating	Sm - Smooth	DF - Drill Fluid	WC - Water Color
"N" - Standard Penetration	Fo - Foliation	St - Stepped	R - Rough	SA - Solid Auger	DP - Down Pressure
"U" - Undisturbed Sample	S - Shear	Ir - Irregular	VR - Very Rough	CA - Casing Advancer	DR - Drill Rate
"T" - Test Pit				HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 0.75** **Asphalt Concrete (Pavement)**		HSA drilling methods. Asphalt concrete (9 in.) over aggregate base course (thickness not recorded)		
					0.75 - 20.00 **SILT; with up to trace sand; ML; gray and brown; non-plastic to low plasticity; moist to wet; soft/very loose; noncemented; homogeneous. (Willamette Formation)**				
5									
10	N1	33	1-1-2	31					
	N2	100	2-2-2	33					
15	N3	100	2-2-2	36					
20	N4	100	0-2-1	35	**20.00 - 25.00** **CLAY with trace sand; CL; gray; medium plasticity; damp to moist; soft; fine- to medium-grained sand; noncemented; homogeneous. (Willamette Formation)**		Measured at end of drilling	5/16/19 ▽	
25	N5	100	6-14-17	43	**25.00 - 30.50** **Silty SAND with up to trace gravel; SM; gray to brown; non-plastic; moist; dense to very dense; fine- to coarse-grained sand; noncemented; homogeneous. (Decomposed Basalt)**				
30	N6	100	50/5"	18					
	C1	68	RQD = 0		**30.50 - 41.00** **BASALT; gray; moderately weathered; soft to medium hard (R2 to R3); closely spaced fractures with sandy silt fracture filling. (Columbia River Basalt)**		Switch to rock coring at 30.5 ft		
35	C2	100	RQD = 0				Short core runs due to core barrel clogging		

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	C2	100							
	C3	92	RQD = 0						
40	C4	100	RQD = 40						
							BOH, backfilled with bentonite chips		
45									
50									
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

Hole No. **TB18841-48**

Project **OR217 SB: Allen Blvd to OR99W**
Purpose **Bridge Foundation**
E.A. No.
Highway **OR217 (Hwy #144)**
County **Washington**
Key No. **18841**
Hole Location Northing: **148,724.57** Easting: **319,187.33**
Start Card No.
Equipment **CME**
Driller **WSSC**
Bridge No.
Project Geologist **M. Zimmerman**
Recorder **Giscombe**
Ground Elev. **197.50 ft**
Start Date **May 12, 2019**
End Date **May 13, 2019**
Total Depth **45.00 ft**
Tube Height

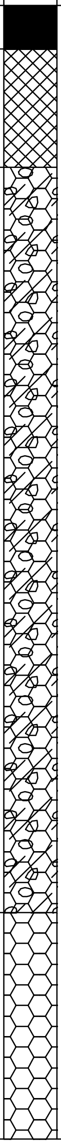
Test Type
"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action



Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 1.33** **Asphalt Concrete (Pavement)**		HSA drilling methods. Asphalt concrete (16 in.) over aggregate base course (thickness not recorded)		
	N1	100	4-9-18	23	**1.33 - 5.00** **Sandy CLAY with trace gravel; CL; green-gray; medium plasticity; damp; very stiff; fine- to coarse-grained sand; fine gravel; noncemented; homogeneous. (Fill)**				
5	N2	100	50/5"	9	**5.00 - 28.00** **Sandy GRAVEL; silty SAND; and SAND with some gravel; GP; SM; and SP; gray to brown; dry to wet; very dense; fine- to coarse-grained sand; fine to coarse gravel; noncemented; homogeneous. (Decomposed Basalt)**				
	N3	100	50/5"				Drill chatter at 7ft Perched groundwater observed from 7.5 to 10.3 ft	5/13/19 ▽	
10	N4	100	50/4"						
15	N5	100	50/4"						
20	N6	100	50/2"						
25	N7	100	50/2"						
					28.00 - 45.00 **BASALT; gray; moderately weathered; medium hard (R3); very-close- to close-spaced fractures; some clay; silt; and sand fracture filling. (Columbia River Basalt)**		Drill chatter, driller indicates harder drilling below 28 ft Switch to rock coring at 29 ft		
	N8	0	50/0"						
30	C1	96	RQD = 20						
	C2	100	RQD = 8						
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	C2	100	RQD = 8						
	C3	98	RQD = 0						
40									
	C4	100	RQD = 0				Driller indicates short core runs due to core barrel plugging from fracture-filling materials		
	C5	100	RQD = 0						
45							BOH, backfilled with bentonite chips		
50									
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-49**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Bridge Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,790.75** Easting: **319,067.97**		Start Card No.
Equipment **CME**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **212.00 ft**
Start Date **May 14, 2019** End Date **May 15, 2019**	Total Depth **49.66 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 8.00** **Removed using vacuum truck**		Vegetated ground surface, vacuum excavation to 8 ft depth		
5										
						8.00 - 30.00 **SILT with up to trace sand; gray and brown; nonplastic to low plasticity; very hard / very dense where nonplastic; fine- to medium-grained sand; noncemented; homogeneous. (Willamette Formation)**		Switch to HSA drilling method at 8 ft		
10	N1	89	1-3-4		32					
15	N2	100	2-3-5		30					
20	N3	100	1-1-2		35					
25	N4	100	1-1-1		34					
30	N5	100	5-11-25		28	**30.00 - 35.50** **Silty SAND and silty gravelly SAND; SM; gray and brown with black; low plasticity; very hard; fine- to coarse-grained sand; fine gravel; noncemented; homogeneous. (Decomposed Basalt)**		Auger chatter below 34 ft	5/15/19 ▽	
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N6 C1	100 100	50/3" RQD = 0	21	**35.50 - 49.66** **BASALT; gray; moderately weathered; soft to medium hard (R2 to R3); very close to close spaced fractures with mineral infilling and staining on fracture faces. (Columbia River Basalt)**		Switch to rock coring at 35.25 ft		
	C2	60	RQD = 0						
40									
	C3	100	RQD = 0						
45									
	C4	95	RQD = 0						
50							BOH, backfilled with bentonite chips		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-50**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **144,443.42** Easting: **319,701.22**		Start Card No.
Equipment **CME 5 #9**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **189.30 ft**
Start Date **May 20, 2019** End Date **May 20, 2019**	Total Depth **51.50 ft**	Tube Height

Test Type	Rock Abbreviations			Typical Drilling Abbreviations	
	Discontinuity	Shape	Surface Roughness	Drilling Methods	Drilling Remarks
"A" - Auger Core	J - Joint	Pl - Planar	P - Polished	WL - Wire Line	LW - Lost Water
"X" - Auger	F - Fault	C - Curved	Sl - Slickensided	HS - Hollow Stem Auger	WR - Water Return
"C" - Core, Barrel Type	B - Bedding	U - Undulating	Sm - Smooth	DF - Drill Fluid	WC - Water Color
"N" - Standard Penetration	Fo - Foliation	St - Stepped	R - Rough	SA - Solid Auger	DP - Down Pressure
"U" - Undisturbed Sample	S - Shear	Ir - Irregular	VR - Very Rough	CA - Casing Advancer	DR - Drill Rate
"T" - Test Pit				HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 0.50** **Asphalt concrete (Pavement)** **0.50 - 7.00** **CLAY with some sand and up to trace gravel; CL; gray; low plasticity; stiff to very stiff; fine- to coarse-grained sand; fine to coarse gravel; noncemented; homogeneous. (Fill)**		Mud rotary drilling methods.		
	N1	67	7-9-10		24					
5	N2	33	3-5-6		26					
	N3	33	5-8-4		27	**7.00 - 9.50** **SILT with some sand and trace gravel; ML; gray; low plasticity; moist; stiff; fine- to coarse-grained sand; fine to coarse gravel; noncemented; homogeneous. (Fill)**				
10	N4	100	2-3-5		29	**9.50 - 15.00** **CLAY with some sand; CL; gray; low plasticity; moist; medium stiff; fine- to medium-grained sand; noncemented; homogeneous. (Fill)**				
15	N5	100	2-3-4		31	**15.00 - 30.00** **SILT with up to some sand; ML with zones of MH; gray and brown; nonplastic to low plasticity; soft to medium stiff / loose where nonplastic; fine- to coarse-grained sand. (Willamette Formation)**				
20	N6	100	1-2-2		36					
25	N7	67	1-4-4		33					
30	N8	100	2-6-6		36	**30.00 - 35.00** **CLAY with trace sand; CH; brown; high plasticity; stiff; fine- to coarse-grained sand. (Willamette Formation)**				
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100	8-10-11	52	**35.00 - 51.50** **Silty SAND to sandy SILT; SM to ML; gray; nonplastic; medium dense; fine- to coarse-grained sand. (Decomposed Basalt)**				
40	N10	100	8-12-13	53					
45	N11	100	8-14-16	56					
50	N12	100	6-20-18	57					
							BOH, backfilled with bentonite chips Groundwater not observed		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

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		Hole No. **TB18841-S01**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **149,068.53**	Easting: **318,690.37**	Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer/Bush**	Ground Elev. **202.50 ft**
Start Date **May 22, 2019** End Date **May 1, 2219**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance	Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 7.00** **CLAY with some sand; CL; brown; low plasticity; medium stiff; fine- to medium-grained sand; noncemented; homogeneous. (Willamette Formation)**		Mud rotary drilling methods, vegetated ground surface Pavement thickness not recorded		
	N1	100	1-2-3		32					
5										
	N2	100	2-3-3		37					
						7.00 - 25.00 **SILT with trace sand and up to trace gravel; no sand or gravel below 11.5 ft; ML; brown and gray; low plasticity; medium stiff to stiff; fine- to medium-grained sand; fine gravel; medium stiff to stiff; noncemented; homogeneous. (Willamette Formation)**				
	N3	100	1-3-4		35					
10										
	N4A	100	1-3-6		35					
	N4B									
15										
	N5	100	2-3-5		38					
20										
	N6	100	1-3-3		35					
25						**25.00 - 31.50** **CLAY and SILT; with trace to some sand; CH and ML; gray; high plasticity clay; low plasticity silt; stiff to very stiff; fine- to coarse-grained sand; noncemented; homogeneous. (Decomposed Basalt)**				
	N7	56	4-9-11		32					
30										
	N8		6-7-6		48					
								BOH, backfilled with bentonite chips Groundwater not observed		
35										

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Page **1** of **1**

		Hole No. **TB18841-S02**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Signal Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,996.92**	Easting: **318,819.49**	Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **207.10 ft**
Start Date **May 23, 2019** End Date **May 23, 2019**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 4.50** **Gravelly CLAY with some sand; CL-GW; brown; medium plasticity; very stiff; fine- to coarse-grained sand; fine gravel; noncemented; homogeneous. (Fill)**		Mud rotary drilling methods, vegetated ground surface		
	N1	56	4-10-8	18					
5	N2	100	4-5-4		**4.50 - 7.00** **GRAVEL with some sand; GP; loose; fine- to coarse-grained sand; fine gravel; poorly graded; noncemented; homogeneous. (Fill)**		Petroleum odor in sample N-2		
	N3	100	1-3-3		**7.00 - 31.50** **SILT with up to some sand; some black gravel below 30 ft; ML; brown; tan and red to 15.0 ft; gray below 15.0 ft; nonplastic to medium plasticity; loose where nonplastic; medium stiff where plastic; very stiff below 30.0 ft; fine- to medium-grained sand; noncemented; homogeneous. (Willamette Formation)**				
10	N4	100	1-3-4	38					
15	N5	66	3-3-4	34					
20	N6	100	1-2-6	36					
25	N7	100	1-2-3	35					
30	N8	100	7-16-20	38					
35							BOH, backfilled with bentonite chips Groundwater not observed		

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

Page **1** of **1**

		Hole No. **TB18841-S03**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Signal Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,889.42** Easting: **318,774.29**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **204.90 ft**
Start Date **May 15, 2019** End Date **May 15, 2019**	Total Depth **31.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

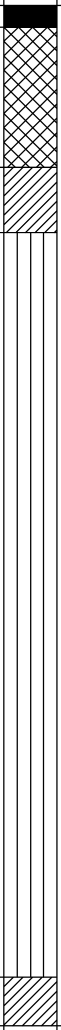
Rock Abbreviations

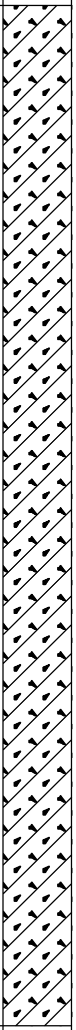
Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Drilling Methods, Size and Remarks	Water Level/ Date
0						**0.00 - 0.66** **Asphalt Concrete (Pavement)**	Hollow stem auger drilling methods. Asphalt concrete (9 in.) over aggregate base	
	N1	39	2-2-2		23	**0.66 - 5.00** **CLAY with trace sand and trace gravel; CL; brown with dark brown and orange mottling; low plasticity; damp; soft; fine- to medium-grained sand; fine gravel; noncemented; homogeneous. (Fill)**		
5	N2	100	2-1-4		28	**5.00 - 7.00** **CLAY with some sand; CL; gray and brown with dark brown; medium plasticity; damp to moist; medium stiff; fine- to coarse-grained sand; noncemented; homogeneous. (Willamette Formation)**		
	N3	78	3-3-3		34			
10	N4	100	2-2-4		32	**7.00 - 30.00** **SILT with up to some sand; ML; gray; with orange and brown mottling to 15.0 ft depth; nonplastic to low plasticity; loose where nonplastic; medium stiff where plastic; fine- to coarse-grained sand; noncemented; homogeneous. (Willamette Formation)**		
15	N5	89	2-2-3		37			
20	N6	100	4-5-5		28			
25	N7	100	3-3-5		28			
30	N8	100	4-4-6		28	**30.00 - 31.50** **CLAY with trace sand; CL; gray; low plasticity; moist; stiff; fine- to medium-grained sand; noncemented; homogeneous. (Willamette Formation)**	BOH, backfilled with bentonite chips Groundwater not observed	
35								





DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Hole No. **TB18841-S04**

Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **151,150.78** Easting: **318,695.80**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer**	Ground Elev. **200.20 ft**
Start Date **May 31, 2019** End Date **May 31, 2019**	Total Depth **51.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0					**0.00 - 30.00** **CLAY; CH to CL; gray and brown; predominately medium plasticity with zones of low and high plasticity; medium stiff to very stiff; noncemented; homogeneous. (Willamette Formation)**		Mud rotary drilling methods, vegetated ground surface		
	N1	100	1-3-7	35					
5	N2	100	6-9-12	32					
	N3	100	3-4-6	36					
10	N4	100	2-2-4	37					
15	N5	100	1-3-4	44					
20	N6	100	2-5-8	29					
25	N7	100	5-5-9	31					
30	N8	100	5-9-19	32	**30.00 - 40.00** **CLAY with some sand to sandy; CH to CL; dark blue with brown mottling; medium plasticity; very stiff to hard; fine- to medium-grained sand; noncemented; homogeneous. (Hillsboro Formation)**				
35									

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100	9-10-15	39		▨			▨
40	N10	100	5-8-13	45	**40.00 - 45.00** **Clayey SAND; SC; dark gray; medium plasticity; very stiff; fine- to medium-grained sand; noncemented; homogeneous. (Hillsboro Formation)**	▨			▨
45	N11	100	10-16-20	23	**45.00 - 51.50** **CLAY; CL; light gray with blue; medium plasticity; hard; noncemented; homogeneous. (Hillsboro Formation)**	▨			▨
50	N12	100	10-13-20	24		▨			▨
							BOH, backfilled with bentonite chips Groundwater not observed		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. **TB18841-S05**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose **Sign Foundation**	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **150,064.63** Easting: **318,807.56**		Start Card No.
Equipment **CME 75**	Driller **WSSC**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Gummer/Bush**	Ground Elev. **205.40 ft**
Start Date **May 23, 2019** End Date **May 23, 2019**	Total Depth **51.50 ft**	Tube Height

Test Type

"A" - Auger Core
"X" - Auger
"C" - Core, Barrel Type
"N" - Standard Penetration
"U" - Undisturbed Sample
"T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
B - Bedding	U - Undulating	Sm - Smooth
Fo - Foliation	St - Stepped	R - Rough
S - Shear	Ir - Irregular	VR - Very Rough

Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0						**0.00 - 51.50** **CLAY; some zones with trace sand; CL to CH; brown to 20 ft; gray below 20 ft; low to high plasticity; soft to very stiff; fine- to coarse-grained sand where present; noncemented; lensed from 7.5 to 25 ft; homogeneous from 0 to 7.5 ft and 25 ft to 51.5 ft. (Willamette Formation)**		Mud rotary drilling methods, vegetated ground surface		
	N1	100	2-3-4		32					
5										
	N2	100	2-4-4		28					
	N3	100	2-1-2		36					
10										
	N4	100	1-2-4		32					
15										
	N5	100	2-4-4		41					
20										
	N6	100	1-7-5		41					
								Driller indicates slower/stiffer drilling at 23 ft		
25										
	N7	100	2-3-4		40					
30										
	N8	100	3-4-6		36					
35										

Depth (ft)	Test Type, No.	Percent Recovery	Soil Driving Resistance / Rock Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
35	N9	100	4-5-6	41		▨			▨
40	N10	100	3-6-6	43		▨			▨
45	N11	100	4-6-7	42		▨			▨
50	N12	100	2-4-13	47		▨			▨
							BOH, backfilled with bentonite chips Groundwater not observed		
55									
60									
65									
70									
75									
80									
85									
88									

DRILL LOG
OREGON DEPARTMENT OF TRANSPORTATION

Page **1** of **1**

		Hole No. **TP18841-01**
Project **OR217 SB: Allen Blvd to OR99W**	Purpose	E.A. No.
Highway **OR217 (Hwy #144)**	County **Washington**	Key No. **18841**
Hole Location Northing: **148,903.00** Easting: **319,050.00**		Start Card No.
Equipment **TRACK HOE**	Driller **ODOT**	Bridge No.
Project Geologist **M. Zimmerman**	Recorder **Giscombe**	Ground Elev. **208.60 ft**
Start Date **May 28, 2019** End Date **May 28, 2019**	Total Depth **12.00 ft**	Tube Height

Test Type

- "A" - Auger Core
- "X" - Auger
- "C" - Core, Barrel Type
- "N" - Standard Penetration
- "U" - Undisturbed Sample
- "T" - Test Pit

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
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Typical Drilling Abbreviations

Drilling Methods	Drilling Remarks
WL - Wire Line	LW - Lost Water
HS - Hollow Stem Auger	WR - Water Return
DF - Drill Fluid	WC - Water Color
SA - Solid Auger	DP - Down Pressure
CA - Casing Advancer	DR - Drill Rate
HA - Hand Auger	DA - Drill Action

Depth (ft)	Test Type, No.	Percent Recovery	Soil: Driving Resistance	Rock: Discontinuity Data Or RQD%	Percent Natural Moisture	Unit Description	Graphic Log	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
0	T1				21	**0.00 - 1.50** **SANDY SILT with trace organics; ML; gray-brown with orange mottling/veins; nonplastic; damp; soft to medium stiff; noncemented; homogeneous. (Willamette Formation)**		Ground surface: grass and topsoil to 0.4 feet. Test pit excavation performed using a track-mounted excavator.		NATIVE MATERIAL
	T2				16	**1.50 - 3.00** **SANDY SILT; ML; gray-brown with orange mottling/veins; nonplastic; damp; stiff; noncemented; homogeneous. (Willamette Formation)**				
	T3				28	**3.00 - 7.00** **SILT with trace sand; ML; gray-brown with orange mottling; nonplastic, damp; stiff to hard; noncemented; homogeneous; fine sand. (Willamette Formation)**				
5										
	T4				29	**7.00 - 11.00** **SILT with trace sand; ML; gray, nonplastic; damp; soft; noncemented; homogeneous. (Willamette Formation)**				
10										
	T5				33	**11.00 - 12.00** **SILT with trace sand; ML; gray with orange veins, nonplastic; damp; soft; noncemented; homogeneous. (Willamette Formation)**				
15										

INSERT TAB

Special Provisions

CONTRACT AND BONDS
FOR HIGHWAY CONSTRUCTION

STATE OF OREGON
1859

OREGON DEPARTMENT OF TRANSPORTATION
SALEM, OREGON

GRADING, DRAINAGE, STRUCTURES, PAVING, SIGNING, ILLUMINATION, SIGNALS, ROADSIDE DEVELOPMENT & INTELLIGENT TRANSPORTATION SYSTEM

OR217: OR10 – OR99W SEC.

BEAVERTON – TIGARD HIGHWAY

WASHINGTON COUNTY

CONTRACT NUMBER 15298

EXPENDITURE ACCOUNT NUMBER CON04430

CLASS OF PROJECT S144(026)

CONTRACTOR KERR CONTRACTORS OREGON LLC

DATE OF AWARD ______

SPECIFIED COMPLETION SEE SUBSECTION 00180.50(h)

Key # 18841

Bid Date 08-26-21
Ad Date 07-08-21

CONTRACT AND BONDS
FOR HIGHWAY CONSTRUCTION

OREGON DEPARTMENT OF TRANSPORTATION
SALEM, OREGON

OREGON TRANSPORTATION COMMISSION

BOB VAN BROCKLIN	Commission Chair
ALANDO SIMPSON	Commissioner
MAURICE HENDERSON	Commissioner
JULIE BROWN	Commissioner
SHARON SMITH	Commissioner
KRIS STRICKLER	Director of Transportation

TABLE OF CONTENTS FOR CONTRACT

DESCRIPTIONS OF PARTS OF CONTRACT WHICH ARE NOT BOUND HEREIN BUT WHICH ARE PART OF THE CONTRACT

(1) Standard Specifications

The "2021 Oregon Standard Specifications for Construction," as published by the Oregon Department of Transportation.

Copies of the 2021 Oregon Standard Specifications for Construction may be purchased by visiting the Oregon Department of Transportation, Specifications website at:

https://www.oregon.gov/ODOT/Business/Pages/Standard_Specifications.aspx

(2) Plans

Applicable Plans, either separate from the Special Provisions or included within the Special Provisions.

Copies of Plans will be furnished by the Project Manager.

SECTION I. SPECIAL PROVISIONS

On the attached or inserted sheets which follow is given a description of the work to be performed under this Contract, together with required provisions bound herein, and Special Provisions, and instructions bound herein which supplement and modify the published "2021 Oregon Standard Specifications for Construction" book, making them part of this Contract and applicable to the particular work to be done.

DESCRIPTION OF WORK

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

TIME AND PLACES OF RECEIVING BIDS (BID CLOSING)

Bid Closing for the work described above will be at 9:00:00 a.m. on the 26th day of August, 2021. Bids will be received by Marie Wright, Construction Contracts Manager at the following time and places:

Before 9:00:00 a.m. on the day of Bid Closing.

For Bids submitted by mail or parcel delivery service, send to:

ODOT Procurement Office - Construction Contracts Unit, MS# 2-2
3930 Fairview Industrial Drive SE
Salem, Oregon 97302-1166.

For Bids submitted by hand delivery, date stamp the Bid with the provided date stamping device and place into the ODOT Procurement Office Bid Box located at the following address:

Oregon Department of Transportation
3930 Fairview Industrial Drive SE
Salem, Oregon 97302.

Bids, Bid modifications, and Bid withdrawals will not be accepted at or after 9:00:00 a.m. on the day of Bid Closing.

PLACE, TIME, AND DATE OF READING BIDS (BID OPENING)

Bid Opening for the work described above will be at the following address: Oregon Department of Transportation, 3930 Fairview Industrial Drive SE, Salem, Oregon, beginning at 9:00:00 a.m. on the day of Bid Closing.

COMPLETION TIME LIMIT

See Subsection 00180.50(h).

CLASS OF PROJECT

This is a Federal-Aid.

CLASS OF WORK

The Class of Work for this Project is either: A) Bridges and Structures, or B) the combination of 1) Asphalt Concrete Paving and Oiling & 2) Earthwork and Drainage.

PROJECT INFORMATION

Information pertaining to this Project may be obtained from the following:

Richard Smith, Resident Engineer, ODOT Sylvan Construction Office, 6000 SW Raab Rd, Portland, OR 97221; Email Richard.SMITH@odot.state.or.us, or Fax 971-673-5225. All requests for information must be in writing with reference to the Project name.

TABLE OF CONTENTS FOR SPECIAL PROVISIONS

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature (Brian Burnham) REGISTERED PROFESSIONAL ENGINEER 90603 Digitally Signed 2021.08.27 06:39:24-07'00' OREGON JULY 14, 2015 BRIAN BURNHAM EXPIRES: 12/31/ 2021	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Bridges No.'s 13574 and 23901 for plan sheets bearing my professional seal. Modified Special Provisions were prepared by me or under my supervision. Sections 00253, 00254, 00310, 00501, 00510, 00512, 00520, 00530, 00540, 00545, 00582, 00583, 00585, 00587, 00589, 00599, 00759, 00842, 00960.30, 01050, 02001, 02030, 02050, 02530, 02690

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature (Eric Paslack) REGISTERED PROFESSIONAL ENGINEER 80491PE Digitally Signed 2021.08.31 12:26:58 -07'00' OREGON DEC. 12, 2012 ERIC C. PASLACK RENEWS: 12-31-2022	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Structure Foundations at geotechnical data locations bearing my professional seal. Modified Special Provisions were prepared by me or under my supervision. Sections 00512, 00520

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature (Liantao Xu) REGISTERED PROFESSIONAL ENGINEER 84,252 Digitally Signed Aug 30 2021 4:26 PM MAY 11, 2010 LIANTAO XU RENEWS: 06-30-2022	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Bridge No. 09671, Sign Structure No.'s 23238 through 23243, and Structure Mounts for Sign Supports for plan sheets bearing my professional seal. Modified Special Provisions were prepared by me or under my supervision. Sections 00220.45, 00253, 00501, 00503, 00510, 00512, 00520, 00530, 00535, 00540, 00550, 00560, 00582, 00584, 00585, 00587, 00590, 00594, 00599, 00842, 00921, 00930, 00960.30, 01050, 02001, 02030, 02050, 02510, 02530, 02690

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature (Max Gummer) REGISTERED PROFESSIONAL ENGINEER 82,711 Digitally Signed Aug 30 2021 7:06 AM OREGON DECEMBER 09, 2013 MAX ALEXANDER GUMMER RENEWS: 06-30-2023	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Retaining Wall No.'s 23862 and 23863. Modified Special Provisions were prepared by me or under my supervision. Sections 00512, 00520, 00541, 00598, 02001

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature (Robert Grubbs) REGISTERED PROFESSIONAL ENGINEER 56148PE Digitally Signed Aug 26 2021 4:29 PM OREGON JAN. 15, 2002 ROBERT E. GRUBBS RENEWS: 06-30-2023	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Structure No.'s 16134, 23873, 23874, 23875 for plan sheets bearing my professional seal. Modified Special Provisions were prepared by me or under my supervision. Sections 00220.45, 00253, 00501, 00503, 00504, 00510, 00512, 00520, 00530, 00535, 00540, 00543, 00544, 00545, 00550, 00556, 00557, 00582, 00583, 00584, 00585, 00587, 00599, 00759, 00842, 00960.30, 01050, 02001, 02030, 02050, 02510, 02530, 02690

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISIONS

FOR

Grading, Drainage, Structures, Paving, Signing, Illumination, Signals, Roadside Development & Intelligent Transportation System
OR217: OR10 – OR99W Sec.
Beaverton-Tigard Highway
Washington County

PROFESSIONAL OF RECORD CERTIFICATION:

Seal w/signature REGISTERED PROFESSIONAL ENGINEER 17298 Digitally Signed Aug 27 2021 8:56 AM OREGON JULY 19, 1994 ROBERT J. TOVAR Expires 6/30/2022	I certify the Special Provision Sections listed below are applicable to the design for the subject project for Structure No's 09457 and 23235. Modified Special Provisions were prepared by me or under my supervision. Sections 00220.45, 00253, 00350, 00360, 00501, 00503, 00504, 00510, 00512, 00520, 00530, 00535, 00540, 00545, 00550, 00582, 00583, 00585, 00587, 00590, 00842, 00960.30, 01069, 02001, 02030,. 02050, 02510, 02530, 02690, 02830, 02831

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

SPECIAL PROVISIONS

WORK TO BE DONE

The Work to be done under this Contract consists of the following:

1. Construct structures, including bridges, retaining walls, sound walls, and sign structures.
2. Construct highway improvements, including earthwork, bases, and paving.
3. Construct drainage and sewers.
4. Construct electrical and communication systems, including illumination, traffic signals, and intelligent transportation system.
5. Install signing and striping.
6. Install right-of-way development and control, including seeding and stormwater management facilities.
7. Perform additional and Incidental Work as called for by the Specifications and Plans.

APPLICABLE SPECIFICATIONS

The Specifications that are applicable to the Work on this Project is the 2021 edition of the "Oregon Standard Specifications for Construction", as modified by these Special Provisions. All Sections in Part 00100 apply, whether or not modified or referenced in the Special Provisions.

All number references in these Special Provisions shall be understood to refer to the Sections and subsections of the Standard Specifications bearing like numbers and to Sections and subsections contained in these Special Provisions in their entirety.

CLASS OF PROJECT

This is a Federal-Aid Project.

00170.06 Federal-Aid Participation - This Project is to be conducted according to the regulations applying to Federal-Aid Highway Projects.

00170.70(a) Insurance Coverages - Add the following to the end of this subsection:

The following insurance coverages and dollar amounts are required pursuant to this subsection:

Insurance Coverages	Combined Single Limit per Occurrence	Annual Aggregate Limit
Commercial General Liability	$5,000,000	$10,000,000
Commercial Automobile Liability	$2,000,000	(aggregate limit not required)

00170.70(k) Builder's Risk Installation Floater - Replace this subsection, except for the subsection number and title, with the following:

If specified by Special Provision, the Contractor shall obtain, at its expense, and keep in effect during the term of the Contract, Builder’s Risk Installation Floater Insurance covering the Contractor's Materials and Equipment to be used for completion of the Work performed under the Contract. The minimum amount of coverage to be carried shall be equal to the full amount of the Contractor´s Equipment, Materials, or fixtures to be installed, in-transit, or stored off-site during the performance of the Contract. This insurance shall include as loss payees the State of Oregon, the Owner, the Contractor and Subcontractors as their interests may appear.

SECTION 00180 - PROSECUTION AND PROGRESS

Comply with Section 00180 of the Standard Specifications modified as follows:

00180.30 Materials, Equipment, and Work Force - Add the following paragraph to the end of the subsection:

ORS 279C.537 (Oregon House Bill 2007 (2019), Sections 17, 18 and 18a) applies to the Contract. The ORS 279C.537 requirements include but are not limited to the requirement that at least 80 percent of the total fleet of motor vehicles powered by diesel engines and equipment powered by nonroad diesel engines used on the site and in the course of performing the Contract must be (a) motor vehicles powered by model year 2010 or newer diesel engines and (b) equipment powered by nonroad diesel engines, whether or not capable of being powered by alternative fuel, that meet or exceed United States Environmental Protection Agency Tier 4 exhaust emission standards for nonroad compression ignition engines (ORS 279C.537(2)). ORS 279C.537(4) contemplates the Oregon Department of Environmental Quality (DEQ) will establish minimum standards and that ODOT, the Oregon Department of Administrative Services and the Oregon Department of Justice will adopt administrative rules (considering the DEQ minimum standards). When those administrative rules are promulgated and effective, the Contractor shall fully comply with the requirements of the administrative rules ODOT deems applicable, which as provided in ORS 279C.537(4)(c) may be required as an alternative to the requirements of ORS 279C.537(2).

Add the following subsection:

00180.40(c) Specific Limitations - Limitations of operations specified in these Special Provisions include, but are not limited to, the following:

Limitations	**Subsection**
Cooperation with Utilities	00150.50
Cooperation with Other Contractors	00150.55
Railways	00170.01(e)
Contract Time	00180.50(h)
Closed Lanes	00220.40(e)(1)
Special Events	00220.40(e)(2)(b)
Limited Duration Road Closure	00220.40(f)
Regulated Work Areas	00290.34(a)
Migratory Birds	00290.36(a)
Noise Control	00290.32
Maintenance Under Traffic	00620.43
Opening Sections to Traffic	00745.51

Access to temporary easements shown is restricted. Access to each numbered easement parcel shown is limited to a period of 36 consecutive months, beginning on the first day of access to the easement parcel.

Access to the temporary easement at 9735 SW Shady Lane, Tigard, Oregon is limited to the hours of 7:00 p.m. to 7:00 a.m. The Contractor shall leave the surface available for public parking every Day between the hours of 7:00 a.m. and 7:00 p.m.

The Contractor shall be aware of and subject to schedule limitations in the Standard Specifications that are not listed in this subsection.

00180.41 Project Work Schedules - Replace this subsection, except subsection number and title, with the following:

The Contractor shall submit a Project Work schedule meeting the requirements of this subsection to the Engineer. The Project Work schedule is intended to identify the sequencing of activities and time required for prosecution of the Work. The Project Work schedule is used to plan, coordinate, and control the progress of construction. Therefore, the Project Work schedule shall provide for orderly, timely, and efficient prosecution of the Work, and shall contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities. Sufficient detail shall also include all required double shifts, overtime work, or combination of both necessary to complete Work within the Contract Time.

The Contractor shall designate a qualified person responsible for preparation and submittal of the Project Work schedule, Project Narrative and monthly progress report and update. The qualifications of the person shall include experience preparing Critical Path Method (CPM) schedules for projects of similar complexity, utilizing the same scheduling software to be used for this Project. At least 10 Calendar Days prior to the preconstruction conference, the Contractor shall submit a resume for the designated person for review and approval by the Engineer.

Contractor's activity related to developing, furnishing, monitoring, and updating all required schedules, reports, and narratives is Incidental.

The Contractor shall submit all electronic documents in an electronic format as identified in this subsection that are compatible with the current version of Microsoft Project, the current version of Primavera P6 by Oracle, or another scheduling program approved by the Engineer.

The Contractor shall submit a supplemental "look ahead" Project Work schedule each week to the Engineer. The "look ahead" Project Work schedule is supplemental to the schedule specified below. The supplemental "look ahead" Project Work schedule shall:

- Identify the sequencing of activities and time required for prosecution of the Work.
- Provide for orderly, timely, and efficient prosecution of the Work.
- Contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities.

The supplemental "look ahead" Project Work schedule shall be written in common terminology and show the planned Work activities broken down into logical, separate activities by area, stage, and size and include the following information:

- The resources the Contractor, Subcontractors, or services will use.
- The locations of each activity that will be done including the limits of the Work by mile posts, stations, or other indicators.
- The time frames of each activity by Calendar Days, shifts, and hours.
- All anticipated Shoulder, lane, and road closures.

At a minimum, the Contractor shall prepare a bar chart that:

- Shows at least 3 weeks of activity including the week the bar chart is issued.
- Uses a largest time scale unit of 1 Calendar Day. Smaller time scale units may be used if needed.
- Is appropriate to the activities included in the detailed Project Work schedule.
- Identifies each Calendar Day by month and Day.
- Identifies each Holiday or non-workday included in the “look ahead” period.

Include the Contract name, Contract number, Contractor's name, and date of issue on each page of the bar chart.

The Contractor shall submit the supplemental "look ahead" Project Work schedule starting at First Notification and continuing each week until Second Notification has been issued and all punch list items and final trimming and clean up has been completed. The Contractor shall meet with the Engineer each week to review the supplemental "look ahead" Project Work schedule. If the Engineer or the Contractor determines that the current supplemental "look ahead" Project Work schedule requires changes or additions, either notations can be made on the current Project Work schedule or the Engineer may require the submittal of a revised supplemental "look ahead" Project Work schedule. Review of the current and subsequent supplemental "look ahead" Project Work schedules does not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(a) Schedule - Schedules are required, the Contractor shall do the following:

(1) Initial Schedule - 10 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer 1 digital copy and 4 paper copies of a time-scaled bar chart Project Work schedule. The initial schedule shall show:

- The expected beginning and completion date of each activity, including all stages and phases;
- The time needed for completion of the Utility relocation work; and
- The elements of the traffic control plan as required under 00221.06.

A time-scaled logic diagram is required.

The initial schedule shall show, in sufficient detail, all Work intended for the first 90 Days of the Contract to the level of detail described in (2) below, and shall show the priority and interdependence (sequencing and network logic) of all major segments of the remainder of the Work.

(2) Detailed Project Work Schedule - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide the Engineer 1 digital copy and 1 paper copy of a detailed time-scaled critical path method (CPM) network Project Work schedule and computer analysis printout, both clearly indicating the critical path.

This detailed Project Work schedule shall be prepared utilizing the CPM of planning and scheduling a construction project where activities are arranged based on activity relationships and network calculations using activity durations to determine when activities can be performed and the longest (critical) path of the Project. The network Project Work schedule shall include anticipated resource-loading for all activities (labor by trade, work element, Subcontractor, and Equipment allocation by type, with descriptions for unique Equipment such as cranes).

Detailed Project Work schedule activities shall include the following:

- Construction activities representing the complete Project scope of Work;
- The quantity of Work for each activity, when appropriate, in common units of measure.
- Any limitations of operation specified in 00180.40;
- The time needed for completion of the Utility relocation work;
- Implementation of a traffic control plan (TCP) for each stage and phase;
- Submittal and approval of Material samples, mix designs, and shop drawings;
- Agency timeframes to process and return Contractor submitted Plans, Working Drawings, Equipment lists and other submittals;

- Review of Submittals by outside agencies;
- Procurement of critical Materials;
- Fabrication, installation, and testing of special Material and Equipment;
- Duration of Work, including completion times of all stages and their sub phases; and
- Specified cure times for all concrete elements – the use of relationship lags for this purpose is prohibited.

Relationships between Construction activities should primarily be Finish-to-Start (FS). Other relationship types including Start-to-Start (SS) and Finish-to-Finish (FF) should be minimized. Start-to-Finish relationships shall not be used.

Lags should not be used with Finish-to-Start (FS) relationships – an activity should be shown. Lags, if used in conjunction with the above noted relationship types (SS and FF) should be limited and should be a positive amount (no negative lags).

The activities shall be separately identifiable by work breakdown structure (WBS). The WBS shall identify, at a minimum, traffic stage, phase, Structure name or number, the direction of travel. If a specific activity is being performed by a Subcontractor, then the activity code shall include unique identifiers for each Subcontractor. Other WBS codes may be added by the Engineer to further define the schedule activities.

The time scale used on the Contractor's detailed time-scaled CPM network Project Work schedule shall be appropriate for the duration of the activities and the Project duration. The time scale shall be in normal workdays, defined as every Day except Saturday, Sunday and legal (and Contractor observed) holidays, with calendar dates identified no less than the first and midpoint of each calendar month. The smallest unit shown shall be 1 Day. The largest amount shown for an individual construction activity shall be 15 workdays. The largest amount shown for long lead or fabricated material procurement may exceed 15 workdays and verifiable by the Engineer by way of Supplier quotation or other means. The network shall show the length of the activity or part scaled to accurately represent the number of normal workdays scheduled. Distinct symbols or graphics shall be used to show multiple shift, holiday, or weekend work. The duration of each activity shall be verifiable and consistent with the description in the Project Narrative required in 00180.41(a)(3).

The schedule network drawing(s) shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the drawings shall be on a reasonable size of paper up to a maximum of 36 inch x 36 inch, using multiple sheets when needed.

The Contractor shall include a tabulation of each activity in the computer mathematical analysis of the network diagram. The following information represents the minimum required for each activity:

- Event (node) number(s) for each activity (activity ID);
- Maintain event (node) numbers throughout the Project;
- Activity description;

- Original duration of activities (in normal workdays);
- Estimated remaining duration of activities (in normal workdays);
- Earliest start date and actual start date (by calendar date);
- Earliest finish date and actual finish date (by calendar date);
- Latest start date (by calendar date);
- Latest finish date (by calendar date); and
- Slack or float time (in workdays).

If abbreviations or truncated words are used within activity descriptions, a listing of these shall be provided for use by the Engineer, as necessary.

Computer print-outs for all Project Work schedules submitted under this Section shall consist of at least a node (activity ID) sort, an “early start/total-float” sort, and a “total-float/early start/early finish (critical path)” sort. Bar chart printouts shall consist of at least a WBS (phase, stage, area, Structure) sort, and a “total-float/early start/early finish (critical path)” sort.

Within 21 Calendar Days after submission of the detailed time-scaled CPM network Project Work schedule, the Engineer and the Contractor shall meet to review the detailed time-scaled CPM network Project Work schedule as submitted. If the Contractor has chosen to utilize a scheduling consultant, the scheduling consultant shall be in attendance at this meeting. Within 7 Calendar Days of the meeting, the Contractor shall resubmit to the Engineer 1 digital and 4 paper copies of the detailed time-scaled CPM network Project Work schedule and reports, including required revisions.

This first accepted detailed time-scaled CPM network Project Work schedule, also called the accepted baseline Project Work schedule, shall represent all Work, as well as the planned sequence and time for the Work. Resource leveling calculations based on the applied resources included in the Project Work schedule are not permitted. Crew or major Equipment restraints, where and when required, shall be documented by the Contractor for review and concurrence by the Engineer. Review and acceptance of any Project Work schedules and Project narratives by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(3) Project Narrative - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide to the Engineer a final written Project narrative that discusses the planning, coordinating, scheduling and resourcing of the Work. The Project narrative shall include the following written description:

- Plans for staging the Project.
- All critical activities.
- All near critical activities defined as those with less than 30 Days of float.
- All Subcontractor activities that are critical, near critical, and those that are greater than 2 weeks in duration.
- Labor resourcing, by stage and phase, to include the number of crews, average crew size and planned night/weekend shifts including that of Subcontractors.

- Equipment allocation, by stage and phase to include mobilization, demobilization and planned activities including that of Subcontractors.
- Notifications required under the Contract during each stage and phase which may include but is not limited to road closures, lanes closures, night work, cold plane Pavement removal, and pile driving.
- Provide discussion on addressing reasonably predictable weather conditions and their impact on all weather sensitive activities. Also, provide discussion on other weather limitations that may affect the Project Work schedule.
- Submittal and approval of material samples, mix designs, and shop drawings.
- Procurement of critical Materials.
- Plans for dealing with "unique" construction items.
- Coordination of utilities and any immediate concerns for impacts/delays.
- Constructability issues.
- Cost reduction proposals and immediate requests for changes to the Specifications.
- Concerns/issues that need to be addressed within the first 90 Days following First Notification.

The accepted Project narrative shall represent all critical and near critical Work, as well as the planned sequence and time for the Work.

(4) Updates, Review and Reporting - The Project Work schedule may require revision as the Work progresses. Therefore, the Contractor shall monitor and when necessary revise the Project Work schedule as follows:

a. Monthly Updated Schedule - The Contractor shall collect information on all activities worked on or scheduled to be worked on during the previous monthly report period, including shop drawings, Material procurement, and Contract Change Orders, with and without Contract Time, that have been approved, processed, and issued. Information shall include actual start and completion dates on activities started or completed, or if still in progress, the remaining time duration. Percentage of completion shall not be used to determine the remaining time duration. The remaining time duration shall be expressed as the number of forecast working period Days remaining as of the schedule data date regardless of percentage completion.

The Contractor shall evaluate this information each month and compare it with the accepted Project Work schedule. The schedule Data Date (Time Now) for each monthly evaluation shall be the first Day of each successive month regardless of the Day of the week this falls upon. For any activity that has started, the Contractor shall add a symbol to show the actual date the activity started and the number of normal workdays remaining until completion. For activities that are finished, a symbol shall be added to show the actual date. No activity is permitted to be shown as actually started or actually completed on or after the schedule Data Date.

The schedule date calculations shall be made using the “Retained Logic” option when utilizing Primavera P6 Professional, Primavera Project Planner (P3) or Sure Trak Project Manager 3.0. If MS Project 2010 or 2013 is utilized, the schedule calculations shall be made using the “Split Task” option. No overriding of logic due to out-of-sequence progress shall be permitted.

All changes contemplated to the current accepted Project Work schedule shall be submitted to the Engineer for approval prior to their incorporation into the subsequent monthly update of the current accepted Project Work schedule. A Project Work schedule without the contemplated changes shall also be submitted for comparison to the proposed revised Project Work schedule.

Changes to the current accepted Project Work schedule in effect at the time of the proposed change shall be limited to:

- Contract changes - Change Orders (CCOs); Extra Work Orders (EWOs) and Additional Work;
- Reallocation of resources, confirmed by schedule resource loading;
- Prior error – either in logic or duration, confirmed by estimate; or
- Recovery of time lost by Contractor (verified in subsequent updates);

The Contractor shall develop a group of activities put in detailed fragmentary networks (fragnets) sub-networks to incorporate changes, Additional Work, and Extra Work into the current accepted Project Work schedule. Detailed fragnets sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. The restraints shall include those activities from the current accepted Project Work schedule that initiated the fragnet sub-network as well as those restrained by it. The schedule fragnet shall be submitted for review by the Engineer.

Upon approval by the Engineer, the Contractor shall then insert the detailed sub-network and logic connectors relating to the Changed Work, Additional Work or Extra Work into the current accepted Project Work schedule and re-calculate the Project status subsequent to the inclusion of the detailed sub-network. This re-calculated status of the Project Work schedule shall be submitted along with the other requirements of 00180.80(c).

b. Review with the Engineer - The Contractor shall perform ongoing review of the accepted Project Work schedule and progress of the Work with the Engineer on a monthly basis. If the Engineer or the Contractor determines that the accepted Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the accepted Project Work schedule.

If, in the opinion of the Engineer, the Project Work falls behind the latest accepted Project Work schedule, the Contractor shall meet with the Engineer and provide a proposal in writing that explains how the Contractor will get back on schedule, submit a request for adjustment of Contract Time, or provide written acknowledgement that liquidated damages will be incurred.

Any changes approved by the Engineer shall be incorporated into the accepted Project Work schedule and associated Project narrative. This revised Project Work schedule and narrative, upon acceptance by the Engineer, will become the new accepted Project Work schedule and associated Project narrative.

The Contractor shall update both accepted Project Work schedule and the revised Project Work schedule at the normal monthly interval until such time as the recovery to the Project Completion has been verified.

The Contractor shall submit, digitally and in paper, 4 copies of the updated bar charts to the Engineer within 7 Days after the progress meeting, along with a progress report as required by 00180.41(a)(4)(c).

c. Progress Report - Each month the Contractor shall submit a progress report and an update of the Project Work schedule to the Engineer. The report and updated Project Work schedule shall be submitted both digitally and in paper copy and shall include the following:

- A sufficient description, in narrative form, to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule;
- Proposed corrective actions;
- Proposals to keep the Project on schedule in the event of a delay; and
- Any changes to the logic as compared to the accepted Project Work schedule and their effect on the construction schedule.

(b) Specified Contract Time Not Superseded by Schedule Revisions - The completion dates in any Project Work schedule and any revised or updated Project Work schedules shall be within the Contract Time(s) specified for the Project, or within adjusted Contract Times approved according to 00180.80(c). Acceptance of any Project Work schedule or any revised or updated Project Work schedules shall not constitute approval of any completion dates that exceed such Contract Time(s). If the Contractor believes that additional Contract Time is due, the Contractor shall submit, with a revised Project Work schedule, a request for adjustment of Contract Time according to 00180.80(c) in the manner described under 00180.41(a)(4)(b). A request for an adjustment of Contract Time will be evaluated using the most recently accepted Project Work schedule.

(c) Float Time - Float time shown on the Project Work schedule, including any time between a Contractor's scheduled completion date and the specified Contract Time(s), does not exist for the exclusive use of either party to the Contract and belongs to the Project. The Contractor is expressly prohibited from adjusting activity durations and/or activity logic in order to consume available float or extend the Project time to reflect an “on time” completion during schedule update preparation.

(d) Schedules Do Not Constitute Notice - Submittal of a Project Work schedule, with supporting Project narrative, does not constitute or substitute for any notice the Contractor is required to give the Agency under the terms of this Contract.

(e) Failure to Provide Schedule - The Project Work schedule is essential to the Agency. The Contractor's failure to provide the schedule, schedule information, progress reports, Project narratives, or schedule updates when required will be cause to suspend the Work, or to withhold Contract payments as necessary to protect the Agency, until the Contractor provides the required information to the Engineer.

00180.42 Preconstruction Conference - Add the following to the end of this subsection:

The Contractor shall conduct a group Utilities scheduling meeting with representatives from the Utility companies involved with this Project and the Engineer before the preconstruction conference. The Contractor shall incorporate the Utilities time needs into the Contractor's schedule submitted at the preconstruction conference.

Add the following subsection:

00180.50(h) Contract Time - There are four Contract Times on this Project as follows:

(1) The Contractor shall complete all Work to be done under the Contract required to construct Sound Walls No. 23942, 23943, 23944, 23945, and 23946 not later than September 30, 2022.

(2) The Contractor shall complete all Work to be done under the Contract (including but not limited to constructing Retaining Walls No. 23861 and 23862, widening Bridges No. 23872 and 23873, retrofitting bridge rails for Bridges No. 16143, 23872, and 23873, installing traffic signals and signs, constructing grading and paving, and temporary pavement markings) required to open the “CD” line between SW Allen Boulevard and SW Denney Road and “DB3” line between SW Denney Road and southbound OR217 in their final traffic configuration with all lanes open to traffic before the elapse of 150 Calendar Days, or not later than November 15, 2023, whichever occurs first. Recording of Calendar Days will begin on the day the Contractor closes the southbound OR217 exit ramp to SW Denney Road or the entrance ramp from SW Denney Road to southbound OR217 as set forth under Extended Roadway Closures in 00220.40(f).

(3) The Contractor shall complete all Work to be done under the Contract (including but not limited to constructing Retaining Walls No. 23939 and 23940, removing existing Bridge No. 09454, constructing Bridge No. 23901, installing signs, constructing grading and paving, and temporary pavement markings) required to reopen SW Hall Boulevard to one lane of traffic in each direction before the elapse of 240 Calendar Days, or not later than August 31, 2025, whichever occurs first. Recording of Calendar Days will begin on the day the Contractor closes SW Hall Boulevard to traffic as set forth under Extended Roadway Closures in 00220.40(f).

(4) The Contractor shall complete all Work to be done under the Contract, except for seeding establishment, not later than October 31, 2025.

00180.80(c) Contractor’s Request Required - Replace the bullet item that begins “A schedule analysis based on…” with the following bullet:

- A schedule analysis based on the current accepted Project Work schedule for each cause of delay, indicating which activities are involved and their impact on Contract completion consistent with the following:

- The Contractor shall prepare a detailed fragmentary network (fragnet) of the Changed Work, Additional Work or Extra Work. The detailed fragnet (sub-network) shall include any activities added as a result of the delay in sufficient detail to represent the added scope to the Project. Development of activity durations and schedule logic shall be submitted to the Engineer for review and documented to the satisfaction of the Engineer. Upon acceptance by the Engineer, the Contractor shall insert the detailed fragnet and logic connectors into the current accepted Project Work schedule and re-calculate the Project status. Both schedules (with and without fragnets) shall be submitted to the Engineer for review and comparison to determine the accuracy of the amount of time being requested.

00180.80(d) Basis for Adjustment of Contract Time - In the paragraph that begins “The Engineer will not consider requests…” add the following bullet to the end of the bullet list:

- Changes to logic or durations made by the Contractor in 00180.41(a)(4)(a);

00180.85(b)(2) Multiple Contract Times - Add the following paragraph and bullet list to the end of this subsection:

The Agency determined percentages of the value of Work required to be complete by the Contract Times listed under 00180.50(h) are as follows:

- For Contract Time 00180.50(h)(1) the Agency determined percentage of Work is 7 percent.
- For Contract Time 00180.50(h)(2) the Agency determined percentage of Work is 19 percent.
- For Contract Time 00180.50(h)(3) the Agency determined percentage of Work is 95 percent.
- For Contract Time 00180.50(h)(4) the Agency determined percentage of Work is 100 percent.

Add the following subsection:

00180.85(c) Lane Closures - Lane closures beyond the limits specified will inconvenience the traveling public and will be a cost to the Agency.

It is impractical to determine the actual damages the Agency will sustain in the event Traffic Lanes are closed beyond the limits listed in 00220.40(e) or 00220.40(f). Therefore, the Contractor shall pay to the Agency, not as a penalty, but as liquidated damages, the amount listed below per 15 minutes, or for a portion of 15 minutes, per lane, for any lane closure beyond the limits listed in 00220.40(e) or 00220.40(f). In addition to the liquidated damages, all added cost for traffic control measures, including flagging, required to maintain the lane closures beyond the allowed time limits, will be at no additional cost to the Agency. The required traffic control measures will be as determined by the Engineer.

- $2000 on Beaverton-Tigard Highway (OR217)
- $1500 on Pacific Highway West (OR99W)
- $500 on all other Roadways

The Engineer will determine when it is safe to reopen lanes to traffic. Assessment of liquidated damages for a given Highway or Roadway will stop when all lanes for that Highway or Roadway have been safely reopened. Any liquidated damages assessed under these provisions will be in addition to those listed in 00180.85(b).

Add the following subsection:

00180.85(e) Traffic Delays Beyond 20 Minutes - Stopping or holding vehicles beyond the limits specified will inconvenience the traveling public and will be a cost to the Agency.

It is impractical to determine the actual damages the Agency will sustain in the event traffic is stopped or held longer than the 20-minute limit listed in 00220.02. Therefore, the Contractor shall pay to the Agency, not as a penalty, but as liquidated damages, the amount shown below per 20 minutes, or for a portion of 20 minutes, for stopping or holding traffic longer than 20 minutes. In addition to the liquidated damages, any added cost for traffic control measures, including flagging, required to stop or hold traffic beyond the 20-minute time limit, will be at no additional cost to the Agency. The required traffic control measures will be as determined by the Engineer.

- $2000 on Beaverton-Tigard Highway (OR217)
- $1500 on Pacific Highway West (OR99W)
- $500 on all other Roadways

Assessment of liquidated damages for a given Highway or Roadway will stop when the Engineer determines that traffic for that Highway or Roadway is no longer stopped or held beyond the 20-minute limit. Any liquidated damages assessed under these provisions will be in addition to those listed in 00180.85(b).

Add the following subsection:

00180.85(f) Southbound OR217 Interchange at SW Denny Road Closure - Closures of the OR217 Southbound Ramp to SW Denney Road and SW Denney Road Ramp to OR217 Southbound (the "Southbound Interchange") beyond the limits specified will inconvenience the traveling public and will be a cost to the Agency.

It is impractical to determine the actual damages the Agency will sustain in the event the Southbound Interchange, or either ramp, is closed beyond the Extended Roadway Closures limit for these facilities listed in 00220.40(f). Therefore, the Contractor shall pay to the Agency, not as a penalty, but as liquidated damages, $1,700 per day, or for a portion of a day for closure beyond the Extended Roadway Closures limit for these facilities listed in 00220.40(f). In addition to the liquidated damages, all added cost for traffic control measures, including flagging, required to maintain the road closures beyond the allowed time limits, will be at no additional cost to the Agency. The required traffic control measures will be as determined by the Engineer.

The Engineer will determine when it is safe to reopen the Southbound Interchange to traffic. Assessment of liquidated damages will stop when the entire Southbound Interchange has been safely reopened. Any liquidated damages assessed under these provisions will be in addition to those listed in 00180.85(b).

SECTION 00190 - MEASUREMENT OF PAY QUANTITIES

Comply with Section 00190 of the Standard Specifications modified as follows:

00190.20(f)(2) Scale Without Automatic Printer - Replace the paragraph that begins " If the scales require manual entry of gross weight …" with the following paragraph:

If the scales require manual entry of gross weight information, the Agency may periodically have a representative weigh witness at the scales to observe the weighing procedures. The Contractor shall inform the Engineer of its intent to use a scale without an automatic printer at least 3 working days before weighing begins or before the Contractor changes to a scale that does not have an automatic printer. The Contractor shall pay costs for the weigh witness. The hourly cost of the weigh witness will be as stated in the Special Provisions. In addition, the Engineer may periodically check the weight for a load of Materials by directing the haul vehicle to reweigh on a different scale that has been inspected and certified according to 00190.20(b) and 00190.20(d).

Add the following paragraph after the paragraph that begins " If the scales require manual entry…":

Pay costs for the weigh witness at $35.00 per hour.

00190.20(g) Agency-Provided Weigh Technician - Add the following paragraph to the end of this subsection:

Pay costs for the weigh technician at $35.00 per hour.

SECTION 00195 - PAYMENT

Comply with Section 00195 of the Standard Specifications modified as follows:

00195.10 Payment For Changes in Materials Costs - Replace this subsection with the following subsection:

00195.10 Asphalt Cement Material Price Escalation/De-escalation - An asphalt cement escalation/de-escalation clause will be in effect during the life of the Contract.

The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this escalation/de-escalation provision shall not limit those rights.

(a) Monthly Asphalt Cement Material Price (MACMP) - The Monthly Asphalt Cement Material Price (MACMP) will be established by the Agency each month and will be based on the published prices of PG 64-22 asphalt cement furnished by Poten & Partners, Inc. If any portion of the Project Site is located within the boundaries of ODOT Maintenance

District 13 or 14, the MACMP will be based on the average prices for the Boise, Idaho area. If no portion of the Project Site is within the boundaries of ODOT Maintenance District 13 or 14, the Contractor may elect to have the MACMP based on the average prices of either the Portland, Oregon area or the Boise, Idaho area. If electing to use Boise, Idaho average prices for determination of the MACMP, the Contractor shall notify the Engineer in writing of the Contractor's election before or within 7 Calendar Days after the date of the preconstruction conference. This election, once acknowledged by the Engineer, will be binding for the entire duration of the Contract. If no such written notification is made, the Portland, Oregon area prices will be used as the basis of the MACMP. The area selected as the basis of the MACMP, once chosen, will become the sole area to be used as the basis for all asphalt cement used on the Project. Each MACMP for a given month will be the average of the published prices for that MACMP for each Friday in that month.

For information regarding the calculation of the MACMP, and for the actual MACMP, go to the Agency website at:

https://www.oregon.gov/ODOT/Business/Pages/Asphalt-Fuel-Price.aspx

If the Agency-selected index ceases to be available for any reason, the Agency in its discretion will select and begin using a substitute price source or index to establish the MACMP each month. The MACMP will apply to all asphalt cement including but not limited to paving grade, polymer modified, and emulsified asphalts, and recycling agents. The Agency does not guarantee that asphalt cement will be available at the MACMP.

(b) Base Asphalt Cement Material Price (Base) - The base asphalt cement material price for this Project is the MACMP published on the Agency website for the month immediately preceding the Bid Opening date.

(c) Monthly Asphalt Cement Adjustment Factor - The monthly asphalt cement adjustment factor will be determined each month as follows:

- If the MACMP is within ± 5% of the Base, there will be no adjustment.
- If the MACMP is more than 105% of the Base, then:

  Adjustment Factor = (MACMP) - (1.05 x Base)

- If the MACMP is less than 95% of the Base, then:

  Adjustment Factor = (MACMP) - (0.95 x Base)

(d) Asphalt Cement Price Adjustment - A price adjustment will be made for the items containing asphalt cement listed below. The price adjustment as calculated in (c) above will use the MACMP for the month the asphalt is incorporated into the Project. The price adjustment will be determined by multiplying the asphalt incorporated during the month for subject Pay Items by the Adjustment Factor.

The Pay Items for which price adjustments will be made are:

Pay Item(s)

PG 64-22 Asphalt in 1/2 Inch ACP
PG 70-22ER Asphalt in 1/2 Inch ACP
Emulsified Asphalt for Tack Coat

Add the following subsection:

00195.11 Fuel Cost Price Escalation/De-escalation - A fuel escalation/de-escalation clause will be in effect during the life of the Contract.

The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this escalation/de-escalation provision shall not limit those rights.

(a) Monthly Fuel Price (MFP) - A Monthly Fuel Price (MFP) will be established by the Agency each month. For the actual MFP, go to the Agency website at:

https://www.oregon.gov/ODOT/Business/Pages/Asphalt-Fuel-Price.aspx

The MFP for a given month will be the average weekly price obtained from the OPIS weekly listing dated the first Monday of that month for No. 2 diesel fuel for Portland, Oregon. Prices are based solely on rack and resellers' prices exclusive of freight, taxes, and special discounts. If the average weekly price is not posted by OPIS or is otherwise not available to the Agency for the first Monday of any month for any reason, the Agency may use the average weekly price posted by OPIS immediately before or after the first Monday of that month. If the average weekly prices cease to be available from OPIS for any reason, the Agency in its discretion will select and begin using a substitute price source or index to establish the MFP each month. The Agency does not guarantee that fuel will be available at the MFP.

(b) Base Fuel Price (Base) - The base fuel price for this Project is the MFP published on the Agency website for the month immediately preceding the Bid Opening date.

(c) Monthly Fuel Adjustment Factor - A monthly fuel adjustment factor will be determined each month as follows:

- If the MFP is within ± 25% of the Base, there will be no adjustment.

- If the MFP is more than 125% of the Base, then:

  Adjustment Factor = (MFP) - (1.25 x Base)

- If the MFP is less than 75% of the Base, then:

  Adjustment Factor = (MFP) - (0.75 x Base)

(d) Fuel Price Adjustment - A fuel price adjustment for fluctuations in the cost of fuel will apply only to the major fuel usage Pay Items shown in the following list and at the respective fuel factors listed:

Item	Fuel Factor

General Excavation	$0.29 Gal/Cu. Yd
12 Inch Subgrade Stabilization	$0.33 Gal/Sq. Yd
Cold Plane Pavement Removal, 0 - 2 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 0 - 3 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 0 - 4 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 0 - 5 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 2 - 8 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 2 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 2 1/2 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 3 Inches Deep	$0.04 Gal/Sq. Yd
Cold Plane Pavement Removal, 5 Inches Deep	$0.04 Gal/Sq. Yd
Aggregate Base	$0.69 Gal/Ton
Level 3, 1/2 Inch ACP	$2.93 Gal/Ton
Level 3, 1/2 Inch ACP in Leveling	$2.93 Gal/Ton
Level 4, 1/2 Inch ACP	$2.93 Gal/Ton
AMG Cold Plane Pavement Removal, 0 - 2 1/2 Inches Deep	$0.04 Gal/Cu. Yd

All Pay Items associated with the following Bridges and Structures:

Bridge No. 09457	19 Gal/$1000
Bridge No. 09671	10 Gal/$1000
Bridge No. 09672	19 Gal/$1000
Bridge No. 13074A	19 Gal/$1000
Bridge No. 16134	19 Gal/$1000
Bridge No. 16143	19 Gal/$1000
Bridge No. 23235	10 Gal/$1000
Bridge No. 23872	19 Gal/$1000
Bridge No. 23873	10 Gal/$1000
Bridge No. 23874	10 Gal/$1000
Bridge No. 23875	19 Gal/$1000
Bridge No. 23901	19 Gal/$1000
Structure No. 23939	19 Gal/$1000
Structure No. 23940	19 Gal/$1000
Structure No. 23941	19 Gal/$1000
Structure No. 23862	19 Gal/$1000
Structure No. 23863	19 Gal/$1000
Structure No. 24023	19 Gal/$1000
Structure No. 23942	10 Gal/$1000
Structure No. 23943	10 Gal/$1000
Structure No. 23944	10 Gal/$1000
Structure No. 23945	10 Gal/$1000
Structure No. 23946	10 Gal/$1000

The Contractor is cautioned to consider that its operations may require more or less fuel.

A price adjustment (±) to the Contractor for fuel cost changes will be made monthly if the Monthly Fuel Price differs 25% or more from the Base Fuel Price. This adjustment will be the product of the Monthly Fuel Adjustment Factor and the estimated Monthly Fuel Used. The Monthly Fuel Used will be determined by multiplying the quantities of Work accomplished during the month for subject Pay Items, by the appropriate Fuel Factors.

Fuel cost adjustments will continue to be made as specified and will not be revised for any reason, including the Contractor's election to use an alternative fuel (natural gas, wood pellets, propane, or other).

00195.12(d) Steel Materials Pay Item Selection - Add the following paragraphs to the end of this subsection:

If the Contractor elects not to participate in the steel escalation/de-escalation program for this Project, no response from the Contractor is required.

The Contractor may elect to participate in the steel escalation/de-escalation program for this Project under 00195.12 through 00195.12(d) by marking each check box for each Pay Item in the list below the Contractor is selecting for participation in the program. The completed list must be submitted in writing, signed and dated by the Contractor, to the Project Manager before or within 7 Calendar Days after the date of the preconstruction conference.

PARTICIPATE	PAY ITEM DESCRIPTION	COST BASIS (CB)
☐	6 inch Ductile Iron Pipe, 5 ft Depth	6%
☐	12 inch Ductile Iron Pipe, 5 ft Depth	6%
☐	18 inch Ductile Iron Pipe, 5 ft Depth	7%
☐	24 inch Ductile Iron Pipe, 5 ft Depth	7%
☐	Drilled Shaft Reinforcement, Grade 60	35%
☐	Furnish HP 10 x 42 Steel Piles	90%
☐	Furnish HP 14 x 89 Steel Piles	90%
☐	Furnish HP 14 x 117 Steel Piles	90%
☐	Furnish PP 16 x 0.5 Steel Piles	90%
☐	Furnish PP 24 x 0.75 Steel Piles	90%
☐	Reinforcement, Grade 60	27%
☐	Coated Reinforcement, Grade 60	27%
☐	Steel Plate Girder	19%
☐	Structural Steel Maintenance	19%
☐	3 Tube Curb Mount Rail	1%
☐	3 Tube Curb Mount Rail, Modified	1%
☐	Combination Bridge Rail	12%
☐	Midwest Guardrail System, Type 2A	11%
☐	Midwest Guardrail System, Type 3	11%

☐	Midwest Guardrail System, Type 4	11%
☐	Monotube Cantilever Sign Structures	35%
☐	Lighting Poles and Arms	35%

Regardless of the number of Pay Items listed by the Agency or selected by the Contractor, or if no Pay Items qualify for the steel escalation/de-escalation program for this Project or the Contractor elects not to participate in the steel escalation/de-escalation program for this Project, the steel price escalation/de-escalation clause (and program) contained in 00195.12 through 00195.12(d) are included in this Contract and are the only steel price escalation/de-escalation clause (and program) that apply to this Contract.

____ _______________________
Contractor's Signature Date

SECTION 00196 - PAYMENT FOR EXTRA WORK

Comply with Section 00196 of the Standard Specifications.

SECTION 00197 - PAYMENT FOR FORCE ACCOUNT WORK

Comply with Section 00197 of the Standard Specifications.

SECTION 00199 - DISAGREEMENTS, PROTESTS, AND CLAIMS

Comply with Section 00199 of the Standard Specifications modified as follows:

00199.40(c) Step 2: Agency Level Review - Replace the paragraph that begins "If the Contractor does not accept the Step 2 …" with the following paragraph:

If the Contractor does not accept the Step 2 decision, the Contractor may, within 10 Calendar Days of receipt of the written decision, request in writing through the Engineer that the claim be advanced to Step 3 or 4 (see (d) and (e) below), as applicable. For purposes of determining which process to use for claims under Step 3 or 4 concerning a combination of additional compensation and Contract Time or for Contract Time only, the value of the claim or portion of the claim for Contract Time will be assumed to be the appropriate Liquidated Damages as provided in 00180.85 multiplied by the number of Calendar Days in question. If applicable, advancement of the claim is subject to the provisions of 00199.60 regarding waiver and dismissal of the claim or portions of the claim.

SECTION 00270 - TEMPORARY FENCES

Comply with Section 00270 of the Standard Specifications.

SECTION 00280 - EROSION AND SEDIMENT CONTROL

Comply with Section 00280 of the Standard Specifications modified as follows:

00280.00 Scope - Add the following paragraph to the end of this subsection:

The Agency's NPDES 1200-CA Permit is applicable to the Project.

00280.15(f)(1) Filter Sock Material - Add the following sentence to the end of this subsection:

Furnish filter sock material with a diameter of 12 inches.

00280.44(f) Compost Erosion Blanket - Add the following to the end of this subsection:

- **Compost Material Mulch** - Incorporate Dry Powder Tackifier with the compost material mulch at the following recommended rates:

Dry Powder Tackifier Rates for Guar per Slope (V:H):

Slope	<1:5	1:4	1:3	1:2	1:1
Lb/Acre	50-60	60-80	80-100	120-150	150-220

Evenly apply Compost Material Mulch with blended Dry Guar Powder Tackifier with a pneumatic blower or other Equipment that propels the material directly at the Soil surface and achieves direct contact with the Soil. See Section 01030 for seeding.

00280.48 Emergency Materials - Add the following paragraphs after the paragraph that begins "Provide, stockpile, and protect...":

Provide and stockpile the following emergency materials on the Project site:

Item	Quantity
Plastic Sheeting	500 SQYD
Straw Bale	40 EACH
Sediment Fence	500 FOOT
Sediment Barrier, Type 3	1000 FOOT
Inlet Protection, Type 4	200 EACH
Inlet Protection, Type 3	100 EACH
Construction Entrance Type 1	4 EACH
Check Dam Type 1	50 EACH
Check Dam Type 6	25 EACH

Matting Type E	500 SQYD
Temporary Mulching, Straw	1 ACRE

00280.70 Removal - Add the following to the end of this subsection:

Unless otherwise shown as a permanent feature of a stormwater facility, all Type 1 (aggregate) check dams placed in stormwater facilities are considered temporary and must be removed according to this Section. Remove aggregate to within 1 inch of the facility flowline. Avoid mechanical disturbance to the surrounding facility bed.

00280.91 Payment - Add a third bullet under "No separate or additional payment will be made for":

- Removal of Type 1 check dams considered temporary per 00280.70.

SECTION 00290 - ENVIRONMENTAL PROTECTION

Comply with Section 00290 of the Standard Specifications modified as follows:

00290.20(c)(2) Clean Fill - Add the following paragraph to the end of this subsection:

Manage all excavated soil that does not meet the definition of clean fill according to Section 00294.

Add the following subsection:

00290.30(a)(7) Water Quality:

- Do not discharge contaminated or sediment-laden water, including drilling fluids and waste, or water contained within a work area isolation, directly into any waters of the State or U.S. until it has been satisfactorily treated (using a best management practice such as a filter, settlement pond, bio-bag, dirt-bag, or pumping to a vegetated upland location).
- Do not use permanent stormwater quality treatment facilities to treat construction runoff unless prescribed by an ESCP approved under Section 00280
- If construction discharge water is released using an outfall or diffuser port, do not exceed velocities more than 4 feet per second, and do not exceed an aperture size of 1 inch.
- Do not use explosives under water.
- Implement containment measures adequate to prevent pollutants or construction and demolition materials, such as waste spoils, fuel or petroleum products, concrete cure water, silt, welding slag and grindings, concrete saw cutting by-products and sandblasting abrasives, from entering waters of the State or U.S.
- Implement containment measures adequate to prevent flowing stream water from coming into contact with concrete or grout within the first 24 hours after placement.

- Do not end-dump riprap into the waters of the State or U.S. Place riprap from above the ordinary high water line.
- Cease Project operations under high flow conditions that may result in inundation of the Project area, except for efforts to avoid or minimize resource damage.
- The Engineer retains the authority to temporarily halt or modify the Work in case of excessive turbidity or damage to natural resources.
- If Work activities violate permit conditions or any requirement of this subsection, stop all in-water work activities and notify the Engineer.

Add the following subsection:

00290.30(a)(8) Meter Turbidity Monitoring - In addition to any turbidity monitoring required by 00280.62(c) to comply with NPDES 1200 series requirements, monitor turbidity using a turbidity meter every two hours during in-water work according to the following:

- Use a turbidity meter that has been maintained and calibrated according to the manufacturer's specifications.
- Measure stream turbidity before beginning each day's in-water work to establish pre-construction turbidity levels.
- Measure upcurrent and downcurrent turbidity at two-hour intervals during in-water work and perform work based on turbidity measurements according to the following:
  - Take upcurrent samples at a location representative of background turbidity approximately 100 feet from the in-water work area.
  - Take downcurrent samples at a location approximately 100 feet from the in-water work area at approximately mid-depth of the water body and within any visible turbidity plume.
  - If the downcurrent reading is less than 5 nephelometric turbidity units (NTU) higher than the upcurrent reading, continue to work and take readings every two hours.
  - If the downcurrent reading is greater than or equal to 5 and less than 30 NTU higher than the upcurrent reading, modify work procedures and repair or implement best management practices (BMP), continue work, and continue to take readings every two hours. If after four hours the downcurrent reading is still greater than or equal to 5 NTU higher than the upcurrent reading, stop all in-water work and repair or implement additional BMP. Resume in-water work activities only after the downcurrent reading is less than 5 NTU above the upcurrent reading.
  - If the downcurrent reading is greater than or equal to 30 and less than 50 NTU higher than the upcurrent reading, modify work procedures, repair or implement BMP and continue work. If, at the subsequent two-hour reading, the downcurrent reading is still more than 30 NTU higher than the upcurrent reading, stop all in-water work and repair or implement additional BMP. Resume in-water work activities only after the downcurrent reading is less than 5 NTU above the upcurrent NTU reading.
  - If the downcurrent reading is 50 NTU or more higher than the upcurrent reading, stop all in-water work, repair or implement additional BMP, and inform the Agency. Resume in-water work activities only after the downcurrent reading is less than 5 NTU above the upcurrent NTU, as determined by continued readings made at least every two hours, or the next day's initial turbidity reading.

- Document all turbidity monitoring observations on form 734-2755, “Turbidity Monitoring Report”, or another form approved by the Agency. Submit reports to the Engineer weekly during in-water work and keep copies of the reports at the Project Site.

00290.32 Noise Control - Add the following paragraphs to the end of this subsection:

Review City of Beaverton City Code Chapter 5.15, City of Tigard Municipal Code Chapter 6.02 Article V, and City of Tualatin Charter and Municipal Code Chapter 6-14 which describe noise control regulations. Comply with the applicable noise control requirements of the permits for Project Work.

Copies of the City of Tigard noise variance permit for this Project are available from the Engineer.

Obtain a noise variance permit from City of Beaverton and furnish a copy to the Engineer prior to performing Work that requires a City of Beaverton noise variance. Obtain a noise variance permit from City of Tualatin and furnish a copy to the Engineer prior to performing Work that requires a City of Tualatin noise variance.

00290.34 Protection of Fish and Fish Habitat - Add the following paragraph:

Meet with the Agency Biologist, Resource Representative, Engineer, and inspector on site, before moving equipment on-site or beginning any work, to ensure that all parties understand the locations of sensitive biological sites and the measures that are required to be taken to protect them.

00290.34(a) Regulated Work Areas - Add the following to the end of this subsection:

The regulated work area is the area at or below the ordinary high water (OHW) elevation shown on the plans.

Perform work within the regulated work area only during the in-water work period. The in-water work period is from July15 to September 30.

The total volume of material filled or discharged into waters of the State and waters of the U.S. shall not exceed 8,758 cubic yards.

The total volume of material excavated from the waters of the State and waters of the U.S. shall not exceed 4,745 cubic yards.

Submit a schedule to complete all work within the regulated work area within the in-water work period at least 10 days prior to the preconstruction conference.

00290.34(b) Prohibited Operations - Add the following to the end of this subsection:

- Install steel piles greater than 24 inches in diameter or H-pile larger than designation HP 24 within the regulated work area.

Add the following subsection:

00290.34(c) Aquatic Species Protection Measures Required by Environmental Permits:

(1) General Requirements:

- Do not install fish ladders (for example: pool and weirs, vertical slots, fishways) or fish trapping systems.
- Do not apply surface fertilizer within 50 feet of any stream channel.

Use heavy equipment as follows:

- Choice of equipment must have the least adverse effects on the environment (for example: minimally sized, low ground pressure).
- Secure absorbent material around all stationary power equipment (for example: generators, cranes, drilling equipment) operated within 150 feet of wetlands, waters of the State, waters of the U. S., drainage ditches, or water quality facilities to prevent leaks, unless suitable containment is provided to prevent spills from entering waters of the State or waters of the U.S.
- Do not cross directly through a stream for construction access, unless shown or approved. If shown or approved, cross perpendicular to the stream and do not block stream flow. When a crossing is no longer needed, completely remove the crossing and restore the soils and vegetation to the original condition.
- Store fuel and maintain all equipment in staging areas that are at least 150 feet away from any waters of the State, waters of the U.S., or storm inlet or on an impervious surface that is isolated from any waters of the State, waters of the U.S., or storm inlet.
- If temporary access roads are needed within 150 feet of any body of water, use existing routes unless new routes are shown or approved.
- Before beginning work on temporary access routes that are not shown, submit a proposal to the Engineer for approval.

(2) Work Area Isolation - Provide work isolation according to Section 00245. Provide safe passage around or through the isolated work area for adult and juvenile migratory fish unless passage did not previously exist.

(3) Water Intake Screening - Install, operate, and maintain fish screens on each water intake used for project construction, including pumps used to isolate an in-water work area. When drawing or pumping water from any stream, protect fish by equipping intakes with screens having a minimum 27 percent open area and meeting the following requirements:

- Perforated plate openings shall be 3/32 inch or smaller.
- Mesh or woven wire screen openings shall be 3/32 inch or smaller in the narrowest direction.
- Profile bar screen or wedge wire openings shall be 1/16 inch or smaller in the narrow direction.

Choose size and position of screens to meet the following criteria in Table 00290-1:

Table 00290-1

Type	Approach Velocity [1] (Ft./Sec.)	Sweeping Velocity [2] (Ft./Sec.)	Wetted Area of Screen (Sq. Ft.)	Comments
Ditch Screen	≤ 0.4	Shall exceed approach velocity	Divide max. water flow rate (cfs) by 0.4 fps	If screen is longer than 4 feet, angle 45° or less to stream flow
Screen with proven self-cleaning system	≤ 0.4	–	Divide max. water flow rate (cfs) by 0.4 fps	–
Screen with no cleaning system other than manual	≤ 0.2	–	Divide max. water flow rate (cfs) by 0.2 fps	Pump rate 1 cfs or less

[1] Velocity perpendicular to screen face at a distance of approximately 3 inches
[2] Velocity parallel to screen

Provide ditch screens with a bypass system to transport fish safely and rapidly back to the stream.

(5) Site Restoration - Restore damaged streambanks to a natural slope, pattern, and profile suitable for establishment of permanent woody vegetation unless precluded by pre-project conditions (for example: natural rock substrate):

- If use of large wood, native topsoil, or native channel material is required for the site restoration according to the roadside development plans, stockpile all large wood, native vegetation, weed-free topsoil, and native channel material displaced by construction. Cut trees or large wood and trees into pieces of no less than 20 feet in length, or as shown on the roadside development plans or as directed. Stockpiled native wood and vegetation remain the property of the Agency.
- Stabilize all disturbed soils, including obliteration of temporary access roads, following any break in work unless construction will resume in 4 Calendar Days.

(6) Surface Water Diversions - Surface water may be diverted to meet construction needs other than work area isolation, consistent with Oregon law, only if water from sources that are already developed, such as municipal supplies, small ponds, reservoirs, or tank trucks, is unavailable or inadequate, and meeting the following conditions:

- When alternative surface sources are available, divert from the stream with the greatest flow.
- Install, operate, and maintain a temporary fish screen.

- Do not exceed a pumping rate and volume of 10 percent of the available flow. For streams with less than 5 cubic feet per second, do not exceed drafting of 18,000 gallons per day. Do not use more than one pump for each site.

(7) Hydro-Acoustic - Unless otherwise shown or approved, steel piling may be installed below the ordinary high water as follows:

- Minimize the number and diameter of pilings, as feasible.
- Repairs, upgrades, and replacement of existing pilings consistent with these conditions are allowed. In addition, up to 5 single pilings or 1 dolphin consisting of 3 to 5 pilings may be added to an existing facility.
- Whenever feasible, use vibratory hammer for piling installation. Otherwise, use the smallest drop or impact hammer necessary to complete the job, and set the drop height to the minimum necessary to drive the piling.
- For all pile installed or removed, maintain a pile installation and removal log and submit the log when the related work is completed. Include types, sizes, locations, installation or removal methods, and dates in the log.
- When using an impact hammer to drive or proof steel piling within a body of water, or as directed, use one of the following sound attenuation devices to effectively dampen sound:

  - Completely isolate the pile from the waters of the State and waters of the U.S. by dewatering the area around the pile according to Section 00245.
  - If water velocity is 1.6 feet per second or less, surround the pile being driven with a bubble curtain that distributes small air bubbles around 100 percent of the piling perimeter for the full depth of the water column and is in accordance to the guidance in the Appendix of The ODOT-FHWA Federal Aid Highway Program Programmatic User’s Guide titled *NMFS and USFWS Impact Pile Driving Sound Attenuation Specifications*. The FAHP User's Guide is available on the Agency's website at:

    https://www.oregon.gov/ODOT/GeoEnvironmental/Pages/Manuals.aspx

  - If water velocity is greater than 1.6 feet per second, surround the piling being driven by a confined bubble curtain (for example: a bubble ring surrounded by a fabric or metal sleeve) that will distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column and is in accordance to the guidance in the Appendix of The ODOT-FHWA FAHP User's Guide titled *NMFS and USFWS Impact Pile Driving Sound Attenuation Specifications*.

(8) Drilling, Boring, or Jacking - If drilling, boring, or jacking is used, the following conditions apply:

- Design, build, and maintain facilities to collect and treat all construction and drilling discharge water using the best available technology applicable to site conditions. Provide treatment to remove debris, nutrients, sediment, petroleum hydrocarbons, metals, and other pollutants likely to be present. An alternate to treatment is collection and proper disposal offsite.

- Isolate drilling operations from wetted stream to prevent drilling fluids from contacting waters of the State or waters of the U.S.
- Use casing to prevent loss of drilling fluid to the subsurface formation. Do not drill without a containment method to keep drilling fluids and slurry isolated.
- If it is necessary to drill through an over-water bridge deck, use containment measures to prevent drilling debris from entering the stream channel.
- If drilling fluid or waste is released to surface water, wetland or other sensitive environment, cease all drilling pending written approval from appropriate regulatory agencies through the Engineer to resume drilling.
- Recover all waste and spoils if precipitation is falling or imminent. Recover, recycle, or dispose of all drilling fluids and waste to prevent entry into flowing water.

  - Recycle drilling fluids using a tank instead of drill recovery/recycling pits, whenever feasible.
  - When drilling is completed, make attempts to remove the remaining drilling fluid from the sleeve (for example: by pumping) to reduce turbidity when the sleeve is removed.

(9) Treated Wood - Treated wood includes any wood treated with any pesticide or wood preservatives. Do not use lumber, pilings, or other wood products that are treated or preserved with pesticidal compounds below the ordinary high water (OHW) or as part of an in-water or over-water structure, except as described below:

- Store treated wood shipped to the Project out of contact with standing water and wet soil, and protected from precipitation.
- Visually inspect each load and piece of treated wood. Reject for use in or above aquatic environments if visible residues, bleeding of preservative, preservative-saturated sawdust, contaminated soil, or other matter is present.
- Use pre-fabrication to the extent feasible. When field fabrication is necessary, all cutting and drilling of treated wood, and field preservative treatment of wood exposed by cutting and drilling, shall occur above the OHW. Use tarps, plastic tubs, or similar devices to contain the bulk of any fabrication debris, and wipe off any excess field preservative.
- All treated wood structures, including pilings, shall have design features to avoid or minimize impacts and abrasion by livestock, pedestrians, vehicles, vessels, and floats.
- Treated wood may be used to construct a bridge, over-water structure or an in-water structure, with the exception of the work containment system, provided that all surfaces exposed to leaching by precipitation, overtopping waves, or submersion are coated with a water-proof seal or barrier are maintained. Apply and contain coatings and paint-on field treatment to prevent contamination. Surfaces that are not exposed to precipitation or wave attack, such as parts of a timber bridge completely covered by the bridge deck, are exempt from this requirement.
- During demolition of treated wood, ensure that no treated wood debris falls into the water. If treated wood debris does fall into the water, remove it immediately.
- Store removed treated wood debris in appropriate dry storage areas, at least 150 feet away from the regulated work area.

(10) Piling Removal - Remove temporary or permanent piling according to the following:

- Dislodge the piling with a vibratory hammer, whenever feasible.
- Once loose, place the piling onto the construction barge or other appropriate dry storage site.

a. Non-Treated Piling - Use the following methods to remove non-creosote piling:

- If a pile in uncontaminated sediment cannot be removed or breaks, cut or push the pile or stump off at least 3 feet below the surface of the sediment and cover with a cap of clean, native substrates that match surrounding streambed materials.

(11) Ditch and Culvert Cleaning - Complete ditch cleaning, culvert and trash rack cleaning by working from the top of bank, unless work area isolation would result in less habitat disturbance.

- Do not work more than 20 feet upstream or downstream the culvert or trash rack.
- Remove only the minimum amount of wood, sediment, or other natural debris necessary to maintain the facility’s function, without disturbing spawning gravel or changing the configuration of the original ditch, unless the new configuration is part of the project design.
- Place all large wood, cobbles, and gravels recovered from during culvert and trash rack cleaning downstream from the structure.
- Complete drift removal in the following priority, as directed:

  - Pull and release whole logs or trees downstream.
  - Pull whole logs and trees and place in the riparian area, as directed.
  - Remove whole logs or trees only if roadside development plans have been developed for replacement in-kind.
  - Pull, cut only as necessary, and release logs and trees downstream.

(12) Floating Structures - The following types of over-water or in-water structures are not allowed:

- boat house
- boat ramp made of asphalt
- buoy or float in an active anchorage or fleeting area
- covered moorage
- floating storage unit
- houseboat
- marine
- pier
- non-water related facilities (including staging areas) inside riparian management areas

- any other over-water structure more than 6-feet wide unless otherwise approved in writing by appropriate regulatory agencies through the Engineer

The following conditions apply to over-water or in-water structures:

- Concrete boat ramps that consist of pre-cast concrete slabs below the ordinary high water elevation, and higher elevation portions that are completed in the dry so that no wet concrete that has cured less than 24 hours is allowed to contact any wetland or waters of the State or waters of the U.S.
- Rock may be used to construct a boat ramp footing, or other protection necessary to prevent scouring, down-cutting, or failure of the boat ramp, provided that the rock does not extend further than 4 feet from the edge of the ramp in any direction.
- Any replacement roof, wall, or garage door for covered moorages and boat houses must be made of translucent materials or skylights. In addition, each side, except the door, of the boat house shall have windows at least 4 feet wide installed the length of the boat house, subject to breaks only for structural support.
- An existing marina may be modified within the existing footprint of the moorage, or in the water more than 50 feet from the shoreline and more than 20 feet deep, except do not place structures in areas that support aquatic vegetation or areas where boat operations may damage aquatic vegetation.
- Fit all pilings, mooring buoys, and navigational aids with devices to prevent perching by piscivorous birds.
- Permanently encapsulate all synthetic flotation material to prevent breakup into small pieces and dispersal in water.
- Install small temporary floats less than 7 Calendar Days before a scheduled event, remove them 5 Days after a scheduled event is concluded, and do not leave them in place longer than 21 Calendar Days.
- Install mooring buoys and temporary floats (for example: shellfish traps) more than 300 feet from native submerged aquatic vegetation, more than 50 feet from the shoreline, and in water deeper than 20 feet deep at all times, or as necessary to ensure that gear does not ground out unnecessarily, and boats do not prop wash the bottom.

(13) Temporary Power, Communication and Water Lines - Before installing temporary power, communication, or water lines across streams or bodies of water, submit a proposed plan to the Engineer for approval. Do not begin installation before receiving approval from the Engineer. Proposed plans for installation of temporary power, communication, and water lines and stream crossings shall utilize the following design methods in the listed order of priority:

1. Aerial lines, including lines hung from existing bridges.

2. Directional drilling, boring and jacking that spans the channel migration zone and any associated wetland.

3. Trenching, which is restricted to intermittent streams and may only be used when the stream is naturally dry. For all sections of trenches below the ordinary high water line, backfill with native material and cap with clean gravel suitable for fish use in the project area.

Align each crossing as perpendicular to the watercourse as possible. For drilled, bored, or jacked crossings, ensure that the line is below the total scour prism. Return any large wood displaced by trenching or plowing as nearly as possible to its original position, or otherwise arranged to restore habitat functions.

(14) Injured Fish Notification - If a dead or injured fish is found in the project area, immediately notify the Agency. If the injured fish is in a location where further injury or stress may take place, attempt to move the fish to a safer location, if one is available, near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead or dies while being captured or moved, save the fish and any tags. The Agency will notify appropriate regulatory agencies about the injured or dead fish and provide additional direction to the Contractor.

00290.36(a) Migratory Birds - Add the following to the end of this subsection:

Do not disturb migratory bird nesting habitat (shrubs, trees, and structures), or clear vegetation from March 1 to September 1 of each year without prior written approval from the Engineer. Notify the Engineer, in writing, a minimum of 10 calendar days prior to starting activities that could harm nesting birds.

(1) Bird Management - Bird management activities to comply with the Migratory Bird Treaty Act (16 U.S.C. 703 712) will be performed by the Agency. Ensure that the Agency and its permitted agents have access to the project area, as needed to prevent migratory bird nesting. Nesting prevention may include daily bird harassment and the installation and maintenance of devices that exclude birds.

Do not disturb migratory bird nesting habitats (shrubs, trees, and structures), or clear vegetation from March 1 to September 1 of each calendar year without prior written approval from the Engineer. Notify the Engineer, in writing, a minimum of 10 Calendar Days prior to starting activities that could harm nesting birds.

00290.41 Protection of Waters of the U.S. or State - Add the following to the end of this subsection:

Permits have been obtained for this project from the US Army Corps of Engineers (Corps) and the Department of State Lands (DSL). Keep a copy of Corps and DSL permits at the project site during construction. Changes to the project that may increase the amount of fill placed or material removed in waters of the U.S. or State, or the acreage of waters impacted are not authorized. The following waters of the U.S. or State are present and have been determined to be unavoidable as indicated in Table 00290-2:

Table 00290-2

Impact Waters of the US or State	Removal Volume (cu yds.)	Fill Volume (Cu yds)	Station	Duration of Impact (Temporary or Permanent)	Area of impact (Acres)
Ash Cr Trib	51	51	"C" 375+40 to "C" 376+40 Lt.	Permanent	0.0158
Red Rock Cr.	18	18	"C" 423+35 Rt and "C" 423+50 Lt	Permanent	0.0054
Wash Sq. Cr. 2	98	98	"GA4" 349+30 to "GA4" 350+95 Lt.	Permanent	0.0304
Wetland B	17	17	"AD2" 218+00 Rt	Permanent	0.0034
Wetland D	677	2,030	"C" 240+20 to "C" 243+60 Rt	Permanent	0.2097
Wetland E	113	113	"C" 249+50 to "C" 251+30 Rt.	Permanent	0.0698
Wetland H	30	89	"C" 331+85 to "C" 332+50 Rt.	Permanent	0.0092
Wetland K	467	933	"C" 374+50 to "C" 378+00 Rt.	Permanent	0.1446
Wetland N	95	95	"C" 423+10 Rt	Permanent	0.0118
Wetland P	275	523	"C" 423+50 Lt	Permanent	0.1574
Wetland Q	1,041	1,427	"C" 374+50 to "C" 377+00 Lt.	Permanent	0.1314
Wetland R	856	1711	"C" 368+60 to "C" 374+00 Lt.	Permanent	0.2652
Wetland S	236	591	"B" 359+90 to "B" 362+90 Lt and "B" 363+10 to "B" 363+65 Lt.	Permanent	0.0732
Wetland T	866	1154	"GA4" 347+80 to "GA4" 353+70	Permanent	0.1788
Wetland U	3	3	"C" 338+90 to "C" 339+15 Lt.	Permanent	0.0016
Wetland X	72	72	"C" 277+80 to "C" 278+95 Lt.	Permanent	0.0448

Add the following subsection:

00290.42 Work Containment Plan - A Work Containment Plan (WCP) is required on this Project for bridge rail removal, bridge rail installation, deck removal, and structure widening construction activities.

Develop and submit a WCP for approval at least 28 Calendar Days prior to mobilization for bridge rail removal, deck removal, or bridge removal activities. Maintain a copy of the WCP on the Project Site at all times during construction, readily available to employees and inspectors. Ensure that all employees comply with the provisions of the WCP. Design the

WCP to avoid or minimize disturbance to protected features (sensitive cultural or natural resources, regulated work areas, aquatic life or habitat in regulated work areas) related to Contractor operations.

Before developing the WCP, meet with Agency to review the Contractor’s activities that require the WCP to ensure that all parties understand the locations of protected features to be avoided and the measures needed to avoid and protect them.

Notify the Engineer at least 10 Calendar Days before beginning work access or containment construction activities.

The Agency reserves the right to stop Work and require the Contractor to change the WCP methods and Equipment before any additional Contract Work, at no additional cost to the Agency, if and when, in the opinion of the Agency, such methods jeopardize sensitive cultural or natural resources, regulated work areas, or aquatic life or habitat in regulated work areas.

The WCP shall identify how the Contractor's construction operations will protect regulated features during mobilization, construction, maintenance, and demolition. Include a narrative describing compliance with Section 00290 as related to construction, operation, and demolition activities specified in Section 00253.

Design, construct, maintain, and remove temporary work access and containment systems according to Section 00253.

00290.90 Payment - Add the following paragraph(s) to the end of this subsection:

The work containment plan will be paid for at the Contract lump sum amount for the item "Work Containment Plan".

Payment will be payment in full for furnishing all Materials, Equipment, labor, and Incidentals necessary to complete the Work as specified. Payment includes providing and updating the Work Containment Plan.

The accepted quantities of turbidity monitoring will be paid for at the Contract lump sum amount for the item "Turbidity Monitoring".

Payment for turbidity monitoring will be payment in full for furnishing and placing all Materials and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

No separate or additional payment will be made for work zone fencing.

SECTION 00294 - CONTAMINATED MEDIA

Section 00294, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00294.00 Scope - In addition to the requirements of Section 00290 and the Specifications, this Work consists of the following:

- Excavate, segregate, stockpile, transport, and reuse of contaminated Shoulder Soil, including grubbing, as defined by 00294.01, from the locations listed in Table 00294-1:

Contaminated Shoulder Soil Location Table 00294-1

From Location/Station to Location/Station	Depth below grade (feet)	Approximate Quantity (cy)	Known Contaminants
SB “C” Sta 210+80 to 430+90, including all ramps From edge of pavement to road work limits (see Wood, 2019)	0 to 1.5’	32,000	Lead, antimony
SB “C” Sta 413+00 to 428+00 0 to 14’ from edge of pavement (Storm Water Work Area 1 in Reynolds, 2019)	0 to 1’	350	Lead
SB “C” Line at 72nd Interchange 0 to 14’ from edge of pavement (Storm Water Work Area 2 in Reynolds, 2019)	Grubbing only	50	Litter
SB “L5N” Sta 105+00 to 109+00 0 to 14’ from edge of pavement (Storm Water Work Area 4 in Reynolds, 2019)	0 to 1’	650	Lead
I-5 NB Haines storm water facility Within roadwork limits only (Storm Water Work Area 5 in Reynolds, 2019)	Grubbing only	200	Litter
NB “C” Sta 317+75 to 324+00 and “3D3” ramp 0 to 14’ from edge of pavement (WA1 in Reynolds, 2019)	0 to 1.5’	225	Lead
NB “C” Sta 324+00 to 345+50 0 to 14’ from edge of pavement (WA2 in Reynolds, 2019)	Grubbing only	200	Litter
NB “C” Sta 345+50 to 354+40 and “GA4” ramp From edge of pavement to roadwork limits (WA3 in Reynolds, 2019)	0 to 1.5’	1,800	Lead
NB “C” Sta 354+40 to 365+00 and “B” ramp From edge of pavement to roadwork limits (WA4 in Reynolds, 2019)	0 to 1.5’	2,700	Lead
NB “C” Sta 365+00 to 393+50 0 to 14’ from edge of pavement (WA5 in Reynolds, 2019)	0 to 1.5’	1,800	Lead, antimony
NB “C” Sta 393+50 to 406+00 and “E” ramp From edge of pavement to road work limits (WA7 in Reynolds, 2019)	0 to 1’	7,200	Lead
NB "C" Sta 406+00 to 423+00, "E2" and "Es" ramps From edge of pavement to roadwork limits (WA8 in Reynolds, 2019)	0 to 1.5’	3,650	Lead

From Location/Station to Location/Station	Depth below grade (feet)	Approximate Quantity (cy)	Known Contaminants
"H" Sta 202+00 to 202+46, "P" Sta 10+40 to 11+47 From edge of pavement to roadwork limits (WA6 in Reynolds, 2019)	0 to 1.5’	100	Lead
Shoulder soil in other work areas not previously tested is assumed contaminated with lead	0 to 1.5’	2,500	Lead
Approximate Total Quantity		53,425 cy	
Quantity to be reused on Project		53,425 cy	
Quantity to be disposed at landfill		0 tons	

- Excavate, segregate, stockpile, transport, and dispose of contaminated Subsurface Soil, as defined by 00294.01, from the locations listed in Table 00294-1A:

Contaminated Subsurface Material Location Table 00294-1A

From Location/Station to Location/Station	Depth below grade (feet)	Approximate Quantity (cy)	Known Contaminants
“C” Sta 217+50 to 224+00, Rt From CL (centerline) to roadwork limits (Area A in ODOT, 2021)	2.5’ to total depth of excavation	2,000	Arsenic
“HB4” Sta 287+00 to 288+00, Rt From CL to roadwork limits (Area B in ODOT, 2021)	3.0 to 6.0’	100	Diesel, oil, PAHs
“C” Sta 292+00 to 297+00, Rt and Lt From CL to roadwork limits (Area C in ODOT, 2021)	Groundwater table to total depth of excavation	500	Vinyl chloride
“C” Sta 364+75, Lt From CL to roadwork limits (Area D in ODOT, 2021)	2.5’ to total depth of excavation	100	Arsenic
Approximate Total Quantity		2,700 cy	
Quantity to be reused on Project		0 cy	
Quantity to be disposed at landfill		4,000 tons	

- In areas where excavation is not required, leave contaminated Shoulder Soil and clearing and grubbing material in place.

- Pump, test, treat, and dispose of contaminated groundwater from the following locations in Table 00294-2:

Table 00294-2

Location/Station	Depth below grade (feet)	Known Contaminants
“C” Sta 291+00 to 298+00, Rt and Lt From CL (centerline) to roadwork limits (Area C in ODOT, 2021)	10 to 20’	Vinyl chloride

The reports documenting the contaminated media identified within the Project include; *Shallow Soil Sampling Southbound Shoulder of Highway 217* (Wood, 2019), *Level 2 Preliminary Site Investigation* (Reynolds Engineering, 2019), and *Subsurface Soil and Groundwater Investigations* (ODOT, 2021) and are available from the Engineer.

- Prepare a Health and Safety Plan (HASP) for work within the contaminated areas of the Project.
- Prepare a written lead compliance plan for work within contaminated areas of the Project.

00294.01 Definitions:

Contaminated Soil - Soil that does not meet the DEQ definition of "Clean Fill", as defined by OAR 340-093-0030(18). This contaminated Soil is a regulated waste, subject to OAR 340-093-0005 through OAR 340-093-0290. If the grubbing material has been determined to be contaminated, it will be considered and treated as contaminated Soil for the purposes of this Section.

Shoulder Soil - Soil outside of the existing Highway Pavement and within Highway Right-of-Way generated during Highway maintenance or construction activities. This definition applies to excess Soil generated to a maximum depth of 1.5 feet below ground surface. This definition does not apply to Soil that is covered by existing impervious surfaces, including but not limited to curbs, sidewalks and parking lots constructed of asphalt or concrete.

ODOT Beneficial Use Determination (ODOT BUD) - The statewide ODOT Beneficial Use Determination (ODOT BUD), approved by DEQ (No. BUD-20181204), outlines a series of pre-approved non-residential reuse options for excess Soil materials that do not meet DEQ's Clean Fill Standards in some circumstances. These options may vary based on project scope and location, and documentation may vary, as directed by the Engineer.

00294.02 Testing of Contaminated Soil and Groundwater - When additional testing of contaminated Soil or groundwater is required to characterize the material for reuse, recycle, or disposal, conduct the tests according to 00290.20(c).

Use analytical methods meeting DEQ's Clean Fill Guidance Screening Levels for each analyte. Contaminated Soil and groundwater sampling must be conducted by an Oregon Registered Geologist or Professional Engineer who has experience characterizing contaminated media.

Collect at least 3 composite Soil samples and submit for the following required testing:

- TPH-Gx and TPH-Dx by Northwest methods.
- Volatile organic compounds (VOCs) by EPA Method 8260.
- Polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270SIM.
- Total metals (RCRA 8) plus antimony, copper, and zinc by EPA 6000 and 7000 series.
- TCLP lead by using EPA Method 1311.

00294.03 Submittals - Submit the following documents:

- A site specific HASP at least 10 Calendar Days before the pre-construction conference.
- The site specific HASP is to be completed and signed by a qualified health and safety professional meeting the requirements of 00294.30.
- The name and qualifications of the qualified health and safety professional.

Submit all modifications to the HASP that are requested by the Engineer or the qualified health and safety professional within 7 Calendar Days of the request.

- Current employee training certificates and medical surveillance information before beginning Work within the contaminated areas.

Submit the following documents within 48 hours of removal of contaminated media:

- Permits, permit applications, and documentation of compliance.
- All reuse, recycled, and disposal receipts.
- Final quantities of Soil and groundwater reused, recycled, and disposed and their final location.
- All analytical test results.
- Documentation of final disposition of any reused Soil material that is reused under ODOT’s Beneficial Use Determination.

00294.05 Health and Safety Plan - Prepare a site specific HASP that meets or exceeds the requirements of 29 CFR 1910.120 and include a personnel and equipment decontamination plan that details how decontamination media will be contained and disposed.

Maintain a copy of the HASP on site at all times and readily available to employees and inspectors during construction activities. If additional information becomes available regarding the site specific conditions, revise the HASP and submit the revised version to the Engineer. Review or acknowledgment of the HASP by the Engineer is not an indication or representation that the HASP is fully compliant with State or federal requirements. Compliance is the responsibility of the Contractor. Review by the Engineer will not impose liability upon the Agency or relieve the Contractor of any responsibilities under the Contract.

Do not begin Work in contaminated areas until the Engineer provides written acknowledgement of the HASP.

All personnel entering contaminated areas shall follow the requirements of the HASP.

Labor

00294.30 Personnel Qualifications - Provide employees meeting the following requirements:

- For removal of contaminated Soil, provide employees trained in:
  - Lead awareness according to 29 CFR 1926.62(l).
  - Chromium according to 29 CFR 1926.1126(j)(2).

  - Cadmium according to 29 CFR 1926.1127(m)(4).

- A qualified health and safety professional that:
  - Has at least 3 years' experience in hazardous waste site work.
  - Meets the HAZWOPER training requirements.

- An Oregon Registered Geologist or Professional Engineer who has experience handling contaminated media.

Construction

00294.40 Contaminated Soil Excavation - Excavate and handle contaminated Soil from Project excavations according to the following:

- Notify the Engineer 3 Calendar Days before beginning excavation activities within contaminated areas.
- Allow the Agency to collect Soil and groundwater samples during excavation activities.
- Field screen Soil using a portable photo ionization detector, portable flame ionization detector, field test kits, or other instrumentation capable of detecting the contaminants identified for this Soil.
- Segregate non-contaminated Soil from contaminated Soil during excavation activities, based on the field screening and the provided contaminated Soil location information.
- Load contaminated Soil directly into trucks and transport directly to the recycling or disposal facility, or on-site reuse areas or, when approved by the Engineer, temporarily store contaminated Soil on-site.
- Obtain Engineer's approval for storing contaminated Soil on the Project Site. Store contaminated Soil in covered water tight containers or place contaminated Soil on minimum 6 mil thick polyethylene sheeting that has an impermeable berm around the edge. Cover the contaminated Soil with minimum 6 mil thick polyethylene sheeting. Do not allow precipitation run-off to enter the excavated contaminated Soil. Label all stored material with the type of material, the contaminants, and the dates of accumulation.
- Remove contaminated media from the exterior of all vehicles before they leave the Project Site.
- Cover trucks transporting contaminated materials to prevent spillage during transit to the disposal facility according to OAR 340-093-0220.
- Where over excavation is required, backfill the excavation according to 00330.42.

00294.41 Contaminated Soil Management - Reuse, recycle, or dispose of contaminated Soil according to any of the following:

(a) Landfill Disposal for Contaminated Subsurface Soil:

- Obtain the Engineer's approval of the disposal facility before disposing of contaminated Subsurface Soil.
- Transport the contaminated Subsurface Soil to a DEQ permitted municipal solid waste landfill or a permitted construction and demolition landfill for disposal. Dispose

of temporarily stored contaminated Subsurface Soils within 30 Days of beginning excavation work or before Second Notification, whichever occurs first.

- Complete and sign all manifests and bill-of-lading forms for handling, loading, transporting, and disposing of the contaminated Subsurface Soil.
- Pay all filing and permit fees.

(b) Recycling:

- Obtain the Engineer's approval of the recycling facility before disposing of contaminated Soil.
- Transport contaminated Soil to a DEQ permitted recycling facility or asphalt batch plant. Recycle temporarily stored contaminated Soils within 30 days of beginning excavation or before Second Notification, whichever occurs first.
- Complete and sign all manifests and bill-of-Lading forms for handling, loading, transporting, and recycling contaminated Soil.

(e) Reuse Contaminated Shoulder Soil Under ODOT BUD No. BUD-20181204:

- Reuse of all contaminated Shoulder Soil shall follow the requirements of the DEQ Tier 3 Solid Waste Beneficial Use Determination Permit (BUD-20181204).
- Reuse contaminated Shoulder Soil according to Section 00236 at Disposal Site 1 as shown. Place contaminated Shoulder Soil as shown. Complete all off-site reuse of Shoulder Soil covered by ODOT BUD No. BUD-20181204 before Project completion.
- Transport and dispose all excess contaminated Shoulder Soil that is not reused within 30 Calendar Days of completing the Soil reuse Work, or before Second Notification, whichever occurs first, to a DEQ permitted municipal solid waste landfill or a permitted construction and demolition landfill (or a permitted recycling facility).

00294.43 Contaminated Groundwater Pumping - Remove and handle contaminated groundwater as follows:

- Allow the Agency to collect groundwater samples during pumping activities and subsequent storage.
- Remove contaminated groundwater from the Project Site or when approved temporarily store contaminated groundwater on-site in water tight containers compatible with the contaminants. Label each container with the contents and dates of accumulation.
- Dispose of stored contaminated groundwater within 30 Days from the date of beginning generation of it or before Second Notification, whichever occurs first, according to 00294.44.

00294.44 Contaminated Groundwater Management - Recycle or dispose of contaminated groundwater according any of the following:

- **Discharge to a Permitted Sanitary Sewer Facility:**
    - Submit all groundwater analytical data and proposed treatment information to the local sewer authority, and obtain written permission or a permit to discharge the contaminated groundwater to the sanitary sewer system.
    - Complete and sign the sewer permit application as the applicant and pay all associated fees.
    - Comply with all permit requirements and all other local sewer authority requirements.
- **Discharge to Surface Water or Storm Sewer:**
    - Register for a general National Pollution Discharge Elimination System (NPDES) permit 1500A.
    - Complete and sign the NPDES permit application as the applicant and pay all associated fees.
    - Comply with all permit requirements.
- **Discharge to ground surface for Infiltration:**
    - Register for a Water Pollution Control Facility (WPCF) permit 1500B.
    - Complete and sign the WPCF permit application as the applicant and pay all associated fees.
    - Comply with all permit requirements.
- **Transport to an Off-Site Recycling or Disposal Facility:**
    - Submit all groundwater analytical data to the receiving facility and obtain written acceptance from that entity.
    - Complete and sign bill-of-lading forms and all other documentation required by the receiving facility.
    - Pay all permit fees.

Measurement

00294.80 Measurement - Work performed under this Section will be measured according to the following:

No measurement of quantities will be made for the following:

- HASP.
- Lead compliance plan.
- Segregate contaminated Shoulder Soil.
- Contaminated groundwater mobilization.

Soil sample and analytical testing will be measured on the unit basis for each sample submitted and tested according to 00294.02 when test results are submitted according to 00294.03.

The quantities of contaminated Soil disposed will be measured on the weight basis, based on weigh tickets from the recycling or disposal facility.

The quantities of contaminated groundwater removed and disposed will be measured on the volume basis, per gallon, based on the receiving facility approved meter tickets or approved on-site meters.

Clearing and grubbing will be measured according to 00320.80.

Payment

00294.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

	Pay Item	Unit of Measurement
(a)	Health and Safety Plan	Lump Sum
(b)	Lead Compliance Plan	Lump Sum
(c)	Segregate and Stockpile Contaminated Shoulder Soil	Lump Sum
(d)	Soil Sample Collection and Analytical Testing	Each
(e)	Contaminated Subsurface Soil Disposal	Ton
(f)	Contaminated Groundwater Mobilization	Lump Sum
(g)	Contaminated Groundwater Removal	Gallon

Item (c) includes segregating, handling, and stockpiling contaminated Shoulder Soil for the purpose of analytical testing, on-site reuse, or disposal.

Item (d) includes mobilization, Soil sampling, testing, analyses, and preparation of reports for tests required in 00294.02. Additional testing beyond that listed in 00294.02 will only be paid if authorized by the Engineer.

Item (e) includes all costs involved with the disposal of contaminated Subsurface Soil at a recycling or disposal facility.

Item (f) includes all mobilization costs for groundwater removal work.

Item (g) includes obtaining all permits and furnishing all Equipment and labor necessary to treat and store contaminated groundwater.

No separate or additional payment will be made for the excavation or reuse of contaminated Soil or contaminated shoulder soil. Payment will be included in payment made for the appropriate items under which the excavation or reuse of contaminated Soils or contaminated shoulder soil is required.

Clearing and grubbing will be paid for according to 00320.90.

Payment will be payment in full for removing and disposing of all Materials, and for furnishing all Equipment, labor, Plans, test results, and Incidentals necessary to complete the Work as specified.

SECTION 00295 - ASBESTOS MATERIALS

Section 00295, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00295.00 Scope - In addition to the requirements of Section 00290, remove asbestos according to the following Specifications.

Remove asbestos from the following locations in Table 00295-1:

Table 00295-1

Location/Address	Material Description	Quantity	Percent Asbestos	Friable or Non-Friable
Bridge No. 9454 – Hall Blvd Overcrossing (South)	Silver sealant on the washers of some bolts connecting the metal railing on the east side of the sidewalk to the concrete parapet	144 bolts	6% chrysotile	Friable
Bridge No. 9671 – Hall Blvd Overcrossing (North)	Easternmost rail bracket, gray rubbery gasket between rail base and concrete barrier	34 braces, each 6” by 9” (13 square feet total)	5% chrysotile	Friable
Bridge No. 9671 – Hall Blvd Overcrossing (North)	Tan crumbly material with debris between some rail braces and concrete barrier		8% chrysotile	Friable
Bridge No. 9671 – Hall Blvd Overcrossing (North)	Gray brittle caulk under some rail bolts	270 bolts	8% chrysotile	Friable
Bridge No. 9671 – Hall Blvd Overcrossing (North)	Beige painted patching mortar on a small damaged area near west end of concrete barrier	20 square feet	2% chrysotile	Friable

The September 2019 Wood report, titled *Bridge Inspection Survey: Lead-Based Paint and Asbestos-Containing Materials, Southbound Highway 217 Bridge Crossings, MP 2.6, 2.8, 3.0 and 5.6, Beaverton to Tigard, Oregon, Project # 861M134960.2 / ODOT Contract B35977* documenting the asbestos identified within the Project is available from the Engineer. Maintain a copy of this report and all additional asbestos survey results on site at all times and readily available to employees and inspectors during demolition and repair activities.

00295.03 Submittals - The following forms and reports are required:

- Completed and signed DEQ Project Notification Form and an abatement plan to Agency and DEQ at least 10 Calendar Days before beginning friable asbestos removal.

- Completed and signed DEQ Waste Shipment Report Form according to the following:
  - Send the form along with the asbestos waste to the disposal facility.
  - Provide a copy of the form to the Engineer within 48 hours of transportation of the asbestos waste.
  - Obtain the final signed form from the disposal facility along with the disposal receipts and submit them to the Engineer within 3 Calendar Days after receiving them from the waste disposal facility.

Labor

00295.30 Personnel Qualifications - Provide employees meeting the following requirements:

Ensure the DEQ Certified Supervisor is on site and overseeing work whenever asbestos containing materials are disturbed or removed.

- Workers trained according to 29 CFR 1926.1101.

Construction

00295.40 Asbestos Removal - Comply with 29 CFR 1910, 29 CFR 1926.1101, 40 CFR 61, 40 CFR 763, OAR 340-248, ORS 468A and the following:

- Complete and sign all manifests and bill-of-lading forms for transporting and disposing the ACM.
- Maintain the ACM in an undamaged and non-friable condition by keeping the material wet during demolition or by using methods approved by DEQ.
- Keep material sealed during transport to the disposal facility. Transport and dispose of all ACM according to OAR 340-248-280 and OAR 340-248-290.

Measurement

00295.80 Measurement - .No measurement of quantities will be made for removing asbestos containing Materials performed under this Section.

Payment

00295.90 Payment - The accepted quantities of removing asbestos containing Materials will be paid for at the Contract lump sum amount for the item "Remove Asbestos Materials".

Payment will be payment in full for furnishing all Equipment, Labor, and Incidentals necessary to complete the Work as specified.

SECTION 00296 - PAINT AND PAINTED MATERIALS

Section 00296, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00296.00 Scope - In addition to the requirements of Section 00290, remove materials coated with lead, chromium, and cadmium based paints, according to the following Specifications.

Paint coatings containing lead and chromium are present on concrete on Bridge No.'s 16134, 16143, 09457/09457A, 09454, and 09671. Analysis of paint samples collected from concrete surfaces detected concentrations of total lead, cadmium and chromium as indicated in Table 00296-1 below:

Table 00296-1

Sample Location and Material	Total Lead (mg/kg)	Total Chromium (mg/kg)	Total Cadmium (mg/kg)
Bridge No. 16134, Allen Blvd Tan and gray paint from abutments on west side	85.5	125	ND (<13.3)
Bridge No. 16134, Allen Blvd Tan and blue paint from abutments on west side	ND (<11.3)	ND (<14.6)	ND (<14.6)
Bridge No. 16134, Allen Blvd Gray paint from abutment on east side	ND (<12.4)	ND (<16.3)	ND (<16.3)
Bridge No. 16143, Denney Rd Off-white paint on west side bridge abutment	ND (<13.6)	14.6	ND (<8.36)
Bridge No. 16143, Denney Rd Off-white paint on east side bridge abutment	18.9	ND (<13.6)	ND (<13.6)
Bridge No. 09457/09457A, Fanno Creek Off-white/gray paint on southwest abutment	ND (<9.77)	14.6	ND (<11.2)
Bridge No. 09457/09457A, Fanno Creek Off-white/gray paint on east side abutment	12.9	ND (<12.0)	ND (<12.0)
Bridge No. 09454, Hall Blvd (South) Gray paint on west side abutment	46.1	ND (<10.7)	ND (<10.7)
Bridge No. 09454, Hall Blvd (South) Gray paint on east side abutment	95.5	ND (<15.0)	ND (<15.0)
Bridge No. 09671, Hall Blvd (North)** Gray/tan paint on concrete barrier (northeast)	544	58.4	ND (<11.4)
Bridge No. 09671, Hall Blvd (North)** Gray/tan paint on concrete barrier (center)	820	20.7	ND (<12.2)
Bridge No. 09671, Hall Blvd (North)** Gray/tan paint on concrete barrier (west)	63.2	ND (<16.5)	ND (<16.5)
Bridge No. 09671, Hall Blvd (North)** Tan with red base layer on concrete barrier (west)	20.7	ND (<12.7)	ND (<12.7)

ND = not detected above the laboratory detection limit.
** Mortar patches on Bridge No. 09671 concrete barrier have tested positive for asbestos (see Section 00295)

Lead and cadmium based paint coats the steel super structure on Bridge No. 09454. Analysis of paint samples collected from steel girders detected the concentrations of total lead, cadmium, and chromium indicated in Table 00296-3 below:

Table 00296-3

Sample Location and Material	**Total Lead (mg/kg)**	**Total Chromium (mg/kg)**	**Total Cadmium (mg/kg)**
Bridge No. 09454, Hall Blvd (South) Outer steel girder	190,000	ND (<14.6)	62.5
Bridge No. 09454, Hall Blvd (South) Steel girder	354,000	ND(<15.9)	37.8

ND = not detected above the laboratory detection limit.

The reports documenting these analyses - *Bridge Inspection Survey: Lead-Based Paint and Asbestos-Containing Materials (Wood, 2019)* and *Steel Girder Paint Results, Bridge No. 9454 (ODOT, 2021)* are available from the Engineer.

Unless otherwise tested, assume that all coatings contain lead, chromium, and cadmium and handle paint and painted materials accordingly during demolition.

00296.03 Submittals - Submit the following documents:

- A job specific written compliance program, according to 29 CFR 1926.62(e)(2), at least 10 Calendar Days before the pre-construction conference. When applicable, include compliance procedures for cadmium and chromium VI, according to 29 CFR 1926.1127 and 29 CFR 1926.1126.
- Modifications to the written compliance program within 7 Calendar Days of the modifications.
- Current employee training certificates and medical surveillance information before beginning work that disturbs paint containing lead, cadmium or chromium.
- Within 48 hours of completing or receiving them:
  - Disposal and recycling facility permits.
  - Transport manifests and bill-of-ladings.
  - All reuse, recycling, and disposal receipts.
  - All analytical test results.

00296.04 Documentation - Include paint and painted materials management and planned reuse, recycling, and disposal information in the pollution control plan. Obtain Engineer approval for the specific reuse, recycling, and disposal methods for all materials before beginning demolition work.

Complete, sign and pay all required fees for all required permits, manifests, and bill-of-lading forms for transport and disposal of the paint and painted materials.

Labor

00296.30 Personnel Qualifications - Provide employees trained in lead awareness, according to 29 CFR 1926.62(l), and also trained according to 29 CFR 1926.1126(j)(2) for chromium and 29 CFR 1926.1127(m)(4) for cadmium, during demolition of painted portions of the structures.

Construction

00296.40 Handling - Minimize employee exposure to the metals contained in the paint. Provide containment that prevents release of paint chips to the environment. Do not remove or separate paint from painted substrates, unless required to accomplish repair activities.

00296.42 Painted Concrete Debris Management – Remove patches of asbestos-containing mortar on Bridge No. 09671 concrete barrier prior to recycling as painted concrete. See Section 00295. Reuse, recycle, or dispose of painted concrete debris according to any of the following:

- **Recycle as New Concrete -** Recycle the concrete into new concrete on site or at an off-site fixed facility. Only use concrete containing recycled concrete debris on the Project when testing demonstrates that the mix meets applicable design standards for the intended use and is acceptable to the Engineer. Before beginning on-site crushing, obtain permits required under OAR 340-216-0020 and comply with all the permit conditions.

  When providing painted concrete to others, obtain the recipients signature on the attached disclaimer form acknowledging their awareness of laboratory test results for chromium, cadmium and lead before giving them possession.

- **Recycle as Aggregate -** Use as aggregate within the road prism or embankment, only when:

  - The concrete debris meets the applicable design standards for the intended use.
  - It is placed on the project where allowed by the Engineer.
  - It is placed at least 4 feet above the mean high groundwater table.
  - It is placed more than 50 feet from all surface water body and sensitive environment areas.
  - It will be paved over or will be covered with least one foot of clean fill material.

00296.43 Painted Metal Management - Reuse, recycle, or dispose of painted metal according to any of the following:

- **Reuse by Others -** Provide or sell painted non-structural scrap metal to the following:

  - Provide to ODOT for use on other projects.
  - Provide to ODOT Maintenance Section.
  - Provide or sell to other government Agencies.
  - Provide or sell to contractors for their reuse.

Obtain the recipients signature on the attached disclaimer form, acknowledging their awareness that the scrap metal contains lead, chromium, and cadmium based paint before giving them possession.

- **Recycle at Recycling Facility -** Transport the painted scrap metal along with the paint analytical results to a recycling facility. Obtain the recipients signature on the attached disclaimer form, acknowledging their awareness that the scrap metal contains lead, chromium and cadmium based paint.

00296.45 Non-Hazardous Waste Paint Management - When non-hazardous paint is separated from its substrate, contain all the paint waste and dispose of it at a permitted municipal solid waste landfill.

00296.46 Hazardous Waste Paint Management - When hazardous waste paint is separated from its substrate, store all the separated paint waste in labeled, sealed, watertight containers and handle the hazardous waste according to 00290.20(d).

Measurement

00296.80 Measurement - No measurement of quantities will be made for recycling or disposing of painted concrete.

No measurement of quantities will be made for reusing, recycling, or disposing of painted metal.

Payment

00296.90 Payment - No separate or additional payment will be made for Work performed under this Section. Payment will be included in payment made for the appropriate items under which this Work is required.

Attachment A
Lead, Chromium, and Cadmium Based Paint Acknowledgement Form

[Contractor] ______________________
[Bridge Identification or Material Location] ______________________
[Description of Scrap (indicate Metal, Concrete or Other)] ____________________

______________ [Recipient] acknowledges that they are aware that metal, concrete, or other materials received from ________________ [Contractor] on ______________ [Date(s)] may contain paint with lead, chromium, or cadmium. Recipient further acknowledges that it is aware of the risk to human health and the environment posed by exposure to lead, chromium and cadmium based paint. All storage, use, sale, and disposal of materials containing lead, chromium or cadmium based paint and any removal of lead, chromium, or cadmium based paint from the materials by Recipient will be conducted in compliance with all applicable Federal and State statutes and regulations, including but not limited to 40 CFR 262 through 265 and OAR Chapter 340, Divisions 100 through 106. Recipient acknowledges that they are solely responsible for any liability or damages resulting from the storage, use, sale, and disposal of the materials and removal of lead, chromium or cadmium based paint by Recipient and Recipient will indemnify and hold harmless the Contractor and the Oregon Department of Transportation from any such claims of liability or damages.

_________________________ [Signature]
_________________________ [Title]
_________________________ [Date]

SECTION 00297 - PCB AND MERCURY CONTAINING EQUIPMENT

Section 00297, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00297.00 Scope - In addition to the requirements of Section 00290 and the Specifications, this Work consists of removing and disposing of the following if required for this Project:

- Polychlorinated biphenyls (PCB) lamp ballasts containing PCB at concentrations greater than 50 ppm.
- Non-PCB lamp ballasts manufactured after July 1979 and labeled as containing less than 50 ppm PCB.
- Electrical transformers containing fluid of unknown PCB concentration.
- High intensity discharge (HID) lamps that may contain mercury.
- Fluorescent lamp tubes that may contain mercury.
- Mercury or PCB containing items.

00297.03 Submittals - Submit the following documents within 48 hours of completing or receiving them:

- Waste characterization and sample analytical data.
- Bill-of-ladings, manifests, disposal and recycling receipts, and destruction certificates.

Labor

00297.30 Personnel Qualifications - Provide employees that handle waste lamps meeting the training requirements of 40 CFR 273.16.

Construction

00297.40 PCB Lamp Ballasts - Comply with OAR 340-110, 40 CFR 761, and the following:

- Assume lamp ballasts contain potting materials with a PCB concentration greater than 50 ppm.
- Disconnect and remove the ballasts and store them at a secure location in a sealed, labeled container.
- Remove from site and dispose of within 30 Days of beginning disconnection work or before Second Notification, whichever occurs first.
- Dispose of as a PCB bulk product waste in a Toxics Substances Control Act (TSCA) approved disposal facility or other EPA approved disposal method.
- Complete and sign all manifests and bill-of-lading forms for transporting and disposing of lamp ballasts as the "offeror".

00297.41 Non-PCB Lamp Ballasts - Comply with OAR 340-110, 40 CFR 761, and the following:

- Confirm PCB content labeling indicates less than 50 ppm PCBs. If labeling is not present, remove and dispose of lamp ballasts according to 00297.40.
- Determine if small capacitors are present and if they are broken or leaking.
  - If the capacitor is not broken or not leaking, dispose of it according to this subsection.
  - If the capacitor is broken or leaking and does not have a label or has a label showing a PCB level of 50 ppm or more, dispose of it according to 00297.40.
  - If the capacitor is broken or leaking and has a label showing a PCB level of less than 50 ppm, dispose of it according to this subsection.
- Disconnect and remove the ballasts and store them in a secure location in a sealed, labeled container.
- Remove from site and dispose of within 30 Days of beginning disconnection work or before Second Notification, whichever occurs first.
- Dispose of as solid waste in a DEQ permitted municipal solid waste landfill, in a TSCA approved disposal facility, or other EPA approved disposal method.
- Complete and sign all required manifests and bill-of-lading forms for transporting and disposing of lamp ballasts.

00297.42 Electrical Transformers - Comply with OAR 340-110, 40 CFR 761, and the following:

- Perform a waste characterization for the transformer fluid according to 00290.20(c).
- Disconnect transformers and store them in a secure location in sealed, labeled containers, with secondary containment sufficient to contain the entire contents of the largest transformer in the containment.
- Dispose of transformer and fluids according to the options provided in 40 CFR 761.60, within 30 Days of beginning disconnection work or before Second Notification, whichever occurs first.
- Complete and sign all required manifests and bill-of-lading forms for transporting and disposing of transformers and sign the manifests, as the offeror.

00297.43 Mercury Lamps - Comply with 40 CFR 273, OAR 340-113, and the following:

- Place all waste lamps in closed, labeled, structurally sound and compatible containers that are sufficient to prevent lamp breakage.
- Transport waste lamps to a DEQ registered universal waste destination facility within 60 Days of beginning removal from fixtures or before Second Notification, whichever occurs first.

Measurement

00297.80 Measurement - No measurement of quantities will be made for Work performed under this Section.

Payment

00297.90 Payment - No separate or additional payment will be paid for Work performed under this Section. Payment will be included in payment made under the appropriate method described in 00950.90.

SECTION 00298 - WELL PRESERVATION AND ABANDONMENT

Section 00298, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00298.00 Scope - In addition to the requirements of Section 00290, protect, preserve, and abandon monitoring wells and water wells according to the following:

Protect and preserve the monitoring well indicated in Table 00298-1 below:

Table 00298-1

Location/Station	Type	Depth below grade (feet)	Diameter (inches)	Other Well Design Information	Known Contaminants
"C" Line / 293+37, 145' Rt	Monitoring Well	120'	2"	Contact Landau Associates (971) 235-3025)	None

Construction

00298.40 Protect and Preserve Wells - Protect and preserve the well during construction. Adjust the well to finished grade with traffic rated metal cover. Notify the Engineer at least 72 hours before beginning work at or near the well. Keep the well capped. Do not allow foreign matter to enter the well.

Measurement

00298.80 Measurement - No measurement of quantities will be made for Work performed under this Section.

Payment

00298.90 Payment - The accepted quantities of Work performed under this Section will be paid for at the Contract lump sum amount for the following item:

	Pay Item	**Unit of Measurement**
(a)	Protect Monitoring Wells	Lump Sum

Payment will be payment in full for furnishing and placing all Materials, and for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

SECTION 00305 - CONSTRUCTION SURVEY WORK

Comply with Section 00305 of the Standard Specifications modified as follows:

00305.00 Scope - Add the following to the end of this subsection:

In addition to the requirements of the ODOT *Construction Surveying Manual for Contractors*, establish Engineering Stationing at 100 foot intervals for the length of the project along the shoulder of the highway. Maintain the stationing so it is visible throughout construction of the project.

SECTION 00310 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

Comply with Section 00310 of the Standard Specifications modified as follows:

00310.41(c) Drainage Structures - Add the following:

Remove the entire drainage Structure where removal of inlets or removal of manholes is shown.

00310.90 Payment - Add the following to the end of this subsection:

No separate or additional payment will be made for removal or disposal Work included in Section 00330 according to 00310.02.

00310.92 Separate Item Basis - Add the following Pay Items to the Pay Item list:

(j)	Removal of Guardrail	Foot
(k)	Removal of Fences	Foot

SECTION 00320 - CLEARING AND GRUBBING

Comply with Section 00320 of the Standard Specifications modified as follows:

SECTION 00490 - WORK ON EXISTING SEWERS AND STRUCTURES

Comply with Section 00490 of the Standard Specifications.

SECTION 00495 - TRENCH RESURFACING

Comply with Section 00495 of the Standard Specifications.

SECTION 00501 - BRIDGE REMOVAL

Comply with Section 00501 of the Standard Specifications modified as follows:

00501.00 Scope - Add the following paragraphs to the end of this subsection:

Remove the existing bridge (Bridge No. 09454) Hwy 141 at MP 4.72 over Hwy 144.

Remove portions of the existing bridge (Bridge No. 09457) Hwy 144 over Fanno Cr as shown.

Remove portions of the existing bridge (Bridge No. 09519) Hwy 1W over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 09565) SW 72nd Ave over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 09671) Hwy 141 over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 13074A) Hwy 144 (Conn 144AX) over Fanno Cr to SW Denny Rd as shown.

Remove portions of the existing bridge (Bridge No. 16134) SW Allen Blvd over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 16143) SW Denney Rd over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 23872) Hwy 144 (Conn 144AW) to SW Denney Rd as shown.

Remove portions of the existing bridge (Bridge No. 23873) SW Denney Rd to Hwy 144SB (Conn 144AY) as shown.

Remove portions of the existing bridge (Bridge No. 23874) Hwy 144 (Conn 144AP) to SW Allen Blvd as shown.

Remove portions of the existing bridge (Bridge No. 23875) SW Allen Blvd to Hwy 144 (Conn 144AR) as shown.

Remove portions of the existing bridge (Bridge No. 09672) Hwy 143 over Hwy 144 as shown.

Remove portions of the existing bridge (Bridge No. 13574) SW Greenburg Rd over Hwy 144 as shown.

Add the following subsection:

00501.02 Plans - Plans of the existing structure are available for viewing at the office of the Engineer. Prints of these plans are available upon request.

Add the following subsection:

00501.03 Submittals - Submit stamped bridge removal plans according to 00150.35 30 Calendar Days before beginning removal work.

Include the following information in the submittal:

- Removal sequence, including contractor staging and traffic staging.
- Detailed schedule of bridge removal work.
- Type of equipment that will be used, including size and capacity.
- Equipment location during removal operations.

Do not begin bridge removal work until the bridge removal plans have been approved.

00501.90 Payment - Replace this subsection, except for the subsection number and title, with the following:

The accepted quantities of Bridge removal Work will be paid for at the Contract lump sum amount for the item "Bridge Removal Work, _____".

The Bridge Number will be inserted in the blank.

Payment will be payment in full for furnishing all Equipment, labor, and Incidentals necessary to complete the Work as specified.

SECTION 00503 - BRIDGE DECK COLD PLANE PAVEMENT REMOVAL

Comply with Section 00503 of the Standard Specifications modified as follows:

00503.20 Equipment for Grinding on Bridge Decks - Add the following to the paragraph that begins " To remove Pavement from bridge decks…":

Limit the gross operational weight of machines to comply with the load limitations of 00220.45. Limit machines to a forward speed of 2.5 feet per minute. Operate at a drum speed of at least 120 RPM.

SECTION 00504 - CONCRETE DECK SURFACE PREPARATION

Comply with Section 00504 of the Standard Specifications modified as follows:

Add the following subsection:

00504.40(h) Taper Grind Deck Concrete - Perform taper grind of deck concrete to facilitate PPC placement, as shown. Use diamond grinding equipment conforming to 00504.21(b)(1). Do not allow traffic on ground concrete surface.

00504.90 Payment - Add the following Pay Item:

(g) Taper Grind Deck Concrete .... Square Yard

SECTION 00510 - STRUCTURE EXCAVATION AND BACKFILL

Comply with Section 00510 of the Standard Specifications modified as follows:

00510.04(a) Defined Shoring Systems - Add the following to the end of this subsection:

Construct shoring at the locations listed below:

Beginning Station	Ending Station	Shoring System Type(s) Allowed
"AD2" Station 220+90 Lt	"AD2" Station 221+20 Lt	All
"C" Station 379+96 Lt	"C" Station 380+56 Lt	All
"CD" Station 248+48 Lt	"CD" Station 248+73 Lt	All
"CD" Station 249+40 Lt	"CD" Station 249+48 Lt	All
"CD" Station 250+20 Lt	"CD" Station 250+28 Lt	All
"DB3" Station 256+35 Lt	"DB3" Station 256+65 Lt	All
"HN" Station 106+66 Lt	"HN" Station 106+92 Lt	All
"HN" Station 109+28 Lt	"HN" Station 109+62 Lt	All
"CD" Station 243+47 Rt Offset 39.2 feet	"CD" Station 243+92 Rt Offset 38.6 feet	5B
"CD" Station 244+54 Rt Offset 38.6 feet	"CD" Station 244+97 Rt Offset 39.3 feet	5B
"CD" Station 243+43 Lt Offset 19.3 feet	"CD" Station 243+86 Lt Offset 19.6 feet	All
"CD" Station 244+45 Lt Offset 20 feet	"CD" Station 244+90 Lt Offset 19.3 feet	All
"CD" Station 243+92 Rt Offset 38.6 feet	"CD" Station 243+86 Lt Offset 19.6 feet	All
"CD" Station 244+54 Rt Offset 38.6 feet	"CD" Station 244+45 Lt Offset 20 feet	All

00510.80(b)(1) Lump Sum - Add the following to the end of this subsection:

The estimated quantity of structure excavation is:

Location	Structure Excavation (Cubic Yard)
Bridge No. 09457	3
Bridge No. 09671	330
Bridge No. 23235	120
Bridge No. 23872 Bent DA1, DA2, DA3	138
Bridge No. 23873 Bent DB5	65
Bridge No. 23874 Bent AA1	7
Bridge No. 23901	1310
Retaining Wall No. 23939	850
Retaining Wall No. 23940	454
Retaining Wall No. 23941	478

00510.80(d)(1) Lump Sum - Add the following to the end of this subsection:

The estimated quantities of granular wall backfill and granular structure backfill are:

Location	Granular Wall Backfill (Cubic Yard)	Granular Structure Backfill (Cubic Yard)
Bridge No. 09457	0	4
Bridge No. 09671	45	0
Bridge No. 21847	0	6
Bridge No. 23235	0	350
Bridge No. 23872 Bent DA1, DA2, DA3	117	0
Bridge No. 23873 Bent DB5	42	5
Bridge No. 23874 Bent AA1	5	10
Bridge No. 23901	0	1150

COFFERDAM DESIGN CHECKLIST

Instructions - This cofferdam design checklist was developed to facilitate the design, review, and erection of cofferdams to be used for ODOT bridge construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed and signed by the cofferdam design engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit the Checklist according to 00510.03.

		YES	NO	N/A
A.	**Contract Plans, Specifications, Permits, etc.**			
1.	Are the cofferdam Working Drawings prepared, stamped and signed by an engineer registered to practice in Oregon?	____	____	____
2.	Have three copies (five copies if railroad approval is required) of the complete design calculations accompanied the cofferdam drawings submittal?	____	____	____
3.	Are cofferdam Working Drawings in compliance with the requirements of the construction plans general notes?	____	____	____
4.	Are cofferdam Working Drawings in compliance with contract plan structural details?	____	____	____
5.	Are cofferdam Working Drawings in compliance with the requirements of the Oregon Standard Specifications for Construction, subsection 00150.35?	____	____	____
6.	Are all existing, adjusted or new utilities in proximity with the proposed cofferdam shown on the cofferdam Working Drawings and is projection of these utilities addressed?	____	____	____
7.	Are clearance requirements satisfied and shown on the cofferdam Working Drawings?	____	____	____
B.	**Loads**			
1.	Are the magnitude and location of all loads, equipment and personnel that will be supported by the cofferdam shown noted on the cofferdam Working Drawings?	____	____	____
2.	Are design loads and material properties used to determine design stresses shown for each different cofferdam member shown on the cofferdam Working Drawings?	____	____	____
3.	Is the assumed water elevation for seal design shown on the Working Drawings?	____	____	____

4. Does the cofferdam design assume water pressure acts on the full height of the cofferdam (from the vent to the bottom of the excavation?) ____ ____ ____

5. Has percolation into the excavation been addressed? ____ ____ ____

C. Allowable Stresses

1. Have the design loads used for cofferdam design of all members been noted in the design calculations? ____ ____ ____

2. Are the allowable stress and the calculated stress listed in the summary for each different cofferdam member? ____ ____ ____

D. Timber Construction

1. Are timber grades consistent with material to be delivered to the construction site, noted on the cofferdam drawings, and in accompanying calculations for all timber cofferdam material? ____ ____ ____

2. If "rough" lumber is specified for the cofferdam, are the actual lumber dimensions used in the calculations shown? ____ ____ ____

E. Steel Construction

1. Are steel structural shapes and plates identified by ASTM number on the cofferdam Working Drawings and in the calculations? ____ ____ ____

2. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? ____ ____ ____

F. Compression Members, Bracing Members and Connections

1. Has general buckling been evaluated for all compression members? ____ ____ ____

2. Has bracing been provided at all points of assumed support for compression members? ____ ____ ____

3. Is bracing strength and stiffness sufficient for the intended purpose? ____ ____ ____

4. Have all connections been designed and detailed? ____ ____ ____

________________________________ ________________________

Designer Engineer of Record Signature Date

SHORING DESIGN CHECKLIST

Instructions - This shoring design checklist was developed to facilitate the design, review, and erection of shoring to be used for ODOT construction projects. This checklist is intended to act as a reminder to design or check for specific important aspects of this construction. It is not a substitute for plan and/or design criteria or specification requirements.

The Checklist is to be completed by the shoring design engineer. Answer every question. Attach to the Checklist an explanation of any negative responses.

Submit this Shoring Design Checklist for each stage and phase of the project, along with the shoring design summary, Working Drawings and calculations according to 00510.04.

	YES	**NO**	**N/A**
A. General			
1. Are the shoring Working Drawings and supporting calculations prepared, stamped, and signed by an engineer registered to practice in the state of Oregon?	____	____	____
2. Are the temporary shoring installation plans, construction sequence, and removal plan compatible with the project construction staging/phasing?	____	____	____
B. Design Standards			
1. Does the shoring design comply with standards identified in ODOT GDM 15.3.26.3 and related sections?	____	____	____
2. Is the design standard and edition identified in the shoring design calculations?	____	____	____
C. Loading			
1. Have the design loads, including special loading conditions (e.g. cranes, stockpiles, etc.), used for shoring design of all members been noted in the design calculations?	____	____	____
2. Have the appropriate load and resistance factors or factors of safety on the shoring system been identified, for all applicable load combinations or load cases?	____	____	____
3. If public traffic is near or directly above the shoring system, has a minimum traffic live load surcharge of 250 psf been applied?	____	____	____
4. Have the loads from actual construction equipment and not less than 250 psf been included in the shoring system design?	____	____	____
	____	____	____

5. Have the construction loads for different stages of construction been considered and included in the calculations? ____ ____ ____

6. Have the effects of any construction activities adjacent to the shoring system on the stability/performance of the shoring system been addressed in the shoring design (e.g., excavation or soil disturbance in front of the wall or slope, excavation dewatering, vibrations and soil loosening due to soil modification/construction activities)? ____ ____ ____

7. Have earth pressure diagrams been included? ____ ____ ____

8. Does the shoring design consider the effect of water saturated soil pressure acting on the full height of the shoring? ____ ____ ____

D. Geotechnical and Structural Analysis

1. Has internal stability been evaluated? ____ ____ ____

2. Has eccentricity/overturning stability been evaluated? ____ ____ ____

3. Has sliding been evaluated? ____ ____ ____

4. Has overall/global stability been evaluated? ____ ____ ____

5. Has bearing capacity been evaluated? ____ ____ ____

6. Have displacement constraints or other performance objectives of the shoring system been identified and evaluated? ____ ____ ____

7. Has each stage of the shoring system construction been evaluated to carry traffic and construction loads and ensure internal and external stability through the construction and loading sequence? ____ ____ ____

8. Are the allowable stress and the calculated stress listed in the summary for each different shoring member? ____ ____ ____

9. Have steel beams been checked for bending, shear, web crippling and buckling of the compression flange? ____ ____ ____

10. Have connections for all phases of construction and removal been designed for all interim loading? ____ ____ ____

11. Has buckling, bracing strength, and stiffness been evaluated for all compression members? ____ ____ ____

E. Materials

1. Are all soil, rock, and other material properties used for the design of the shoring system provided and consistent with GDM and the subsurface field and lab data? ____ ____ ____

2. Are timber grades noted on shoring drawings and in accompanying calculations? ____ ____ ____

3. Are the minimum lumber dimensions shown in the calculations and noted on the Working Drawings? ____ ____ ____

4. Are steel structural shapes, bolts, connections, and plates identified by ASTM number on the shoring Working Drawings and in the calculations? ____ ____ ____

F. Shoring Working Drawings

1. Is the field verified ground topography above and below the shoring wall shown? ____ ____ ____

2. Are all existing, adjusted or new utilities, structures, and “no work zones” in proximity to the proposed shoring shown on the shoring Working Drawings and is protection of these items addressed? ____ ____ ____

3. Are horizontal and vertical clearance requirements identified and shown on the shoring Working Drawings? ____ ____ ____

4. Are plan view, elevation and cross sections drawn to scale, with dimensions defining location and size of the temporary shoring, components, and excavation limits? ____ ____ ____

5. Are the magnitude and location of all loads, equipment and personnel that will be supported by the shoring shown or noted on the shoring Working Drawings? ____ ____ ____

6. Has a dewatering plan been shown? ____ ____ ____

7. Have all connections been detailed? ____ ____ ____

8. Has bracing been detailed? ____ ____ ____

G. Testing and Monitoring

1. If a “yes” response to No. D-6, is a monitoring plan provided to verify adequate performance of the shoring system throughout the design life of the system? ____ ____ ____

2. Has a load testing program been provided for soil nails, tiebacks, or other applicable elements of the shoring system ____ ____ ____

______________________________ Design Engineer of Record Signature

______________________ Date

SECTION 00512 - DRILLED SHAFTS

Comply with Section 00512 of the Standard Specifications modified as follows:

00512.80(d) Drilled Shaft Concrete - Add the following at the end of this subsection:

The estimated quantity of drilled shaft concrete is:

Structure	**Quantity (Cubic Yard)**
Bridge No. 09671	37
Bridge No. 23235	18
Bridge No. 23873	315
Bridge No. 23874	241
Bridge No. 23901	287

00512.80(e) Drilled Shaft Reinforcement - Add the following at the end of the paragraph:

The estimated quantity of drilled shaft reinforcement is:

Structure Number	Uncoated Reinforcement Quantity (Pound)		
	Grade 60	Grade 80	Grade 100
Bridge No. 09671	7,050	0	0
Bridge No. 23235	9,600	0	0
Bridge No. 23873	74,564	0	0
Bridge No. 23874	56,716	0	0
Bridge No. 23901	95,000	0	0

00512.90 Payment - Add the following to the end of this subsection:

No separate or additional payment will be made for falsework.

SECTION 00515 - MICROPILES

Section 00515, which is not a Standard Specification, is included in this Project by Special Provision.

Description

00515.00 Scope - This Work consists of designing, furnishing, constructing and testing micropiles at the locations shown and specified.

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
2720	0530-0104000A REINFORCEMENT, GRADE 60	LUMP SUM	ALL	6,000.00	6,000.00
2730	0530-0104100A COATED REINFORCEMENT, GRADE 60	LUMP SUM	ALL	500.00	500.00
2740	0540-0302000A GENERAL STRUCTURAL CONCRETE, CLASS 4000	LUMP SUM	ALL	95,000.00	95,000.00
2750	0545-0100000J REINFORCED CONCRETE BRIDGE END PANELS	SQYD	21.00	500.00	10,500.00
2760	0556-0300000J FURNISH MPCO MATERIAL	SQYD	898.00	30.00	26,940.00
2770	0556-0500000J CONSTRUCT MPCO	SQYD	898.00	28.00	25,144.00
2780	0585-0215000A PRECOMPRESSED FOAM SILICONE JOINT SEAL	LUMP SUM	ALL	2,500.00	2,500.00
2790	0587-0105000A 3 TUBE CURB MOUNT RAIL	LUMP SUM	ALL	15,000.00	15,000.00
2800	0587-0106000A 3 TUBE CURB MOUNT RAIL, MODIFIED	LUMP SUM	ALL	200,000.00	200,000.00
2810	0842-0401000E BRIDGE IDENTIFICATION MARKERS	EACH	1.00	200.00	200.00
2820	0930-0105000A BRIDGE STRUCTURE MOUNTS	LUMP SUM	ALL	18,000.00	18,000.00

SECTION 0011 BRIDGE NO. 09671 - HALL BLVD WIDENING

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
2830	0253-0106000A TEMPORARY WORK ACCESS AND CONTAINMENT, BR. NO. 09671	LUMP SUM	ALL	50,000.00	50,000.00
2840	0501-0100000A BRIDGE REMOVAL WORK, BR NO. 09671	LUMP SUM	ALL	150,000.00	150,000.00
2850	0503-0102000J BRIDGE DECK COLD PLANE PAVEMENT REMOVAL, 2-4 INCHES DEEP	SQYD	1,260.00	11.00	13,860.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)
KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
2860	0510-0100000A SHORING, CRIBBING, AND COFFERDAMS	LUMP SUM	ALL	45,000.00	45,000.00
2870	0510-0101000A STRUCTURE EXCAVATION	LUMP SUM	ALL	21,000.00	21,000.00
2880	0510-0106000A GRANULAR WALL BACKFILL	LUMP SUM	ALL	5,500.00	5,500.00
2890	0512-0100000A FURNISH DRILLING EQUIPMENT	LUMP SUM	ALL	25,000.00	25,000.00
2900	0512-0101000A DRILLED SHAFT CONCRETE	LUMP SUM	ALL	20,000.00	20,000.00
2910	0512-0104000A DRILLED SHAFT REINFORCEMENT, GRADE 60	LUMP SUM	ALL	20,000.00	20,000.00
2920	0512-0105000F CSL TEST ACCESS TUBES	FOOT	210.00	10.00	2,100.00
2930	0512-0106000E CSL TESTS	EACH	1.00	2,500.00	2,500.00
2940	0512-0112000F DRILLED SHAFT EXCAVATION, 72 INCH DIAMETER	FOOT	35.00	225.00	7,875.00
2950	0520-0100000A FURNISH PILE DRIVING EQUIPMENT	LUMP SUM	ALL	20,000.00	20,000.00
2960	0520-0113000F FURNISH HP 14 X 117 STEEL PILES	FOOT	647.00	105.00	67,935.00
2970	0520-0212000E DRIVE HP 14 X 117 STEEL PILES	EACH	24.00	2,000.00	48,000.00
2980	0520-0330000E REINFORCED PILE TIPS	EACH	24.00	300.00	7,200.00
2990	0520-0409000E HP 14 X 117 STEEL PILE SPLICES	EACH	2.00	250.00	500.00
3000	0530-0104000A REINFORCEMENT, GRADE 60	LUMP SUM	ALL	140,000.00	140,000.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3010	0530-0104100A COATED REINFORCEMENT, GRADE 60	LUMP SUM	ALL	7,500.00	7,500.00
3020	0540-0101000A FOUNDATION CONCRETE, CLASS 3300	LUMP SUM	ALL	25,000.00	25,000.00
3030	0540-0203100A DECK CONCRETE, CLASS HPC4500	LUMP SUM	ALL	225,000.00	225,000.00
3040	0540-0301000A GENERAL STRUCTURAL CONCRETE, CLASS 3300	LUMP SUM	ALL	225,000.00	225,000.00
3050	0540-0303000A GENERAL STRUCTURAL CONCRETE, CLASS 5000	LUMP SUM	ALL	50,000.00	50,000.00
3060	0550-0145000F 48 INCH PRECAST PRESTRESSED BOX BEAMS	FOOT	915.00	950.00	869,250.00
3070	0560-0109000A STRUCTURAL STEEL MAINTENANCE	LUMP SUM	ALL	20,000.00	20,000.00
3080	0584-0100000F ELASTOMERIC CONCRETE NOSING	FOOT	35.00	125.00	4,375.00
3090	0585-0215000A PRECOMPRESSED FOAM SILICONE JOINT SEAL	LUMP SUM	ALL	15,000.00	15,000.00
3100	0587-0108000A COMBINATION BRIDGE RAIL	LUMP SUM	ALL	80,000.00	80,000.00
3110	0587-0139000A RECTANGULAR TUBE RETROFIT	LUMP SUM	ALL	45,000.00	45,000.00
3120	0590-0100000J POLYMER MEMBRANE	SQFT	15,000.00	3.25	48,750.00
3130	0599-0100000J CONCRETE SLOPE PAVING	SQFT	1,650.00	16.00	26,400.00
3140	0599-0103000F SLOPE PAVING CURBS	FOOT	50.00	75.00	3,750.00
3150	0842-0401000E BRIDGE IDENTIFICATION MARKERS	EACH	4.00	200.00	800.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3160	0930-0105000A BRIDGE STRUCTURE MOUNTS, ITS SITE 7	LUMP SUM	ALL	24,000.00	24,000.00
3170	1050-0224000F 9 FOOT TYPE A PROTECTIVE FENCE	FOOT	195.00	490.00	95,550.00
3180	1999-9Z90000A WALKWAY PLATFORMS, ITS SITE 7	LUMP SUM	ALL	130,000.00	130,000.00
SECTION 0012 BRIDGE NO. 23235 - FANNO CREEK					
3190	0350-0105000J SUBGRADE GETOTEXTILE, BR NO. 23235	SQYD	370.00	5.00	1,850.00
3200	0360-0102000K GRANULAR DRAINAGE BLANKET, BR NO. 23235	CUYD	7.00	95.00	665.00
3210	0430-0100080F 8 INCH DRAIN PIPE, BR NO. 23235	FOOT	132.00	35.00	4,620.00
3220	0510-0100000A SHORING, CRIBBING, AND COFFERDAMS	LUMP SUM	ALL	150,000.00	150,000.00
3230	0510-0101000A STRUCTURE EXCAVATION	LUMP SUM	ALL	10,000.00	10,000.00
3240	0510-0108000A GRANULAR STRUCTURE BACKFILL	LUMP SUM	ALL	50,000.00	50,000.00
3250	0512-0101000A DRILLED SHAFT CONCRETE	LUMP SUM	ALL	10,000.00	10,000.00
3260	0512-0104000A DRILLED SHAFT REINFORCEMENT, GRADE 60	LUMP SUM	ALL	20,000.00	20,000.00
3270	0520-0100000A FURNISH PILE DRIVING EQUIPMENT	LUMP SUM	ALL	150,000.00	150,000.00
3280	0520-0139000F FURNISH PP 24 X 0.75 STEEL PILES	FOOT	1,916.00	270.00	517,320.00
3290	0520-0324000E DRIVE PP 24 X 0.75 STEEL PILES	EACH	24.00	3,000.00	72,000.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3300	0520-0329000E PILE LOAD TEST (DYNAMIC), BR NO. 23235	EACH	8.00	1,000.00	8,000.00
3310	0520-0435000E PP 24 X 0.75 STEEL PILE SPLICES	EACH	8.00	750.00	6,000.00
3320	0530-0104000A REINFORCEMENT, GRADE 60	LUMP SUM	ALL	175,000.00	175,000.00
3330	0530-0104100A COATED REINFORCEMENT, GRADE 60	LUMP SUM	ALL	2,000.00	2,000.00
3340	0540-0203100A DECK CONCRETE, CLASS HPC4500	LUMP SUM	ALL	350,000.00	350,000.00
3350	0540-0302000A GENERAL STRUCTURAL CONCRETE, CLASS 4000	LUMP SUM	ALL	300,000.00	300,000.00
3360	0540-0401000J SAW CUT TEXTURING	SQYD	530.00	6.00	3,180.00
3370	0545-0100000J REINFORCED CONCRETE BRIDGE END PANELS	SQYD	270.00	375.00	101,250.00
3380	0550-0136000F 18 INCH PRECAST PRESTRESSED SLABS	FOOT	400.00	575.00	230,000.00
3390	0550-0137000F 21 INCH PRECAST PRESTRESSED SLABS	FOOT	240.00	575.00	138,000.00
3400	0583-0202000F GRC CONDUIT SYSTEM, 2 INCH DIAMETER	FOOT	400.00	54.50	21,800.00
3410	0585-0206100A POURED JOINT SEAL	LUMP SUM	ALL	4,000.00	4,000.00
3420	0587-0105000A 3 TUBE CURB MOUNT RAIL	LUMP SUM	ALL	120,000.00	120,000.00
3430	0842-0401000E BRIDGE IDENTIFICATION MARKERS	EACH	1.00	200.00	200.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)
KERR CONTRACTORS OREGON LLC

SECTION 0013 BRIDGE NO. 23873 - SW DENNEY ROAD TO HWY 144SB (CON 144AY)

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3440	0253-0106000A TEMPORARY WORK ACCESS AND CONTAINMENT, BR NO. 23873	LUMP SUM	ALL	120,000.00	120,000.00
3450	0501-0100000A BRIDGE REMOVAL WORK, BR NO. 23873	LUMP SUM	ALL	350,000.00	350,000.00
3460	0503-0103000J BRIDGE END PANEL COLD PLANE PAVEMENT REMOVAL, 2-5 INCHES DEEP	SQYD	520.00	12.00	6,240.00
3470	0504-0100000J CLASS 2 PREPARATION	SQYD	17.00	300.00	5,100.00
3480	0510-0100000A SHORING, CRIBBING, AND COFFERDAMS	LUMP SUM	ALL	35,000.00	35,000.00
3490	0510-0101000A STRUCTURE EXCAVATION	LUMP SUM	ALL	6,000.00	6,000.00
3500	0510-0106000A GRANULAR WALL BACKFILL	LUMP SUM	ALL	8,000.00	8,000.00
3510	0510-0108000A GRANULAR STRUCTURE BACKFILL	LUMP SUM	ALL	1,500.00	1,500.00
3520	0512-0100000A FURNISH DRILLING EQUIPMENT	LUMP SUM	ALL	40,000.00	40,000.00
3530	0512-0101000A DRILLED SHAFT CONCRETE	LUMP SUM	ALL	25,000.00	25,000.00
3540	0512-0104000A DRILLED SHAFT REINFORCEMENT, GRADE 60	LUMP SUM	ALL	135,000.00	135,000.00
3550	0512-0105000F CSL TEST ACCESS TUBES	FOOT	1,923.00	7.00	13,461.00
3560	0512-0106000E CSL TESTS	EACH	4.00	1,275.00	5,100.00
3570	0512-0112000F DRILLED SHAFT EXCAVATION, 72 INCH DIAMETER	FOOT	301.00	225.00	67,725.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)
KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3580	0520-0100000A FURNISH PILE DRIVING EQUIPMENT	LUMP SUM	ALL	35,000.00	35,000.00
3590	0520-0127000F FURNISH PP 16 X 0.5 STEEL PILES	FOOT	390.00	100.00	39,000.00
3600	0520-0312000E DRIVE PP 16 X 0.5 STEEL PILES	EACH	6.00	2,500.00	15,000.00
3610	0520-0329000E PILE LOAD TEST (DYNAMIC), BR NO. 23873	EACH	2.00	1,000.00	2,000.00
3620	0520-0423000E PP 16 X 0.5 STEEL PILE SPLICES	EACH	3.00	750.00	2,250.00
3630	0530-0104000A REINFORCEMENT, GRADE 60	LUMP SUM	ALL	200,000.00	200,000.00
3640	0530-0104100A COATED REINFORCEMENT, GRADE 60	LUMP SUM	ALL	2,000.00	2,000.00
3650	0540-0102000A FOUNDATION CONCRETE, CLASS 4000	LUMP SUM	ALL	25,000.00	25,000.00
3660	0540-0203100A DECK CONCRETE, CLASS HPC4500	LUMP SUM	ALL	225,000.00	225,000.00
3670	0540-0302000A GENERAL STRUCTURAL CONCRETE, CLASS 4000	LUMP SUM	ALL	300,000.00	300,000.00
3680	0540-0401000J SAW CUT TEXTURING	SQYD	350.00	6.00	2,100.00
3690	0543-0100000J ARCHITECTURAL TREATMENT	SQYD	43.00	50.00	2,150.00
3700	0545-0100000J REINFORCED CONCRETE BRIDGE END PANELS	SQYD	35.00	550.00	19,250.00
3710	0550-0144000F 42 INCH PRECAST PRESTRESSED BOX BEAMS	FOOT	475.00	900.00	427,500.00
3720	0556-0300000J FURNISH MPCO MATERIAL	SQYD	300.00	30.00	9,000.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3730	0556-0500000J CONSTRUCT MPCO	SQYD	300.00	28.00	8,400.00
3740	0557-0102000K FURNISH PREMIXED POLYMER CONCRETE	CUYD	47.00	4,500.00	211,500.00
3750	0557-0104000J CONSTRUCT PPC OVERLAY	SQYD	738.00	225.00	166,050.00
3760	0584-0100000F ELASTOMERIC CONCRETE NOSING	FOOT	69.00	125.00	8,625.00
3770	0585-0215000A PRECOMPRESSED FOAM SILICONE JOINT SEAL	LUMP SUM	ALL	6,000.00	6,000.00
3780	0587-0105000A 3 TUBE CURB MOUNT RAIL	LUMP SUM	ALL	100,000.00	100,000.00
3790	0587-0106000A 3 TUBE CURB MOUNT RAIL, MODIFIED	LUMP SUM	ALL	110,000.00	110,000.00
3800	0842-0401000E BRIDGE IDENTIFICATION MARKERS	EACH	1.00	200.00	200.00
3810	0000-0100000A DELETED BID ITEM	LUMP SUM	ALL	0.00	0.00
3820	1999-9Z90000A TYPE "F" TRAFFIC BARRIER COPING WITH MOMENT SLAB	LUMP SUM	ALL	225,000.00	225,000.00
3830	1999-9Z90000F JOINT RECONSTRUCTION	FOOT	69.00	125.00	8,625.00
3840	1999-9Z90000I TAPER GRIND DECK CONCRETE	SQYD	191.00	23.00	4,393.00

SECTION 0014 BRIDGE NO. 23874 - HWY 144 (CONN 144AP) TO SW ALLEN

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3850	0253-0106000A TEMPORARY WORK ACCESS AND CONTAINMENT, BR. NO. 23874	LUMP SUM	ALL	150,000.00	150,000.00
3860	0501-0100000A BRIDGE REMOVAL WORK, BR NO. 23874	LUMP SUM	ALL	150,000.00	150,000.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
3870	0503-0103000J BRIDGE END PANEL COLD PLANE PAVEMENT REMOVAL, 2-5.5 INCHES DEEP	SQYD	70.00	60.00	4,200.00
3880	0504-0100000J CLASS 2 PREPARATION	SQYD	30.00	250.00	7,500.00
3890	0510-0100000A SHORING, CRIBBING, AND COFFERDAMS	LUMP SUM	ALL	100,000.00	100,000.00
3900	0510-0101000A STRUCTURE EXCAVATION	LUMP SUM	ALL	1,000.00	1,000.00
3910	0510-0106000A GRANULAR WALL BACKFILL	LUMP SUM	ALL	1,000.00	1,000.00
3920	0510-0108000A GRANULAR STRUCTURE BACKFILL	LUMP SUM	ALL	2,000.00	2,000.00
3930	0512-0100000A FURNISH DRILLING EQUIPMENT	LUMP SUM	ALL	35,000.00	35,000.00
3940	0512-0101000A DRILLED SHAFT CONCRETE	LUMP SUM	ALL	20,000.00	20,000.00
3950	0512-0104000A DRILLED SHAFT REINFORCEMENT, GRADE 60	LUMP SUM	ALL	100,000.00	100,000.00
3960	0512-0105000F CSL TEST ACCESS TUBES	FOOT	1,470.00	6.00	8,820.00
3970	0512-0106000E CSL TESTS	EACH	3.00	2,500.00	7,500.00
3980	0512-0112000F DRILLED SHAFT EXCAVATION, 72 INCH DIAMETER	FOOT	230.00	225.00	51,750.00
3990	0520-0100000A FURNISH PILE DRIVING EQUIPMENT	LUMP SUM	ALL	25,000.00	25,000.00
4000	0520-0127000F FURNISH PP 16 X 0.5 STEEL PILES	FOOT	245.00	95.00	23,275.00
4010	0520-0312000E DRIVE PP 16 X 0.5 STEEL PILES	EACH	3.00	3,000.00	9,000.00

SCHEDULE OF ITEMS

OR217: OR10 - OR99W SEC. (C15298)

KERR CONTRACTORS OREGON LLC

ITEM NO	ITEM DESCRIPTION	UNIT OF MEASURE	QUANTITY	UNIT PRICE (IN FIGURES)	TOTAL (IN FIGURES)
4020	0520-0329000E PILE LOAD TEST (DYNAMIC), BR NO. 23874	EACH	2.00	1,000.00	2,000.00
4030	0520-0423000E PP 16 X 0.5 STEEL PILE SPLICES	EACH	3.00	500.00	1,500.00
4040	0530-0104000A REINFORCEMENT, GRADE 60	LUMP SUM	ALL	165,000.00	165,000.00
4050	0530-0104100A COATED REINFORCEMENT, GRADE 60	LUMP SUM	ALL	3,500.00	3,500.00
4060	0540-0203100A DECK CONCRETE, CLASS HPC4500	LUMP SUM	ALL	300,000.00	300,000.00
4070	0540-0302000A GENERAL STRUCTURAL CONCRETE, CLASS 4000	LUMP SUM	ALL	250,000.00	250,000.00
4080	0540-0401000J SAW CUT TEXTURING	SQYD	150.00	6.00	900.00
4090	0545-0100000J REINFORCED CONCRETE BRIDGE END PANELS	SQYD	37.00	500.00	18,500.00
4100	0550-0145000F 48 INCH PRECAST PRESTRESSED BOX BEAMS	FOOT	500.00	950.00	475,000.00
4110	0556-0300000J FURNISH MPCO MATERIAL	SQYD	1,502.00	30.00	45,060.00
4120	0556-0500000J CONSTRUCT MPCO	SQYD	1,502.00	28.00	42,056.00
4130	0585-0215000A PRECOMPRESSED FOAM SILICONE JOINT SEAL	LUMP SUM	ALL	3,000.00	3,000.00
4140	0587-0105000A 3 TUBE CURB MOUNT RAIL	LUMP SUM	ALL	100,000.00	100,000.00
4150	0587-0106000A 3 TUBE CURB MOUNT RAIL, MODIFIED	LUMP SUM	ALL	100,000.00	100,000.00
4160	0599-0100000J CONCRETE SLOPE PAVING	SQFT	544.00	16.00	8,704.00

INSERT TAB

Installation Plan
Original

KERR CONTRACTORS

P.O. Box 1060 Woodburn, OR 97071
Main Office 971 216 0050

SUBMITTAL

TO: Rick Smith Oregon Department of Transportation
6000 SW Raab Rd.
Portland, OR 97221

FROM: Daley McKay
PROJECT NAME: OR217: OR10-OR99W
CONTRACT#: 15298
KERR JOB# 221018

SPEC SECTION: 00512
BID ITEM NO: 2900, 3250, 3530, 3570, 3940, 3980, 4860, 4900
SUBMITTAL #: 076
SUB/SUPPLIER: Cascade Bridge
DESCRIPTION: Drilled Shaft Plan - Structures
DATE: 1/10/2022

REMARKS:

Please see the attached submittal.

Submittal Transmittal

Detailed, Grouped by Each Number

OR217: OR10 - OR99W **Project # 21110** **Cascade Bridge, LLC**

Tel: Fax:

Date: 1/17/2022 **Reference Number: 0020**

Transmitted To:

David Finnigan
Kerr Contractors Inc.
PO Box 1060
Woodburn, OR 97071
Tel: (971) 216-0050
Fax: (503) 981-1161

Transmitted By:

Kyle Barber
Cascade Bridge, LLC
14215 NW 3rd Court
Vancouver, Washington 98685
Tel: (360) 737-6576
Fax: (360) 737-6579

Qty	Submittal Package No	Description	Due Date	Package Action
1	0020 - 00512 - 0	Drilled Shaft Installation Plan Rev0	1/31/2022	For Approval

Transmitted For	Delivered Via	Tracking Number
Approval	Email	

Items	Qty	Description	Notes	Item Action
1	1	Drilled Shaft Installation Plan Rev0		For Approval

Cc: Company Name	Contact Name	Copies	Notes

Remarks

Signature

Signed Date

OR 217
DRILLED SHAFT SUBMITTAL

SCOPE:
The scope of work addressed in this submittal includes installation of the 13 each 72” dia. drilled shafts installed using conventional drilling methods. This scope consists of 4 different bridge structures along the Beaverton Tigard HWY (OR217). Scope includes furnishing drilling/support equipment to each project site, drilling shafts to tip depths shown on plans, hoisting, and placing rebar cages (cages w/ CSL tubes provided by others), backfilling with 4,000 psi Drilled Shaft concrete to construction joints, and performing CSL Testing on completed shafts (testing and summary reports provided by others). Pile cap forms and concrete finishing done by others. All required aspects of the work are addressed in this submittal.

QUALIFICATONS:
Pacific Foundation Inc. is a geotechnical construction company that specializes in drilled shafts, DSM columns, solder piles, CFA, tiebacks, secant piles, micropiles and soil nail systems.

Pacific Foundation is owned and managed by Michael Zeman and his management team. Over the past 15 years, they have estimated, managed, and constructed approximately $250 Million of drilling and shoring projects in nearly every ground condition.

Pacific Foundation was formed in January of 2012, starting with a single drill rig and a very small crew. They made a commitment to only use the best equipment (Bauer and Klemm drill rigs), focus on treating their clients right, and focusing on the best quality in the industry. That formula has worked well - now in their 9th year, Pacific Foundation is anticipating 2022 revenues of approximately $40,000,000 and have increased the fleet to include a total of 22 drill rigs and 8 cranes, including one of the most powerful drill rigs in the world, the massive Bauer BG55.

A. US26 Bridge Creek Bridge – 2021 **Mitchell, OR**
This project included drilling 10 ea. 24” dia. shafts to a depth of approx. 47’, backfilling with concrete, and placing a 16” pipe pile for the new bridge replacement foundation. Pacific used conventional drilling methods to achieve a 10’ rock socket in ground conditions consisting of poorly-graded sands with gravels, sandy lean clay, cobbles, and fresh to moderately weathered Siltstone (R1 to R3). (Marcum & Sons, Tim Way, 541.604.9559)

B. **Satus Creek Bridge- 2020** **Goldendale,** WA
This project included drilling and installation of 4 ea. conventional drilled shafts for a new bridge along highway US 97 over Satus Creek. The 6 ft diameter shafts ranged in depth from 30 to 40 ft in depth, and were drilled with temporary down to bedrock, at which point the 6ft shaft was socketed 10ft into the bedrock. (Cascade Bridge, Dan Mingo, 360-737- 6576)

C. **Port of Ridgefield Rail Overpass- 2020** **Ridgefield, WA**
This project included drilling and installation of 12 ea conventional drilled shafts for a new bridge extending from downtown Ridgefield over the BNSF rail line to connect the downtown area to the recreational boat launch area below. The 8 ft diameter shafts ranged in depth from 60 to 70 ft in depth, and were drilled with full depth temporary casing through challenging soils ranging from loose wet silts and clays, embedded 40 ft into dense cobbles and gravels. (Tapani Construction LLC, Zane Shout, 360-952-4330)

D. I5 Marine Drive – Fremont Bridge Section - 2019 **Portland, OR**
This project included drilling and installation of 4 major sign support drilled shafts along I5 at Marine Drive and I5 at Albert St. The 5 ft diameter shafts ranged in depth from 40 to 60 ft deep in challenging soils ranging from heaving sands to boulders. (NE Electric, Troy Halberg, 360-225-7004)

E. I205 Johnson Ck - Glenn Jackson Bridge - 2019 **Portland, OR**
This project included drilling and installation of 22 major sign support drilled shafts along I205 from Johnson Creek Blvd to the Glenn Jackson Bridge. The 5 ft diameter shafts ranged in depth from 40 to 60 ft deep in challenging soils ranging from heaving sands to boulders. (Kerr Contractors, Jay Hedberg, 971-216-0050)

F. Lacamas Creek Bridge - 2019 **Vader, WA**
This project included drilling and installation of 6ea 6ft diameter drilled shafts for a new vehicle. The shafts we 70 ft in depth, and utilized full depth permanent casing. The soils included silts, clays, sands, cobbles and bedrock. (Farline Bridge, Joey Walzcak, 503-769-3014)

G. River S Bridge - 2019 **Ridgefield, WA**
This project included drilling and installation of 3ea 10ft diameter drilled shafts and 4ea 5ft diameter drilled shafts for a new vehicle bridge at the Ridgefield Wildlife Preserve. The 10 ft shafts depths ranged from 97 – 132 ft in depth, and the 5ft shafts from 70-90 ft in depth. The soils included silts, clays, sands and gravels. (Ceccanti Inc, Jake Brockmoller, 253-537-2990)

H. **Vesta Bridge – 2018** **Vesta, WA**
This project included drilling and installation of 3ea 9ft diameter shafts ranging 60-65 ft in depth, and 4ea 5ft shafts, 50ft in depth, for a new vehicle bridge. Soils included very silt find sands and hard siltstone. (Cascade Bridge, LLC, Dan Mingo, 360-737-6576)

I. **I-5 Tigard Interchange - 2018** **Portland, OR**
This project included drilling and installation of 18 drilled shafts for new sign bridges along I-5 in the Tigard area. Shaft depths ranged from 20 to 32 feet in depth I soils that range from dry to wet and included silts, sands, and boulders. (HP Civil, Josh Smith, 503-769-2466, Summer 2018).

***Construction Experience Personnel* -**
Ryan Maddock will be the General Superintendent. Ryan has been a General Superintendent for approximately 3 years, he was a drilled shaft foreman for 8 years and has vast knowledge in having installed shafts up to 120” on a variety of projects in Oregon and Washington. He was involved with the Mill Plain shafts. A few example projects include 72” diameter shafts at the Cowlitz Casino, 60” diameter shafts at Tillamook, and 54” diameter shafts at BNSF Task 6 in Kalama.

Ben Baldridge will be the Preconstruction Manager. Ben has over 15 years of experience with every scope of work that Pacific Foundation performs. Combined with his knowledge and rapport with our clients, Ben is a valuable part of making sure that our projects get kicked off and set for success.

Cody Brasier will likely be the foreman for this project. Cody has been a foreman for Pacific for five years and has lead projects including drilled shafts, soldier pile walls with tiebacks, shotcrete walls, and micropiles. He was worked numerous projects with ODOT consisting of signal and sign bridge foundations.

Shane Raymond will likely be the vertical drill operator for this project. Shane has been operating drill rigs for Pacific Foundation for over 6 years and has previous experience as well. See attached relevant project list for Shane.

Jim Brunkhorst PE will be the project manager. He will handle all administrative and contractual issues, as well as technical or engineering related issues. He has over 22 years of construction experience with over 18 years of experience related to geotechnical construction, as a project manager and estimator.

DRILLED SHAFT INSTALLATION

EQUIPMENT

We anticipate using a Bauer BG24H, BG22, or BG24 as the drill rig for this project given their size and power, as well as their ability to install casing in Poorly Graded Gravel base rock, if needed. These rigs will have the capacity required to drill the shafts at all locations on this project. The rig is described below:

- **Bauer BG24H, BG22H, BG24**

  The BG24H is a moderately compact 220,000 lb track mount drill rig, ideal for portions of the site with reasonable access, drilled shafts, CFA of all depths and diameters, and cased soldier piles with that require conventional drilling systems. Conventionally, it is capable of drilling 96" diameter shafts to a depth of 135 feet in silts, sands, and bedrock conditions. It can install CFA piles to a depth of 60 feet without an extension, up to a maximum diameter of 36 inches. We may also use an oscillator to advance temporary sectional casing to stabilize the drill hole prior to placement of the rebar cage and concrete. See attached data sheets.

  In drilling the shafts, we may use the following drill tools:

  - Core Barrel: For use of coring in hard rock.
  - Rock Auger: For use in compacted/consolidated deposits.
  - Flighted Auger: For use in soft alluvial material or gravelly conditions.
  - Digging bucket: for use in soft material and saturated gravels.
  - Temporary Sectional Drill Casing will be used as needed to stabilize the upper portions of the shaft prior to rebar and concrete placement.
  - Casing Oscillator

DETAILS OF DRILLED SHAFT INSTALLATION METHOD

We anticipate drilling all shafts using the conventional method for this project. The conventional method includes utilizing a standard vertical drill rig fitted with kelly bar and drill tool (core barrel, digging bucket, rock bucket or auger). The shaft will be excavated using a variety of tools until tip elevation is reached, at which time we will clean the bottom of the shaft using a cleanout bucket. We anticipate that shaft installation will be open hole. If during construction shaft stabilization is needed, we will achieve it through temporary casing or the use of slurry. Casing will be a minimum of 72" o.d. for the 6ft diameter bridge shafts at all structure locations. Tooling will be small enough to drill inside this casing. An oscillator size for the casing may also be used if needed to advance and remove the temporary casing.

In the case where stable soils are present in the shafts and casing is only partially needed or not needed at all, the drill tooling will be at a minimum the same diameter as the planned shaft diameter. If a temporary top casing is used, it will be slightly oversized so that the appropriately sized drill tooling can pass through it during shaft excavation. All temporary casing will be removed.

All access, survey and layout for the drilled shaft locations will be performed by the General Contractor, and the General Contractor’s Surveyor. Layout shall consist of a center hub location for the shaft, and four 90-degree offsets that can be used to verify alignment of the shaft as the drilling progresses. The drilling equipment will be aligned in order to access the individual shaft locations and be able to spin in one direction to drop drill spoils. There does not appear to be any overhead constraints that will affect access and drilling once the utility relocation has been completed by others.

After survey and site prep for drilling has been completed, Pacific Foundation will walk the drill rig into place and get lined up on the hole, and then proceed to drill out the shaft using a variety of tools suited for drilling in the soil conditions shown in the geotechnical reports for this project, until the shaft tip is reached.

During Drilling, if cobbles and/or boulders are encountered, the driller will first attempt to remove them using tooling that has openings or flights large enough to pull them out of the shaft. If the boulder is large enough, a core barrel may be used to core a hole through the boulder and drilling will continue as originally described above. Another method is to use smaller diameter tooling to perforate and break up the larger rocks so that they can be removed with conventional tooling. In the event that the shaft cannot be advanced through due to ground conditions, Pacific Foundation will backfill uncased portions of the shaft with lean mix or CLSM to replace the soil, then re-drill through this material the next day. This technique often works well to temporarily stabilize soils that cannot be contained using other conventional methods. The cause of the obstruction will be reviewed with project team to determine if a Differing Site Condition exists.

Once the tip of shaft is reached, the bottom will be cleaned using a clean-out bucket. The project inspector shall verify that the bottom is cleaned and to the correct tip elevation. Once this has been verified, the rebar cage (provided by others) will be hoisted into place and secured using an on-site crane. The crew will place the cage and will make small adjustments by hand if needed and will be in visual of the crane operator if adjustments need to be made to ensure the cage is placed within tolerances. The cage will be secured on dunnage using beam clamps and angle. The rebar cage will have a rebar feet tied to the bottom of the cage so that the cage cannot sink to the bottom of the drilled hole when released to remove temporary casing. Cap Rebar and Bolt cage if applicable will be placed and aligned by others.

After the rebar cage has been placed and secured, Pacific Foundation will place 4000 PSI concrete to the construction joint elevation shown in the plans. Concrete will be placed by the free fall method in dry shafts or through the use of a tremie system in wet shafts. If the shaft is wet, a 4” or 5” tremie pipe connected to the concrete pump. The tremie will be fitted with a foam insert to prevent water from entering the pipe. It will be lowered to the bottom of the shaft, and then raised approximately 6” as concrete begins to flow. It will remain a minimum of 5’ below the top of concrete at all times to prevent segregation during the pour. Any water that is displaced during placement will be pumped off the top of shaft by the Contractor. If temporary casing was installed during drilling, it will be removed using the drill rig during the placement of concrete.

At least 5 days after concrete placement, CSL testing will be performed by others and test results will be submitted for final acceptance by the engineer. All CSL testing and reports will be provided by others.

Drill spoils will be contained to the local area adjacent to drill hole for disposal by the General Contractor. Spoils are expected to be wet. Pacific will work with the GC to use a mud box for containment; should water be present. Any fluids used will be contained in a tank and disposed of by the Contractor.

Concrete Mix Design:

The 4000psi drilled shaft concrete for this project will be provided by either Cal Portland or Wilsonville Concrete. Mix designs are provided in the enclosures.

Rebar Cage Shop Drawings:

Rebar cages w/ CSL tubes are supplied by others.

Enclosures:

a. Jim Brunkhorst Resume
b. Cody Brasier Project List
c. Shane Raymond Project List
d. Equipment Specifications
e. Drill Tooling
f. Concrete Mix Designs
g. Drilled Shaft JHA
h. Drill Log Examples

Jim Brunkhorst

Jim P. Brunkhorst, PE

- Phone: (360) 301-0771 • E-Mail: jim@pacific-foundation.com

Education:

North Dakota State University, Fargo, ND

- B.S. Civil Engineering – 1997
- Fundamentals of Engineering (EIT# 127951) 2004
- Professional Engineer (NE# 13383) 2010
- Professional Engineer (OR# 89201PE) 2014

Continuing Education:

"Grouting", Seminar, Florida State University with DFI, November, 2002
"Grouting and Ground Treatment" 3rd International Conference" Geo-Institute, February 2003
"Micro Piles", DFI and ADSC, 2003, 2004, 2005, 2006
"North American Tunneling Conference", 2008, 2010
"Blasting Techniques", Gordon Revey, 2008
"Kiewit Superintendent School" 2009
"Concrete Mix Design" 2005

Skills:

Estimating, Project Engineering, Project Management, Earthwork, Site Characterization, Contaminated Materials, Deep Foundations, Tunneling, Drilled/mined Shafts, Grouting, Micro piling, Earth Retention, Constructability Analysis, Value Engineering, Claim Preparation

Experience Synopsis: Jim has 14 years experience working with 3 large civil construction companies performing demolition, excavation, earth retention, shaft construction, deep foundations, NATM tunneling, drill and blast Tunneling, and all aspects of grouting. Coupled with this construction experience, Jim was a consulting engineer for 3 years designing foundations, earth retentions systems, grouting plans, and demolition plans, and has experience on numerous projects from conception to completion applying geotechnical construction options. A summary of his project experience is as follows.

Key Project Experience:

Safety

Have worked with the field crews to maintain or lower the EMR of the company. Recently worked with the safety program to lower the EMR for the company to 0.61.

Grouting and Remedial Foundation Support

- Estimator/Project Manager, Humboldt Mill Lofts, Minneapolis, MN, Install shoring system for historic walls and micro piles for end use retrofit.
- Estimator/Project Manager, Pump House #3, Victoria, MN, Utilized compaction grouting to stabilize soil mass and raise foundation.

Demolition

- Designer, Grand Hotel Demolition, Bloomington, MN. Engineered the demolition plan for a 15 story Post tensioned concrete hotel. This included the sequencing of the location and amount of the building to be at a time to prevent internal collapse. Proximity to active MSP airport was the controlling issue.
- Designer, Four Bears Bridge Demolition, Newtown, ND. Engineered the demolition plan for the demolition and removal of a 4500LF steel truss bridge. Specifically worked with the locations of the explosive charges used to cut the members while retaining internal stability of the remaining sections. Provided review of crane & barge selection for removal of debris.

Geotechnical Instrumentation

- Michigan St. Tunnel, Grand Rapids, MI. Installed and read 6 point VW extensometers 70 ft deep from road surface to monitor the activity of a NATM tunnel construction below.
- 44th St. Interceptor, Minneapolis, MN. Installed and read Inclinometers and Extensometers to monitor tunneling activities below.
- Project Engineer for Sandy River Tunnel Project and overseen construction and monitoring of all piezometer, inclinometers, and horizontal profiler work

Underground Construction

- Estimating Manager working with the business development department preparing hard bid estimates, Statement of Qualification, and Proposals for tunnel projects throughout North America.
- Worked with Joint Venture estimates dealing with coordination, estimate comparison, and Close Out.

- Project Engineer for Sandy River Crossing Design Build NATM Tunnel Project Worked directly with Design Firm to develop design packages for the Definitive, Final, and IFC Drawing Sets. Remained as Project Engineer for construction.

- Estimator/Project Manager of multiple drilled shaft projects throughout the NW for various end uses that include transportation, power transmission, hydro, and wind.

- Estimator/Project Manager, McLean County Courthouse, Washburn, ND, Design and construct micro pile retrofit of existing footing for future ADA requirements.

- Estimator/Project Manager, Saint Thomas Law School, Minneapolis, MN, Utilized Chemical grouting to stabilize soil mass under foundation to allow for deeper adjacent excavation for new structure.

- Designer/Project Manager, Historic Carnegie Library, Stillwater, MN. Designed and managed a 12 ft underpinning construction of an elevator shaft by use of chemical grouting, Shot Crete and struts. Excavation

- Estimator/Project Manager, New Flyer Bus Factory, prepared bid for 25 acre site and managed the site work construction. Developed plan for site balance.

- Estimator/Project Manager, Minneapolis Convention Center Expansion, Prepared bid and managed the construction of the 500,000 CY excavation and export. Dealt with the management and disposal of 25,000 CY of contaminated soil. Worked with 100,000 SF of permanent earth retention.

- Estimator/Project Manager, Minneapolis, Site re-development of a brown field site in downtown Minneapolis dealing with lead, mercury, and PAH soils. Worked with on-site sampling and classification for disposal options.

- Estimator/Project Manager, Alma, WI. 2+ acre cell construction. Project included moving 80,000 CY of earth, a low perm soil, GCL, and HDPE liner section followed by leechate collection system. Earth Retention

- Estimator/Project Manager, Walker Art Center Expansion, Excavation and earth retention of a five story below grade parking structure. Involved 60 foot deep soldier pile and lagging walls, helical tiebacks, pressure grouted tiebacks, and vertical micro piles.

- Estimator/Project Manager, MSP LRT Tunnel and Station, Minneapolis, MN, Constructed north and south portals using a combination of CCW walls, temporary soldier pile and lagging, rock bolting and shotcrete headwalls. Performed support activities for TBM operations.

- Estimator/Project Manager, MCES MWWTP Solids Processing Project, St. Paul, MN, Constructed 180 x 360 foot coffer cell using sheet piles and dead-man retention. Driven piling and earth support for 1200 foot cut and cover tunnel. Provided site dewatering.

- Estimator/Project Manager, Sheppard Road Re-Construct, St. Paul, MN, Construction of 900 foot seawall on Mississippi River using sheet pile and a dead man system. Used cofferdam to construct outfall structures.

- Over site of Coquille Valley Hospital Soil nail wall. 30VF x 335HF (7500SF) of permanent soil nail wall construction.

- Phalen/Dodge Substation, Wala Wala, WA, Drilled shaft foundations for wind farm substation including concrete placement through the anchor bolts.

Business Management

- Worked with Bonding Companies to increase and improve bonding limits and pricing.

- Was directly responsible for the financing and purchasing of the heavy equipment for projects.

- Managed and improved the corporate insurance portfolio through meeting with various insurance providers.

SHAYNE RAYMOND

PACIFIC FOUNDATION PARTIAL PROJECT HISTORY

PACIFIC FOUNDATION PARTIAL PROJECT HISTORY

Project Info					Contract Info									Shaft						Other								1						Equipment											Superintendant					Foreman																			Vertical Drill Operator							Klemm Operator									
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm	CFA (QTY)	Drilled Shafts (QTY)	Soldier Pile (QTY)	Secant (QTY)	Diameter (Inches) MAX	Depth (Feet) MAX	Pile Drive (QTY.)	Sheet Pile (Sq. Ft.)	Underpinning (QTY.)	Tieback Anchors (QTY.)	Shotcrete (SF)	Soil Nail (SF)	Micro Pile/Rock Anchor (QTY)	Wood Lagging (Sq.Ft.)	Control Modulus (QTY.)	Deep Soil Mixing (QTY.)	Deep Soil Mixing (CY)	Stone Column (QTY.)	Grouting (QTY.)	Dewatering (QTY.)	BG-12	BG-15	BG-20 SERIES	BG-24	BG-40 SERIES	BG-55 SERIES	MC-96	RTG	KLEMM	TEI	OTHER	Jeremy Sayad	Ben Baldridge	Ryan Maddock	Ryan Boettcher	Cory Perron	Eddie Cepurno	Cesar Castenada	Al Champ	Jamie Corban	Michael Fischer	Steve Thompson	Peter Way	Ben Bish	Cody Braiser	Brad Hutton	Aaron Knerr	Troy Reynolds	Jeremy Sayad	Chris Thompson	Peter Way	Randall West	Josh Hughes	Ryan Stewart	Mike Fischer	Dwane H Beck	Tyler Ahmann	Matt Erickson	Harrylee Kahee	Shane Raymond	Steven Thompson	Jason Sewell	Andrew Cardiel	Cesar Castaneda	Edward Hasslen	Joshua Hughes	Eugene Johnson	Josiah Long	Corey Jannings	Troy Reynolds	Chris Thompson	Peter Way
20182	**Satus Creek Bridge**	Goldendale, WA	Install 72" Rock drilled shafts, and shafts	Sam S	Casecade Bridge 14215 NW 3rd Ct. Vancouver, WA 98685		WSDOT 1655 2nd Ave SW. Tumwater, WA	$357,181.18			12/08/20	08/27/20																										✓																														✓						✓												
20142	**UP Franz R Campus**	Portland, OR	Install sodlier piles, intall lagging rebar, and shotcrete.	Sam S	Lease Crutcher Lewis. 550SW 12th Ave, Portland, OR 97205. Ph. 503. 623.5373		University of Portland 5000 N Willamette Bllvd, Porltand, OR 97203 Ph. 503. 943.8000	$158,878.00			10/15/20	11/06/20																						✓																✓																								✓												
20100	**Raw Water 1.0 Secants Shafts**	Willsonville, OR	Install launch secant cell, install receiving secant cell.	Sam S	James W. Fowler Co. 12775 Westview Dr. Dalles, OR 97338 Ph. 503.623.5373		Willamette Water Supply 1850 SW 170th Ave, Beaverton, OR 97003 Ph. 503.941.4563				09/25/20		Pacific Structural Solutions.				136																					✓	✓										✓																							✓	✓		✓										
19325	**Ridgefield Overpass Project**	Ridgefield, WA	Drilled Shafts	Sam S	Tapani Inc. 5305 NE 121st Ave Unit 412. Vancover, WA 98682	Tapani Inc. 5305 NE 121st Ave Unit 412. Vancover, WA 98682	Port of Ridgefield 111 West Divison St. Ridgefield, WA 98642. Ph. 360.887.3873	$1,082,913.07			04/24/20	09/03/20	Jacobs		12			96	70																			✓							✓																													✓												
19309	**OJC Supreme Court**	Salem, OR	Soldier Pile and lagging installation	Jim B	Fortis Construction Inc. 1705 SW Taylor St. #200 Portland, OR 97205		Oregon Justice Department 1163 State Street Salem, OR 97301	$493,864.75			03/24/20	10/16/20																									✓															✓																						✓												
19016	**Grand Apartments**	Portland, OR	Soldier Piles and Soil Nails.	Sam S	Fairfield Development 5388 Sterling Center Dr. Westlake, CA 91316		Fairfield Residential 5510 Morehouse Dr., Suite 200. San Diego, CA 92121. Ph. 503.546.5728	$756,395.00			12/30/19	01/29/21				✓							✓				✓										✓								✓					✓				✓														✓					✓												
18299	**AC Marriot Cornell Oaks**	Beaverton, OR	Project included installing 23680 sf of galvanized sheet piling with sheets as long as 51'.	Jim B	Goodfellow Bros. 7515 NE Ambassador Place, Suite E Portland, OR 97220 (503) 256-4114	John Kirsch Goodfellow Bros. Ph. 503.969.8967	Brandt Hospitaility Group 2640 47th Ave. S Fargo, ND 58104	$1,360,922.87			04/29/19	07/03/19									23680																				✓			Diesel Hammer & 100 Ton Hydro			✓											✓												✓			✓												
18292	**ODOT I-205 Glenn Jackson Bridge**	Clackamas & Multnomah Co.	Project includes 22ea 5ft diameter drilled signal shafts along the 205 corridor with various soils, both night & day work, and bridge work. Shafts up to 60 ft in depth.	Sam S	Kerr Contractors, Inc. 9771, 395 Shenandoah Ln. NE Woodburn, OR 97071	Stan Thompson Kerr Contractors Ph. 971.216.0050	ODOT 4040 Fairview Indust. Dr Salem, OR 97302	$836,372.87			03/28/29	08/02/19			22			60"	61'																			✓																✓															✓			✓												
18277	**ODOT Snow Zone SIR**	La Grande, OR	Build rebar cages, drill shafts, and do CSL testing.	Sam S	HP Civil Inc. N 2nd Ave, Slayton, OR 97383.		Oregon Department of Transportation 3012 Island Ave La Grande, Oregon 97850.	$531,531.98			07/31/19	10/14/19			360			60"	35'																		✓																					✓																✓												
18218	**River S Bridge**	Ridgefield, WA	Project included construction of 3 10ft diameter shafts and 4 5ft diameter shafts. Deepest 10ft shaft was 132ft. Drilling was from a barge over water.	Sam S	Ceccanti Construction	Jake Brockmoller Ceccanti Inc. 253-888-2514	Federal Highway Administartion Western Federal Lands Div Carolyn Sourek 360-619-7868	$1,128,816.00			04/01/19	05/20/19			7			120"	132'																				✓																								✓											✓	✓												
18073	**Grays Harbor Vesta Bridge**	Cosmopolis, WA	Project included drilling 5ft and 9ft shafts for new bridge, through challenging soils and bedrock	Sam S	Cascade Bridge, LLC 14215 NW 3rd Ct. Vancouver, WA 98685 360.737.6576	Cascade Bridge, LLC 14215 NW 3rd Ct. Vancouver, WA 98685	Grays Harbor County Montesano, WA	$457,753.00			06/19/18	07/27/19			7			108	62																			✓									✓				✓												✓												✓												
17289	**I-5 Tigard Interchange**	Portland, OR	Project includes 18 - 3ft diameter shafts to depths of 35 ft in sand and dense gravels and cobbles.	Sam S	HP Civil PO Box 556 Stayton, OR 97383 PH: (503) 769-2466 Subcontract: 1501.002	HP Civil PO Box 556 Stayton, OR 97383 PH: (503) 769-2466 Subcontract: 1501.002	ODOT 335 Capital St NE Salem, OR 97301 Project: 14746	$432,997.00			03/12/17	04/12/17	ODOT		18			36	32																	✓											✓				✓																					✓		✓	✓											
17284	**Oregon State Capital**	Salem, OR	Project includes the design and construct a dewatering system. Install 2 secant shoring walls for vaults. Install waler, tiebacks, and tiedown anchors.	Jim B	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 P: (503) 221-8811	Hoffman Construction Andy Cerotsky 805 SW Broadway, Suite 2100 Portland, OR 97205 P: (503) 221-8811	Oregon State	$2,976,472.00			03/12/17	06/25/17	SRG/Catena	120		60	117	42	50	223			80															✓	✓			✓		70 ton Mantis		✓						✓																					✓	✓												
17101	**Tertiary Treatment Soldier Pile wall**	Coeur d'Alene, ID	Furnish and installation of 42 soldier piels and 6888 SF of lagging	Jim B	Apollo Construction 1133 W. Columbia Drive Kennewick, WA 99336 Amy Jenne	Apollo Construction 1133 W. Columbia Drive Kennewick, WA 99336 Amy Jenne	City of Coeur d'Alene 710 E. Mullan Ave Coeur d'Alene, ID 83814	$568,912.28			05/15/17	05/31/17	HDR Engineering / Berger ABAM			42		18	43																	✓																								✓				✓							✓		✓	✓											
17096	**NW Timber Road**	Gales Creek, OR	Project includes 20 - 5ft diameter shafts to depths of 70-103 ft in sand and dense gravels.	Jim B	Carter & Company, Inc. Larry Carter 4676 Commercial St. SE #203 Salem, OR 97302 (503) 371-4582	Carter & Company, Inc. Larry Carter 4676 Commercial St. SE #203 Salem, OR 97302 (503) 371-4582	Washington County Dept of Land Use 1550 N 1st Ave, Suite 350 Hillsboro, OR 97125	$102,131.00			07/12/17	07/19/17	Washington Cty Dept of Land Use		8			60	103																	✓											✓				✓																					✓		✓	✓											
17085	**Amazon Corner**	Eugene, OR	Project consisted of soldier piles, lagging and handrail.	mike Z	Essex Construcrtion BO Oswald 4284 W 7th Ave Eugene, OR 97402	Essex Construcrtion BO Oswald 4284 W 7th Ave Eugene, OR 97403	Amazon Corner LLC PO Box 5395. Eugene OR 97405	$246,232.00			05/13/17	06/03/17	Rowell Brokwaw			58											3,880									✓																																							✓												
17062	**MLK**	Portland, OR	Project included designing tieback anchors and installing temporary soldier piles.	mike Z	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 PH: (503) 221-8811	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 PH: (503) 221-8812	Gerding Edien Develop. 1477 NW Everett Street. Portland, OR 97209	$1,408,178.00			12/20/17	02/15/19	Geodesign										173				19,801									✓						✓					✓		✓																					✓				✓												
17056	**NE 10th Avenue Extension**	Vancouver, WA	Project includes drilling 4 shafts to tip with a conventional method drill. Includes stone columns and Controlled Modulus shafts for ground improvement	jim B	Cascade Bridge 14215 NW 3rd Court Vancouver, WA 98685 (360) 737-6576	Cascade Bridge 14215 NW 3rd Court Vancouver, WA 98685 (360) 737-6576	Clark County Public Works 1300 Franklin Street Vancouver, WA 98666-9810	$1,289,712.00			06/26/17	12/04/17	Geodesign		4			72	50									12,000			13,750							✓	✓	✓								✓							✓			✓																			✓												
17030	**Town Storage**	Portland, OR	Project included furnishing and installing 7 soldier piles and furnishing and installing steel waler DCP tieback anchors and required	Jim B	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1005	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1006	Sentinel Development	$104,307.00			03/04/17	03/18/17	KPFF																					✓	✓																			✓																					✓												
16123	**Washginton Park Reservoir**	Portland, OR	This $15M project consisted of 0ver 16,000 SF of soldier pile, tieback and timber lagging	Jim B	Hoffman Construction 805 SW Broadway, Suite 2100	Hoffman Construction 805 SW Broadway, Suite 2100	City of Portland 1120 SW 5th Ave. #1250 Portland, OR 97204-1912	$16,521,000.00			11/05/16	05/18/19	Cornforth/Portland Water Bureau		176	167		60	167				1058				18,000											✓				✓																		✓			✓											✓	✓	✓												
16003	**9th & Belmont - Little LOCA**	Portland, OR	Furnish and installation of 96 ea - 16" diameter CFA piles up to 60 feet in depth for a new buidling foundation.	Mike Z	Andersen Construction Glenn Whitefield 6712 N Cutter Circle Portland, OR 97217 PH: 503.283.6712	Andersen Construction Glenn Whitefield 6712 N Cutter Circle Portland, OR 97217 PH: 503.283.6712	Killian Pacific 500 Broadway St #110 Vancouver, WA 98660	$ 276,620.10			05/09/16	05/29/16	Ankrom Moisan	96				16	70									96								✓												✓				✓		✓						✓										✓			✓	✓					✓							
15180	**Knight Cancer Research**	Portland, OR	Installation of 24" - 60" Drilled shafts to 100ft in 3 blow count material over Troutdale. Used both slurry and oscillator methods. Also included a 35 pile shoring wall with 2 rows of tiebacks.	Jim B	McCathy Anderson JV 621 SW Morrison Suite 950 Portland, OR 97205	McCathy Anderson JV 621 SW Morrison Suite 950 Portland, OR 97205	Oregon Health & Sciences University 3181 SW Sam Jackson RD Portland, OR 97239	$ 3,509,143.98			07/05/16	08/01/16	Catena		100	33		60	99				33				4,752									✓		✓	✓									✓												✓	✓		✓		✓										✓												✓
15163	**17th & Front**	Portland, OR	Installation of Soldier Pile and Tieback Wall & CDSM	Mike Z	Lease Crucher Lewis Craig Robertson 550 SW 12th Ave Portland, OR 97205 O: (503) 223-0500	Lease Crucher Lewis Craig Robertson 550 SW 12th Ave Portland, OR 97205 O: (503) 223-0500	BC Group, Inc 1231 NW Hoyt Street Portland, OR 97209	$ 1,566,119.73			02/02/16	03/11/16	Berger ABAM	84				48	14				83				11,944		833	5,425						✓		✓	✓			✓				✓			✓				✓								✓	✓							✓		✓	✓	✓			✓	✓	✓	✓						✓
15160	**I-5 Siskiyou Rest Area**	Ashland, OR	Preboring fo 28 piles 30" diameter in hard rock up to 35 feet in depth. Installing soldier piles and lgging.	Mike Z	Wildish Standard Paving Sean Williams PO Box 40310 Eugene, OR 97404	Wildish Standard Paving Sean Williams PO Box 40310 Eugene, OR 97404	ODOT 335 Capital St NE Salem, OR 97301 Project: 14746				12/01/15	12/22/15	ODOT			26		36	33								3,156							✓	✓																																					✓				✓												

CODY BRASIER
FOREMAN
PROJECT HISTORY

PACIFIC FOUNDATION PARTIAL PROJECT HISTORY

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
21017	**Block 17**	Vancouver, WA	24" CFA Rigid inclusions	Sam S	Alliance Residential Co. 1325 4th Ave Suite 1005. Seattle, WA 98101		Vancouver Waterfront LLC 695 Waterfront Way Vancouver, WA 98660	$11,145.15			02/12/21	04/28/21	KGA Structual Engineers
20443	**Columbia WWTP**	Portland, OR	24" Drilled shafts	Mike Z	O'niel Construction Group 4444 SE 27th Ave Portland, OR 97202		Kiewit Institution West Co. 2200 Columbia House Blvd Vancouver, WA 98661	$26,746.00			12/21/20	12/23/20	
20304	**Cayote Lane Bridge**	Cowiltz County, WA	Drill and pre-bore shafts.	Sam S	Legacy Contracting PO Box I Staton, OR 97383		Cowiltz County Public Works. 1600 13th Ave South Kelso, WA, 98626-2851	$30,810.26			08/17/20	08/25/20	
20219	**Nutrien Shafts**	Kennewick, WA	30" Drilled shafts	Sam S	Apollo Mechanical 7555 SW Tech Center Dr. Tigard, OR 97223		Nutrient AG Solution 13131 Lake Fraser Dr. SE Calgary AB T2J 7E8	$62,895.00			06/04/20	07/24/20	
20212	**Block 42**	SW Bond Ave. SW Lane St. Portland, OR 97239 South Water Front	Project Included design and installation of 386 ea. 4' dia. CDSM columns and 34 uplift anchors. Project consisted of using a BG28 for pre-drilling CDSM 2' into dense gravels, ~35.5' BGS, followed by the BG40 fitted with CDSM capabilities installing the CDSM columns.	Jim B	Anderson Construction 6712 N Cutler Circle Portland, OR 97217	Anderson Construction 6712 N Cutler Circle Portland, OR 97217	Alamo Manhattan Properties, LLC 3012 Fairmount Street, Suite 100 Dallas, TX 75201	$1,084,092.00			08/23/21	11/08/21	Geodesign/ Nv5 Pacific Structural
20158	**CTP Rigid Inclusions, Tacoma**	Tacoma, WA	Design-build sheet pile shoring and rigid inclusion ground improvement. Sheet pile cell 126'x57', 11' deep. Rigid inclusions 30"-dia. to depth of 69' below excavation subgrade.	Rob C	Prospect Construction. 116 23rd St. SE, Pullyaup, WA 98372	Prospect Construction. 116 23rd St. SE, Pullyaup, WA 98372	City of Tacoma 747 Market St. Tacoma, WA 98402	$1,192,504.00	$676,310.00		10/21/20	05/05/21	GeoDesign/NV5, Pacific Structural Solutions, GeoEngineers, Carollo
20072	**South Park**	Seattle, WA	Drill and mix CDSM columns, vibe in sheet piles.	Jim B	Prospect Comstruction Inc. 115 23rd St. SE Puyallup, WA 98372		Seattle Public Utilities 700 5th Ave Seattle, WA 98104				09/25/20		Civil Tech Engineering
19283	**303 Battery**	Seattle, WA	CFA foundation shafts with hybrid shoring lagging. 32 ea. 24"-dia. shafts to 39' deep with rebar cages and concentric W-shape beams. Treated lagging shoring about 1,320 sf	Jim B	Swinerton 14432 SE Eastgate Way. Suite 230 Bellevue WA 98007	Swinerton 14432 SE Eastgate Way. Suite 230 Bellevue WA 98007	Sustainable Living Solution 710 2nd Ave, Suite 1400. Seattle, WA 98104	$277,815.00	$224,915.00		03/09/20	12/23/20	DCI Engineers

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
19206	**Portland Fuel Station**	Bingen, WA	Drive sheet pile, weld and install walers.	Jim B	Advanced American 8444 NW Saint Helens Rd. Portland, OR 97231 Ph. 503.445.9000		BNSF Railway 2454 Occidental Ave S Unit 1A Seattle, WA 98134	$298,997.00			04/07/20	08/26/20	
19197	**NE Broadway & 94th Pump Station**	Portland, OR	Project Included drilling and installing 18 soldier piles reaching 28' in length. Soil conditions consisted of fill and gravels.	Kody M	Stettler Supply Company 4420 Ridge NE, Salem, OR 97301 Ph: 503.585.5550	Brandon Hageman Stettler Supply Co. Ph. 503.510.5127	City of Portland 1120 SW 5th Ave, Rm 1000 Portland, OR 97204	$65,525.07			03/09/20	03/16/20	
19170	**I-5 Marine Dr. - Fremont Bridge Section ITS**	Portland, OR	Drilled Shaft, istall cages, and backfill with concrete.	Sam S	NorthEast Electric 1780 Down River Drive		Oregon Department of Transportation	$233,106.28			11/21/19	01/15/20	
19113	**UofO Hayward Field Hammer Throw**	Eugene, OR	installation of shafts	Sam S	Hoffman Construction. 805 SW Broadway, Suite 2100. Portland, OR 97205	Kae Excavating 3871 Langley St. SE Salem, OR 97317 Ph. 503.399.4833	UofO 1580 E 15th Ave Eugene, OR 97403 Ph. 541.346.1000	$42,463.78			7/23/19		
18299	**AC Marriot Cornell Oaks**	Beaverton, OR	Project included installing 23680 sf of galvanized sheet piling with sheets as long as 51'.	Jim B	Goodfellow Bros. 7515 NE Ambassador Place, Suite E Portland, OR 97220 (503) 256-4114	John Kirsch Goodfellow Bros. Ph. 503.969.8967	Brandt Hospitaility Group 2640 47th Ave. S Fargo, ND 58104	$1,360,922.87			04/29/19	07/03/19	
18284	**CDA WTTP Cell**										10/29/18	11/02/18	
18277	**ODOT Snow Zone SIR**	La Grande, OR	Build rebar cages, drill shafts, and do CSL testing.	Sam S	HP Civil Inc. N 2nd Ave, Slayton, OR 97383.		Oregon Department of Transportation 3012 Island Ave La Grande, Oregon 97850.	$531,531.98			07/31/19	10/14/19	
18214	**OR 126 Slide**	Springfield, OR	Install soldier piles, and perform verification testing.	Sam S	Wildish Standard Paving Co. 5319 SW Westgate Dr #22, Poetland, OR 971221	Ryan Drake Wildish Standard Paving Co. ryand@wildish.com 541.228.8256	Oregon Department of Transportation 3930 Fairview Industrial Dr. S.E Salem, OR 97302	$251,124.30			12.03.18	12.27.18	
17004	**Press Blocks Test Drilling**	Portland, OR	Project included drilling a 24" shaft, spoil disposal, and backfill & sidewalk patching.	Ryan B	Lease Crutcher Lewis 550 SW 12th Ave Portland, OR 97206. PH: (503) 223-0500	John Marasco Security Properties	John Marasco Security Properties	$6,350.00			2/21/17	2/21/17	

BAUER BG24H

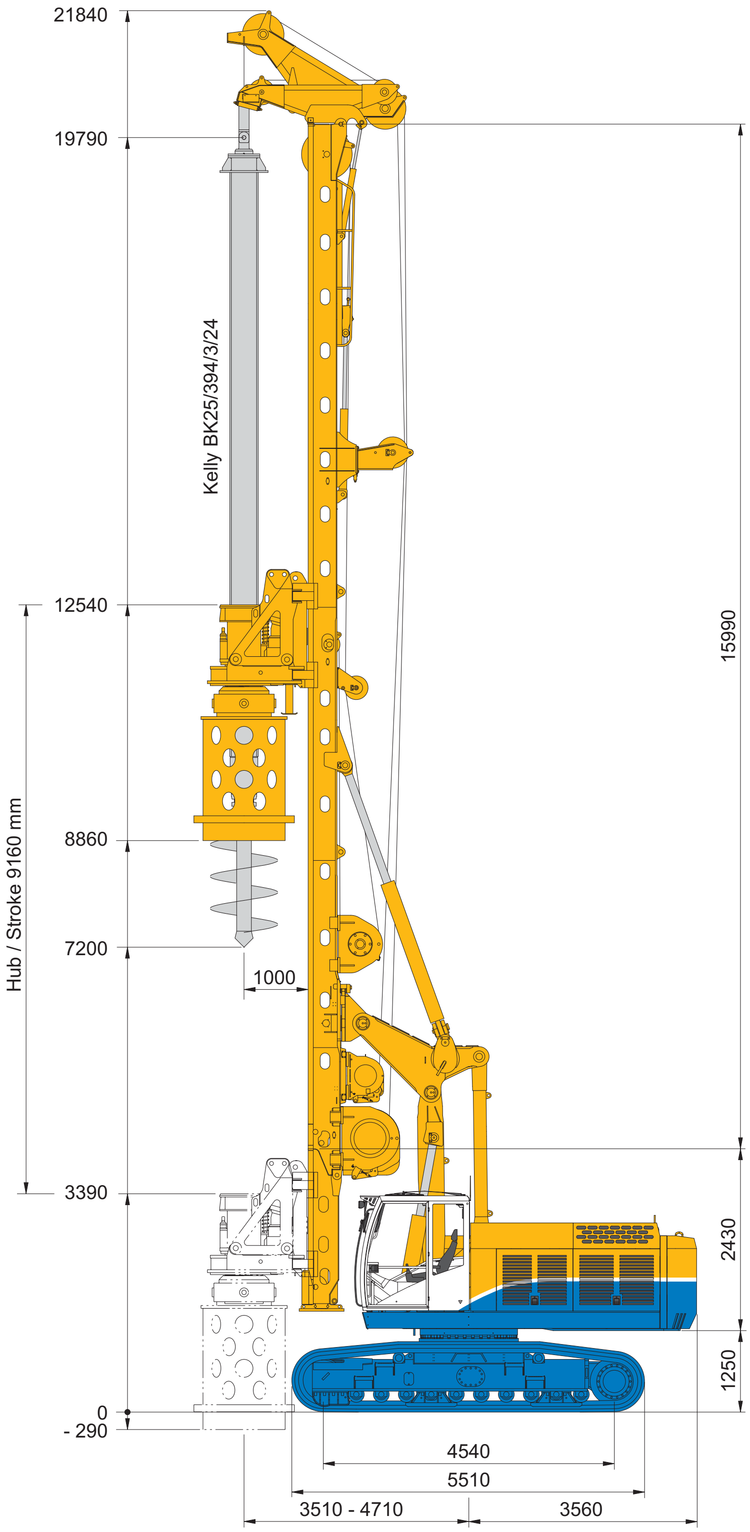
Abmessungen Dimensions

Die **BG 24 H,** ein Gerät mit einem Einsatzgewicht von ca. 82,5 t dient zur Herstellung von

- verrohrten Bohrungen (Eindrehen des Bohrrohres mit dem Drehgetriebe oder mit angebauter Verrohrungsmaschine)
- unverrohrten, flüssigkeitsgestützten Bohrungen
- Bohrungen mit langer Hohlschnecke (SOB) - mit oder ohne Kellyverlängerung
- Sonderverfahren wie VdW-Bohren, Verdrängerbohrungen, Soil-Mixing Verfahren (CSM und SMW)

The **BG 24 H** rotary drilling rig has an operating weight of approx. 82,5 t.
It is ideally suited for:

- Drilling cased boreholes (installation of casing by rotary drive or optionally by hydraulic oscillator – both are powered by the drilling rig)
- Drilling uncased deep boreholes that are stabilised by drilling fluid
- Drilling boreholes with long hollow stem augers (CFA system), with or without kelly extensions
- Special drilling systems, such as FOW piles, displacement piles, soil mixing systems (CSM and SMW)



Bohrverfahren mit Serienausstattung:

Kellybohren (ohne Verrohrungsmaschine)

SOB-Verfahren (hydraulisch und elektrisch vorgerüstet)

FDP Verdrängerbohren (hydraulisch und elektrisch vorgerüstet)

Drilling processes with standard equipment:

Kelly drilling (without casing oscillator)

CFA drilling (pre-equipped with hydraulic and electric installations)

FDP Full-Displacement-Piling (pre-equipped with hydraulic and electric installations)

Technische Daten Technical specifications

Gesamthöhe	**Overall height**	21.870 mm
Einsatzgewicht ca. (mit Kelly BK 394/3/24)	**Operating weight** (approx.) (with kelly BK 394/3/24)	82.500 kg
Drehantrieb	**Rotary drive**	**KDK 250 K**
Drehmoment (nominal) bei 300 bar	Torque (nominal) at 300 bar	237 kNm
Drehzahl max	Speed of rotation (max.)	32 U/min (RPM)
Vorschubwinde	**Crowd winch**	
Druckkraft / Zugkraft (effektiv)	Crowd force push / pull (effective)	330 kN / 330 kN
Druckkraft / Zugkraft gemessen am Drehteller KDK	Crowd force push / pull measured at the casing drive adapter	270 kN / 280 kN
Hub (Kellysystem)	Stroke (kelly system)	9.155 mm
max. Schlittenhub	max. stroke of sledge	15.425 mm
Geschwindigkeit (ab/auf)	Speed (down/up)	6,5 / 6,5 m/min
Schnellgang (ab/auf)	Fast speed (down/up)	25 / 25 m/min
Hauptwinde	**Main winch**	
Windenklasse	Winch classification	M6 / L3 / T5
Zugkraft (1. Lage) effektiv/nominal	Line pull (1st layer) effective/nominal	200 kN / 250 kN
Seildurchmesser / Länge	Rope diameter / Length	28 mm / 75 m
Windengeschwindigkeit	Line speed max.	85 m/min
Hilfswinde	**Auxiliary winch**	
Windenklasse	Winch classification	M6 / L3 / T5
Zugkraft (1. Lage) effektiv/nominal	Line pull (1st layer) effective/nominal	80 kN / 100 kN
Seildurchmesser / Länge	Rope diameter / Length	20 mm / 50 m
Windengeschwindigkeit	Line speed (max.)	55 m/min
Mastneigung	**Mast inclination**	
nach hinten / vorne / quer	Backward / forward / lateral	15° / 5° / 8°

Serienausstattung

- Drehgetriebe KDK 250 K (Konstantgetriebe)
- Hauptwinde mit hydraulischer Freilaufsteuerung
- Haupt- und Hilfswinde mit Spezialrillung
- Hubendschalter für Haupt- und Hilfswinde
- Wirbel für Hauptseil
- Vorschub schnell / langsam
- Schwenkbarer Anschlagpunkt für Haupt- und Hilfsseil

Mess- und Steuerungstechnik

- SPS Rechner für alle elektrisch angesteuerten Funktionen
- Bauer Komfortbildschirm inkl. Diagnosefunktion und digitale Anzeige der Pumpendrücke
- Anzeige von Fehlermeldungen in Klartext
- Schockiereinrichtung
- Notsteuerung Bohrgerät (Kernfunktionen)
- Mastneigungsmessung in x/y Richtung (Anzeige digital/ analog)
- Mastautomatik (automatische Vertikalstellung)
- Hauptwinde mit elektronischer Seilkraftmessung
- Hilfswinde mit hydraulischer Seilkraftmessung
- Tiefenmessung Hauptwinde
- Tiefenmessung Vorschubwinde
- Funktion "Wirbel aufstellen" Hauptwinde
- Drehzahlmessung KDK
- Schlappseilabschaltung Hauptwinde
- Anpresskraft-Einstellung
- Abbohrassistent Kelly
- Ziehsteuerung

Standard equipment

- Rotary drive KDK 250 K (single gear drive)
- Main winch with hydraulically operated freewheeling
- Main and auxiliary winch with special grooving
- Hoist limit switch on main and auxiliary winches
- Swivel for main rope
- Crowd in fast or slow mode
- Pivoted anchor points for main and auxiliary ropes

Measuring and control equipment

- PLC processor for all electrically actuated functions
- Bauer extended monitor incl. diagnostic functions and digital display of pump pressures
- Display of fault messages as plain text
- Uni-directional impact function on KDK (for auger discharge)
- Emergency mode of operation for drilling rig (core functions)
- Mast inclination measurement on x/y axes (digital/analog display)
- Automatic vertical alignment of mast
- Electronic load sensing on main rope
- Hydraulic load sensing on auxiliary rope
- Depth measuring device on main winch
- Depth measuring device on crowd winch
- Swivel alignment function on main winch
- Speed measuring device on KDK
- Rope slack prevention on main winch
- Crowd pressure setting
- Crowd control system Kelly
- Tool extraction control system

Drehgetriebe

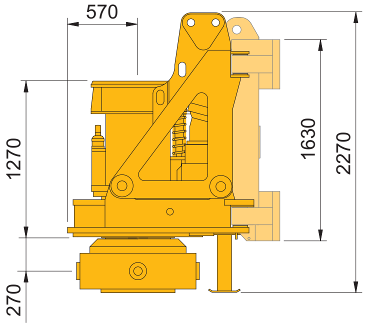
Rotary drive

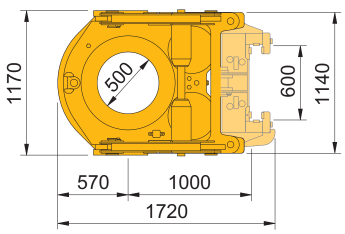
Serienausstattung:

- integriertes Kellydämpfungssystem
- Gleitleisten sind ohne Demontage des Drehgetriebes auswechselbar
- auswechselbare Kellymitnehmer
- auswechselbare Mitnehmerleisten
- Kardangelenk
- Hydraulische Verbindungen mit Schnellkupplungen
- 3 einstellbare Betriebsmodi (siehe Diagramme)
- Transportstützen
- Hebegeschirr

Standard equipment:

- Integrated kelly damping system
- Wear pads exchangeable without removal of rotary drive
- Exchangeable kelly drive adapter
- Exchangeable kelly drive keys
- Cardanic joint
- Quick-release couplers on hydraulic hoses
- 3 selectable modes of operation (refer to diagrams)
- Transport supports
- Slings gear for rotary drive





Gewicht ohne Schlitten Weight without sledge	4,9 to

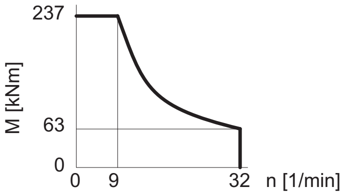
KDK 250 K (Standard)

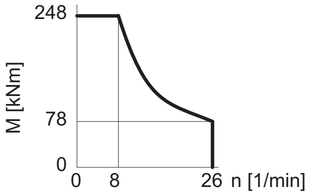
Konstantgetriebe
Single gear rotary drive

KDK 250 S (Optional)

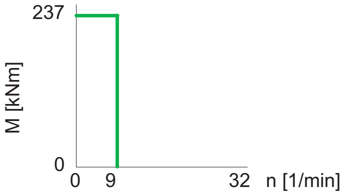
Schaltgetriebe
Multi gear rotary drive

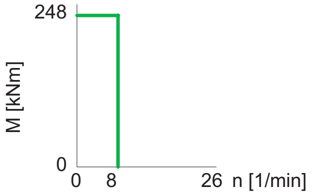
1. Gang Standardbetrieb
1st gear standard mode



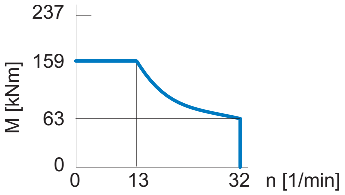


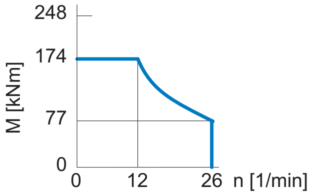
1. Gang Einrichten und Felsbohren
1st gear Set up and rock drilling





1. Gang M_D reduziert
1st gear M_D reduced

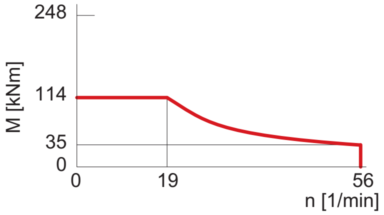




2. Gang Standardbetrieb
2nd gear standard mode

Drehmoment nominal
Darstellung nicht maßstäblich

nominal torque values
not to scale

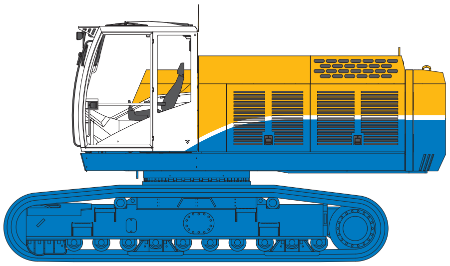


Geräteträger BT 75

Base carrier BT 75

Das Trägergerät BT 75 wird von Bauer Maschinen geplant und gebaut. Es zeichnet sich aus durch optimale Kühlleistung bis 45 °C bei moderater Lärmemission.

The base carrier BT 75 is designed and built by Bauer Maschinen. It is especially characterized by an optimal cooling capacity up to 45° C ambient temperature at moderate noise emission.



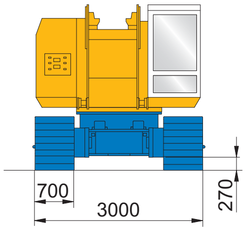
Motor	**Engine**	**CAT C11**
Nennleistung ISO 3046-1	Rated output ISO 3046-1	313 kW @ 1800 U/min (rpm)
Motor spezifiziert nach Abgasnorm	Engine conforms to Exhaust Emission Standard	EEC 97/68EC Stage 3 und EPA/CARB TIER III
Dieseltank	Diesel tank	740 l
Umgebungstemperatur unter Vollast	Ambient air temperature (at full power)	bis (up to) 45° C
Schalldruckpegel in Kabine (EN 791, Anh. A)	Sound pressure level in cabin (EN 791, Annex A)	L_{PA} 80 dB(A)
Schalleistungspegel (2000/14/EG u. EN 791, Anh.A)	Sound power level (2000/14/EG u. EN 791, Annex A)	L_{WA} 113 dB(A)
Hydrauliksystem	**Hydraulic system**	Zweikreisbohrhydraulik 2-hydraulic circuit system for drilling
Hydraulische Leistung (gemessen am Verteilerblock KDK)	Hydraulic power output (measured at inlet to rotary drive)	**235 kW**
Hydraulikdruck	Hydraulic pressure	320 bar
Fördermengen (Hauptkreise + Hilfskreis)	Flow rates (main circuits + auxiliary circuit)	2 x 250 l/min + 1 x 215 l/min
Tankvolumen	Hydraulic oil tank capacity	700 l
Unterwagen (Teleskopfahrwerk)	**Undercarriage** (Retractable crawler frames)	**UW 80**
Laufwerksklasse	Crawler type	B 7
Spurweite (eingefahren/ausgefahren)	Track width (retracted/extended)	2.300 / 3.700 mm
Fahrwerksbreite (eingefahren/ausgefahren)	Overall width of crawlers (retracted/extended)	3.000 / 4.400 mm
3-Steg Bodenplatten	Width of triple grouser track shoes	700 mm
Fahrwerkslänge	Overall length of crawlers	5.500 mm
Zugkraft effektiv/nominal	Traction force effectiv/nominal	486 / 570 kN
Fahrgeschwindigkeit	Travel speed	1,5 km/h

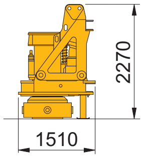
Serienausstattung	Standard equipment
• Motornotsteuerung	• Emergency mode of operation for engine
• Leerlaufautomatik (zur Verbrauchsoptimierung)	• Automatic idling mode (to optimise fuel consumption)
• Motordiagnostiksystem	• Engine diagnostic system
• Diagnoseleiste für hydraulische Funktionen	• Diagnostic panel for hydraulic functions
• abnehmbarer Ballast	• Removable counterweight
• abnehmbare Raupenträger	• Removable crawler side frames
• Verzurraugen an Raupenträgern	• Transport securing lugs on crawler units
• Aufstiegsleiter zum Oberwagen	• Access ladder on uppercarriage
• Bordbeleuchtungssatz	• On-board lighting set
• Bordwerkzeugsatz	• On-board tool set
• Elektrische Betankungspumpe	• Electric refuelling pump
• Komfortfahrerkabine (Breite 950 mm)	• High-comfort operator's cab (width 950 mm)
• Kabine mit FOPS Standard	• Operator’s cab (FOPS compliant)
• Klimaanlage	• Air conditioning system
• Radio und CD	• Radio and CD player
• Trittroste (neben und vor der Kabine)	• Catwalk (on side and in front of operator’s cab)
• Elektronische Lüftersteuerung	• Electronical fan control

Transportdaten   Transport data

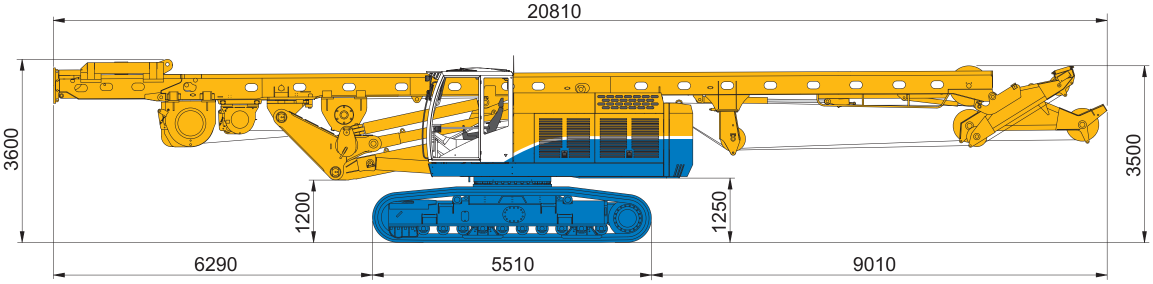
Gewichtsangaben sind ca. Werte, Zusatzausrüstungen (Optionen) können das Gesamtgewicht verändern

Weights shown are approximate values; optional equipment may change the overall weight

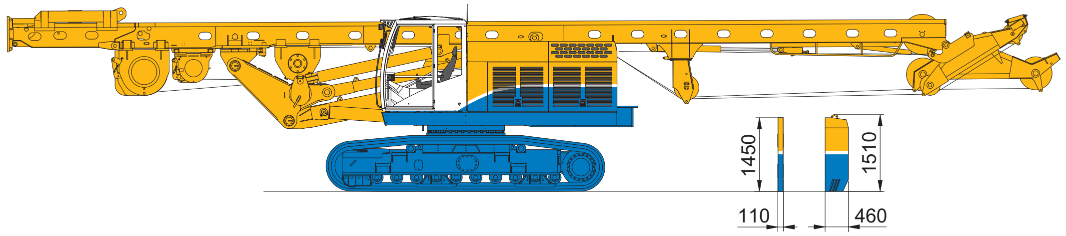




G = 4,9 to
Breite = 1170
(Width)

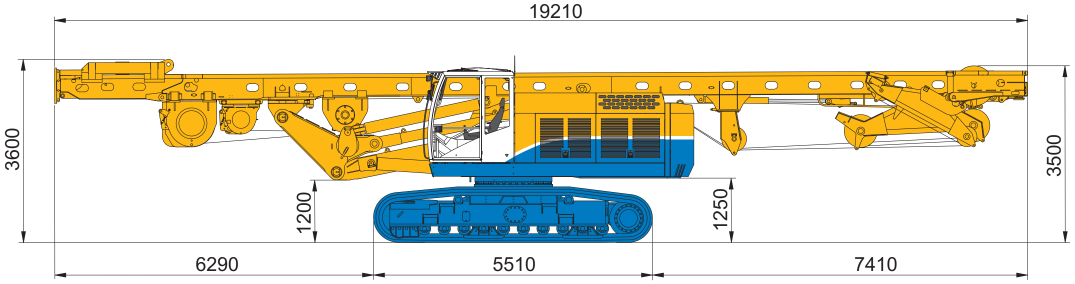


G = 69,5 to mit Gegengewicht
with counterweight



G = 59,5 to ohne Gegengewicht
without counterweight

G = 2,0 + 8,0 to
abnehmbare Gegengewichte
removable counterweights



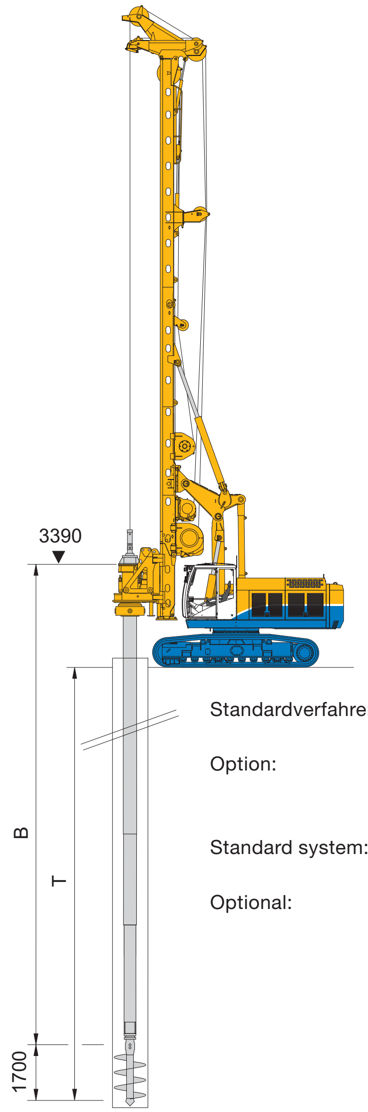
mit 2 m Mastverlängerung, seitlich geklappt
with 2 m tilted mast extension

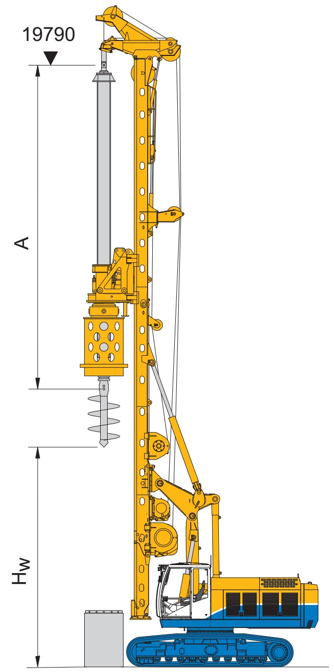
G = 70,6 to mit Gegengewicht
with counterweight

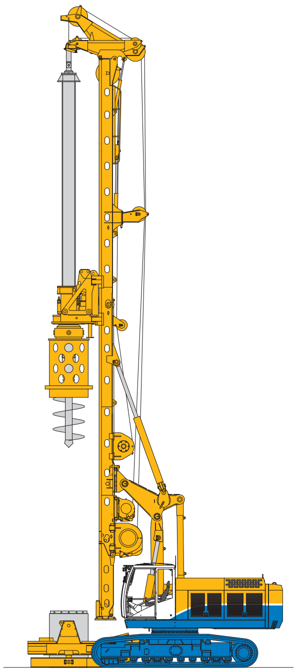
G = 60,6 to ohne Gegengewicht
without counterweight

Anwendungen Applications

Kellybohrverfahren Kelly drilling system







Standardverfahren:	unverrohrt, oder Einbau der Bohrrohre mit Drehgetriebe
Option:	Einbau der Bohrrohre mit angebauter hydraulischer Verrohrungsmaschine
Standard system:	Uncased drilling or installation of casing with rotary drive
Optional:	Installation of casing with hydraulic oscillator attached to the drilling rig

Zusatzausstattung / optional equipment:

Anbau Verrohrungsmaschine
Attachment of hydraulic oscillator

BV 1500 HD-08

Bohrtiefen Drilling depths

Kellytyp Type of kelly bar	A (m)	B (m)	Gewicht Weight (kg)	Hw (m)	T (m)
BK25/394/3/24	10,71	27,20	4.700	6,60	**25,50**
BK25/394/3/27	11,71	30,20	5.120	5,60	**28,50**
BK25/394/3/30	12,71	33,20	5.530	4,60	**31,50**
BK25/394/3/36	14,71	39,20	6.350	2,60	**37,50**
BK25/394/4/32	10,71	35,47	6.850	6,60	**33,80**
BK25/394/4/36	11,71	39,47	7.150	5,60	**37,80**
BK25/394/4/40	12,71	43,47	7.730	4,60	**41,80**
BK25/394/4/48	14,71	51,47	8.850	2,60	**49,80**
BK25/394/4/52	15,71	55,47	9.450	1,60	**53,80**
BK25/394/4/56	16,71	59,47	10.000	0,60	**57,80**

Bohrdurchmesser Drilling diameter

Unverrohrt	Uncased	1.700 mm
Verrohrt	Cased	1.400 mm

Bohrrohrlängen Length of casing sections

Ohne BV	Without casing oscillator	Hw – 0,5 m
Mit BV	With casing oscillator	Hw – 1,5 m

Bemerkungen zur Bohrdatenermittlung siehe „Kellystangen 905.518.1“

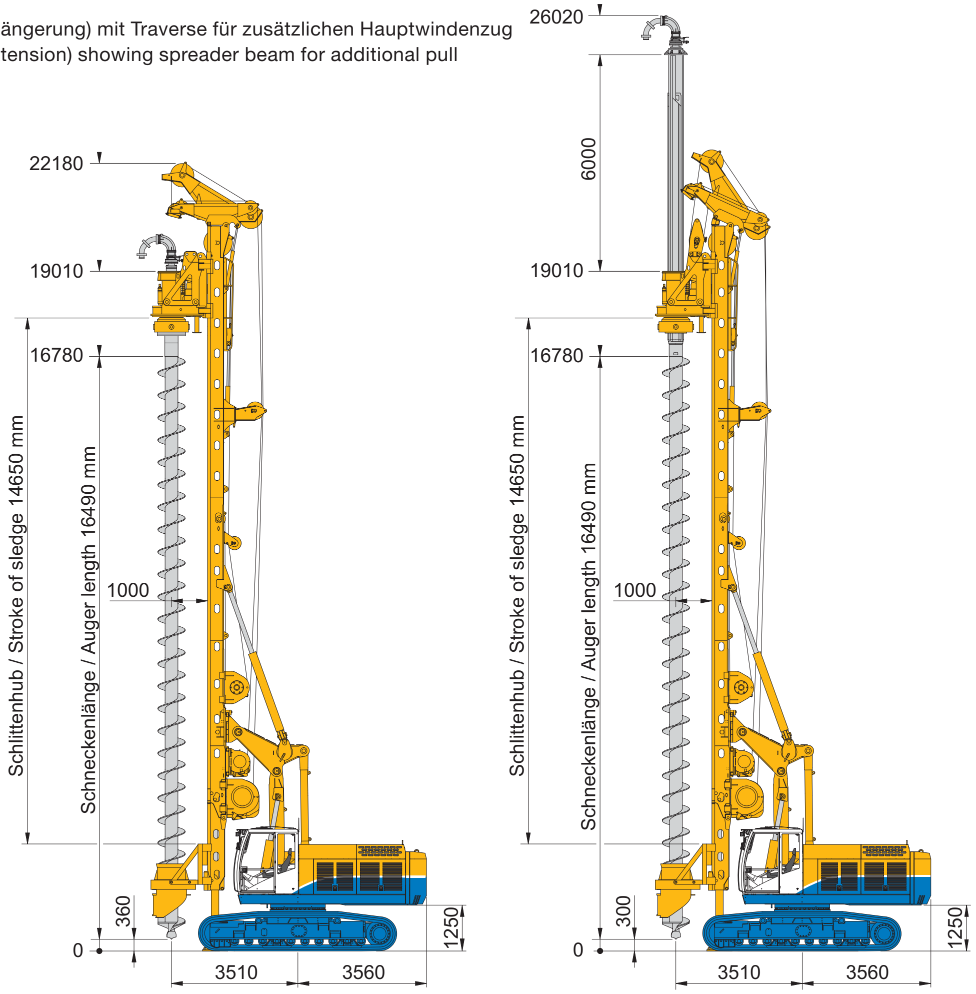
For further details on the acquisition of drilling data please refer to “Kelly Bars 905.518.1”

Anwendungen Applications

SOB – Bohrverfahren CFA – drilling system

hydraulische Mastabstützung erforderlich / hydraulic mast support required

Zeichnung (mit Kellyverlängerung) mit Traverse für zusätzlichen Hauptwindenzug
Illustration (with kelly extension) showing spreader beam for additional pull
with main winch



	ohne Kellyverlängerung without kelly extension	mit Kellyverlängerung 6,0 m with kelly extension 6,0 m
Bohrtiefe mit Schneckenputzer Drilling depth with auger cleaner	13,00 m	19,00 m
Bohrtiefe ohne Schneckenputzer Drilling depth without auger cleaner	14,20 m	20,20 m
Max. Bohrdurchmesser Max. drilling diameter	1.000 mm	1.000 mm
Max. Zugkraft Max. extraction	330 kN	330 kN
Max. Zugkraft mit Haupt- und Vorschubwinde (effektiv) Max. extraction force with main- and crowd winch (effective)	730 kN (400 + 330 kN)	730 kN (400 + 330 kN)
Max. Anpresskraft Max. crowd force	270 kN + Schneckengewicht 270 kN + auger weight	270 kN + Schneckengewicht 270 kN + auger weight
Schneckenlänge (inkl. Pilot) Continuous flight auger length (incl. pilot)	16,49 m	16,49 m

BAUER SECTIONAL CASING

Bohrrohre Casings

Rohrkragen - Rohrschuhe
Joints and Casing shoe

7/2005

BAUER

Bohrrohre

Casings

Die leistungsstarken Drehgetriebe der BG-Bohrgeräte und die Verrohrungsanlagen von Bauer erfordern auch qualitativ hochwertige Bohrrohre.
Es werden zwei verschiedene Typen von Bohrrohren angeboten:

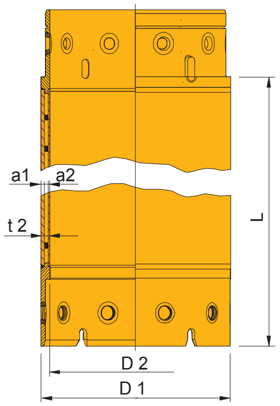
Bohrrohre doppelwandig - Bohrrohre einwandig

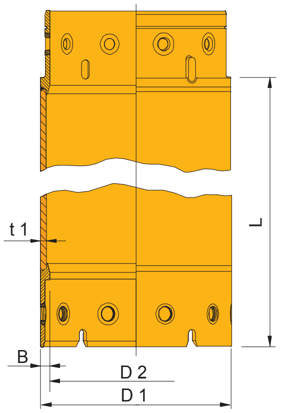
Die doppelwandigen Bohrrohre können generell eingesetzt werden, da sie auf die hohen Drehmomente der KDK-Getriebe und der Verrohrungsanlagen abgestimmt worden sind.
Durch die doppelwandige Bauweise wird ein durchgehend glatter Bohrstrang gewährleistet.
Bei einwandigen Bohrrohren ist eine Abstimmung dieser Faktoren und des Boden vorzunehmen.

*The use of powerful rotary drives of the BG-series or the use of oscillators requires the application of heavy-duty casings.
Bauer offers two types of casings:*

double-walled casings - single-walled casings

*Double-walled casings can be used universally, as they are designed especially for transmitting high rotational and vertical forces as created by the KDK rotary drives and oscillators.
The use of double-walled casings ensures a flush drill string.
Single-walled casings can be used for applications where weight reduction is important*





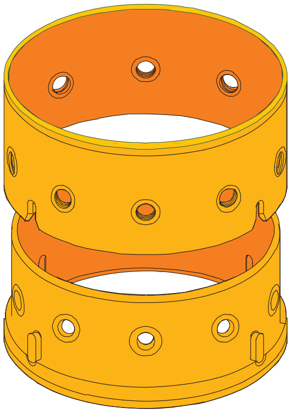
Technische Daten - doppelwandige Rohre

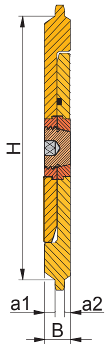
Technical Data - double-walled casings

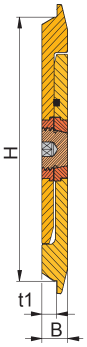
	Nutzlänge / *effective length* L (m)									
D1/D2 (mm)	1m	2m	3m	4m	5m	6m	a1	a2	t2	Schrauben *bolts*
	Gewicht / *weight* (kg)						mm	mm	mm	(Anz. / *No.*)
620/540	403	739	1074	1411	1747	2081	12	8	40	8
750/670	492	902	1311	1722	2131	2540	12	8	40	10
880/800	585	1069	1552	2036	2520	3005	12	8	40	10
1000/920	669	1221	1773	2326	2877	3429	12	8	40	10
1180/1100	844	1580	2316	3052	3787	4522	16	8	40	12
1200/1120	872	1620	2370	3120	3870	4620	16	8	40	12
1300/1220	933	1746	2558	3372	4184	4995	16	8	40	12
1500/1400	1433	2625	3817	5009	6201	7393	20	10	50	12
1800/1700	1730	3166	4602	6038	7474	8910	20	10	50	16
2000/1880	2450	4280	6110	7940	9770	11600	20	15	60	12
2200/2080	2700	4720	6740	8760	10780	12800	20	15	60	12
2500/2380	2960	5240	7520	9800	12080	14360	20	15	60	16

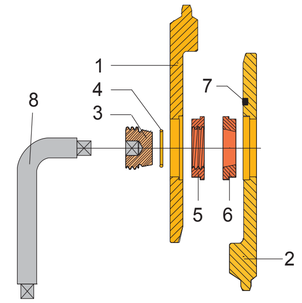
Bohrrohrverbinder und Rohrschrauben

Casing joints and Conical bolts







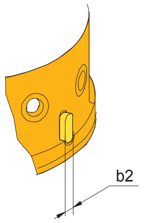


1	Mutterteil	Female part
2	Vaterteil	Male part
3	Schraube	Conical bolt
4	O-Ring	O-ring
5	Gewindering	Thread ring
6	Konusring	Conical ring
7	Dichtung	Sealing
8	Schlüssel	Wrench

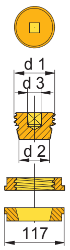
Dimensionen *dimensions*				Schrauben und Einsätze *bolts and inserts*				Paßfedern *keys*		*O-Ring*
D1/D2	H	B	Gewicht weight	Schraube bolt		Gewindering thread ring	Konusring conical ring		b2	
mm	mm	mm	kg	Anz qty	Type	Anzahl/qty	Anzahl/qty	Anz./qty	mm	mm
620/540	340	40	179	8	I	8	8	4	40	10x535
750/670	340	40	218	10	I	10	10	4	40	10x665
880/800	340	40	261	10	I	10	10	4	40	10x790
1000/920	340	40	300	10	I	10	10	4	40	10x910
1180/1100	340	40	355	12	I	12	12	4	40	10x1090
1200/1120	340	40	375	12	I	12	12	4	40	10x1110
1300/1220	340	40	393	12	I	12	12	4	40	10x1210
1500/1400	490	50	827	12	II	12	12	4	60	10x1400
1800/1700	490	50	998	16	II	16	16	4	60	10x1695
2000/1880	560	60	1520	12	III	12	12	6	90	10x1870
2200/2080	560	60	1670	12	III	12	12	6	90	10x2070
2500/2380	560	60	1800	16	III	16	16	8	90	10x2360

Rohrschrauben

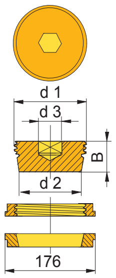
Conical bolts



TYPE I/II



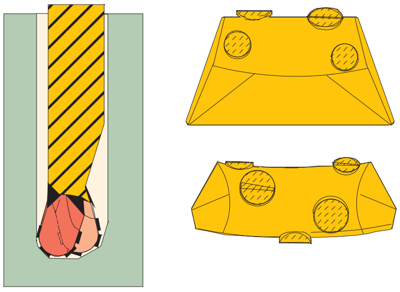
TYPE III



Type	**d1**	**d2**	**d3**	**B**	**Gewicht** ***weight***
	mm	**mm**	**mm**	**mm**	**kg**
I	**75**	**60**	**SQ 28**	**40**	**1,0**
II	**75**	**60**	**SQ 28**	**50**	**1,1**
III	**100**	**82**	**HEX 41**	**60**	**3,2**

Schneidringe

Cutting rings



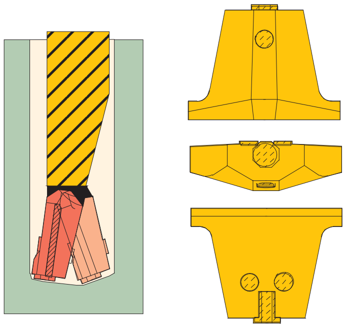
Typ BR

Hauptmerkmale und Eigenschaften
Ausgeprägter Fräseffekt. Optimaler Freischnitt durch verschränkte Zahnanordnung. Rückschneideffekt durch schräg nach außen verlaufenden Stollenrücken. Variable Stellungen des Stollens möglich.

Einsatzbereiche:
harte rollige und bindige Böden, Gerölle, Fels, überschnittene Bohrpfahlwand. Besonders geeignet für schweren Verrohrungsmaschineneinsatz.

Characteristics and Features:
Optimum shape for milling of soil. Round milling front with hard metal inserts allows variable tooth inclination. Hard metal tips on the outside of the inclined shoulder eases extraction of casing.

suitable for:
heavy oscillator work in hard soil, gravel, cobbles, rock, concrete in secant pile wall



Typ BH

Hauptmerkmale und Eigenschaften:
Ausgeprägter Schneid- und Räumeffekt. Optimaler Freischnitt durch verschränkte Zahnordnung. Rückschneideffekt durch schräg nach außen verlaufende Zahnflanken. Variable Stellung möglich.

Einsatzbereiche:
sandige, kiesige und bindige Böden, Weichgestein (Ton, Mergel, Nagelfluh) Besonders geeignet für Drehbohrverfahren.

Characteristics and Features:
Optimum shape for cutting and reaming. Hard metal tips on outside inclined shoulder eases extraction of casing. “aggressive” cutting behaviour.

suitable for:
mainly for rotary drilling in sand, cohesive soil, marl, soft rock (like claystone)

D1 /D2	a	t4	Gewicht *weight*	*Zähne teeth*
mm	mm	mm	mm	mm
620/540	302	35	160	16
750/670	302	35	200	16
880/800	302	35	230	18
1000/920	302	35	260	18
1180/1100	302	35	310	20
1200/1120	302	35	313	20
1300/1220	302	35	340	24
1500/1400	302	45	513	30
1800/1700	302	45	620	36
2000/1880	302	55	830	36
2200/2080	302	55	910	40
2500/2380	302	55	1050	46

Rohrschuhe (mit Anschweißzähnen)

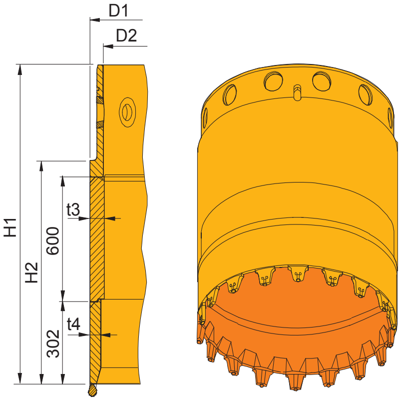
Casing shoes (with weld-on teeth)

Lange Ausführung

Schneidring bestückbar mit Zähnen Typ BR,BH (andere Zahntypen auf Wunsch)
Optimale Rundlaufeigenschaft
Zentriernut zwischen Schneidschuh und Verschleißring ermöglicht einfachen Austausch des Schneidringes auf der Baustelle

Long Version

Cutting ring can be equipped with BR or BH type teeth (other types on request
Male joint, wear ring and cutting ring are machine faced.
Centering groove on wear ring and tack welding of cutting ring to wear ring allow easy replacement of cutting ring on site.

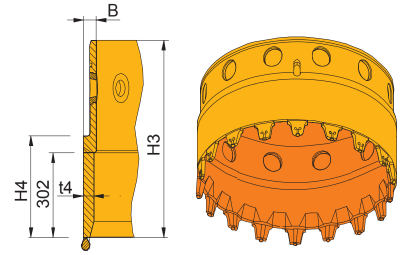


Kurze Ausführung

Schneidring bestückbar mit Zähnen Typ BR,BH (andere Zahntypen auf Wunsch)
Optimale Rundlaufeigenschaft.
Vaterteil und Schneidring sind voll verschweißt.

Short Version

Cutting ring can be equipped with BR or BH type teeth (other teeth types on request
Male joint, wear ring and cutting ring are machine faced.
Cutting ring welded directly to male joint.



	Lange Version *long version*					**Kurze Version** *short version*		
D1/D2	H1	H2	t3 / t4	Gewicht weigh	Schraube joints	H3	H4	Gewicht weigh
mm	mm	mm	mm	kg	Anz. / no	mm	mm	kg
620/540	1186	954	40 / 35	590	8	586	354	339
750/670	1186	954	40 / 35	725	10	586	354	418
880/800	1186	954	40 / 35	855	10	586	354	491
1000/920	1186	954	40 / 35	975	10	586	354	560
1180/1100	1186	954	40 / 35	1160	12	586	354	665
1200/1120	1186	954	40 / 35	1177	12	586	354	677
1300/1220	1186	954	40 / 35	1275	12	586	354	733
1500/1400	1321	969	50 / 45	2005	12	721	369	1340
1800/1700	1321	969	50 / 45	2420	16	721	369	1618
2000/1880	1402	1002	60 / 55	3290	18	802	402	2350
2200/2080	1402	1002	60 / 55	3640	18	802	402	2580
2500/2380	1402	1002	60 / 55	4110	24	802	402	2850

Rohrschuhe (mit Wechselstollen WS 39)

Casing shoes (with pin-on teeth WS 39)

Die Entwicklung des Rohrschuhs mit Wechselstollen ist das Ergebnis jahrelanger Erfahrung bei der Herstellung von verrohrten Bohrungen in schwierigen Böden. Der Rohrschuh eignet sich besonders für Einbindungen in Fels oder für das Herstellen von Bohrpfahlwänden.

Besondere Kennzeichen:

- gute Schneidwirkung
- guter Materialfluss am Zahn
- hohe Standzeit
- baustellengerechte Wartungsmöglichkeit

Die Zahnform wurde optimiert um mit einem Zahntyp einen idealen Freischnitt nach außen und nach innen zu gewährleisten.

Vorteile für die Baustelle:

- einfacher Zahnwechsel ohne Hilfswerkzeug
- ein Zahntyp (für äußeren und inneren Freischnitt)
- Schneidgeometrie bleibt nach Zahnwechsel erhalten
- geheftete Verschleißplatten können einfach gewechselt werden (keine Aufpanzerungsarbeiten)

The development of a casing shoe fitted with pin-on teeth is the result of years of experience of drilling cased boreholes in difficult soil formations. The casing shoe is particularly suitable for the formation of rock sockets and the construction of bored pile walls.

Special features:

- *good cutting properties*
- *good materialflow at the tooth*
- *excellent wear resistance*
- *easy on-site serviceability*

The shape of the teeth has been optimised to produce a single reversible tooth. By mounting just one type of tooth, but with alternating face orientation, the lateral cutting capability of the shoe is guaranteed to be of the same quality on both the outer and the inner circumference of the annulus.

Advantages:

- *easy replacement without the need for special aids.*
- *one tooth type only*
- *no change of the shape of annulus and tooth angle*
- *hard faced vertically aligned steel plates welded onto the lower section of the shoe provide permanent wear resistance easily renewable on site.*

Rohrschuhe (mit Wechselstollen WS 39)

Casing shoes (with pin-on teeth WS 39)

Durchmesser (mm) *Diameter (mm)*	620	750	880	1000	1180	1300	1500
Stollenanzahl *No of teeth*	14	16	18	18	20	24	30
Gewicht (kg) *Weight (kg)*	309	374	439	500	589	653	955

Standard:
Stollenring angeschweißt an Rohrverbinder mit Nutzhöhe 500 mm

Option 1:
Stollenschuh ohne Rohrverbinder (als Anschweißteil)

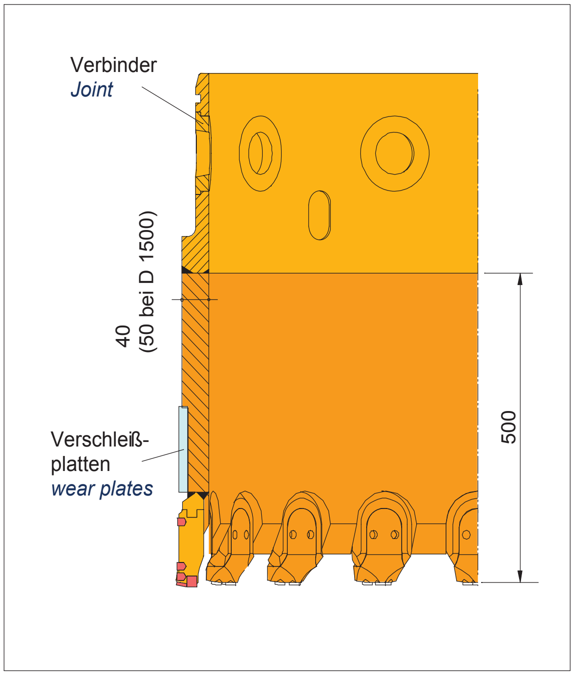
Option 2:
Stollenschuh lang, Nutzlänge 2 m (mit oder ohne Rohrverbinder

Ausführung Stollenring in St52 oder Hardox

Standard:
Cutting shoe welded on to casing joint, net length 500 mm

Option 1:
Casing shoe without casing joint (to be used as weld-on section)

Option 2:
Extended cutting shoe with overall length 2 m (with or without casing joint)
Cutting shoe welded on to casing joint net length 500 mm



Zahnhalter
Tooth holder

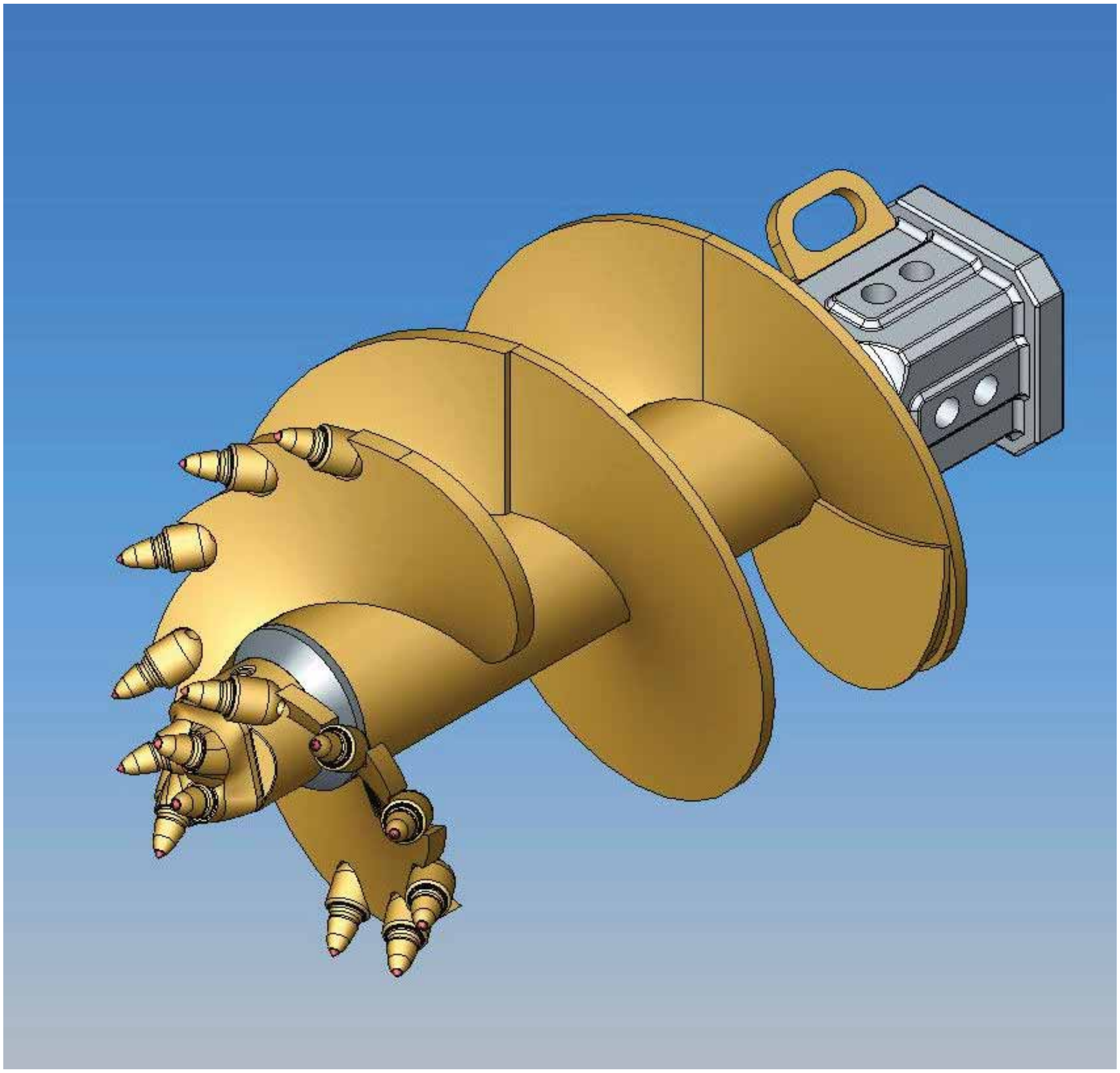
Zahnanordnung außen / innen vertikale Verschleißplatten
Outer / inner cutting arrangement of teeth vertical hard faced wear plates

BAUER Maschinen GmbH
BAUER-Straße 1
D-86529 Schrobenhausen
Tel. +49 (0)8252/97-0
Fax +49 (0)8252/97-1135
e-mail: BMA@bauer.de
www.bauer.de

PI 55 07/2005

DRILL TOOLING

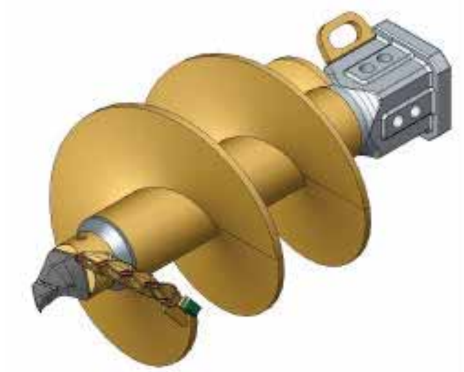
Drehbohrwerkzeuge
Rotary Drilling Tools



Schneckenbohrer, einschneidig *Single Start Auger*

Standard Ausführung bis 180 kNm ***Standard Type up to 180 kNm***

SB-S



Merkmale:
- Pilot ZP 190
- Flachzähne FZ 54

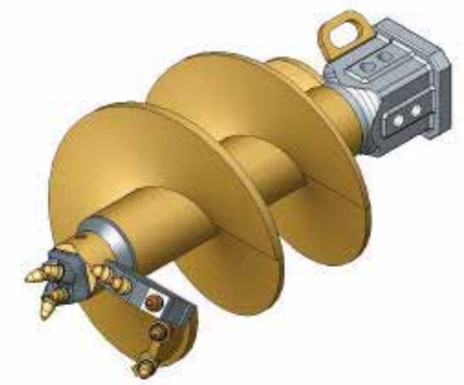
Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton

Features:
- *pilot ZP 190*
- *flat teeth FZ 54*

Soil:
- *sand and gravel up to dense*
- *silt and clay*

SBF-K-S

mit Kaliberschneide
with collar plate



Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-200
- Kaliberring mit R-Meißel

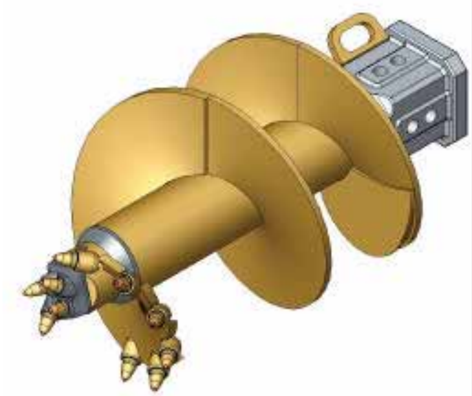
Boden:
- Sand, Kies bis sehr dichte Lagerung
- leichter Fels

Features:
- *cutting edge with R-chisels*
- *pilot RP 4-200*
- *collar ring*

Soil:
- *sand and gravel, up to very dense*
- *weak rock*

SBF-P-S

Felsausführung mit Progressivschneide
rock type with progressiv edge



Merkmale:
- progressive Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-200

Boden:
- bis harter Fels

Features:
- *progressiv cutting edge with R-chisels*
- *pilot RP 4-200*

Soil:
- *up to hard rock*

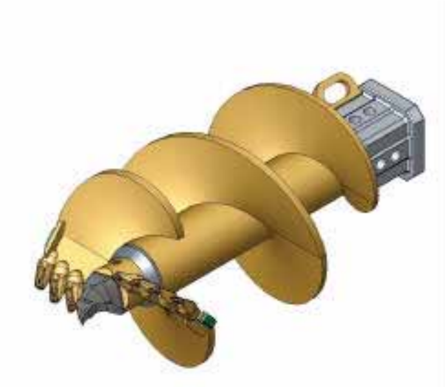
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
520 mm - 1200 mm	1200 mm oder / *or* 1700 mm (effektive Nutzlänge)	150 mm oder / *or* 200 mm

Schneckenbohrer, zweischneidig *Double Start Auger*

Standard Ausführung bis 180 kNm *Standard Type up to 180 kNm*

SB-2-S



Merkmale:
- Pilot ZP 190
- Flachzähne FZ 54

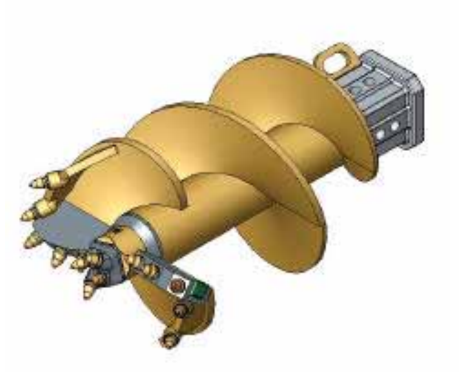
Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton

Features:
- *pilot ZP 190*
- *flat teeth FZ 54*
- *vent pipe*

Soil:
- *sand and gravel up to dense*
- *silt and clay*

SBF-K2-S

Felsausführung und Kaliberschneide *rock type with collar plate*



Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-200
- Kaliberring mit R-Meißel

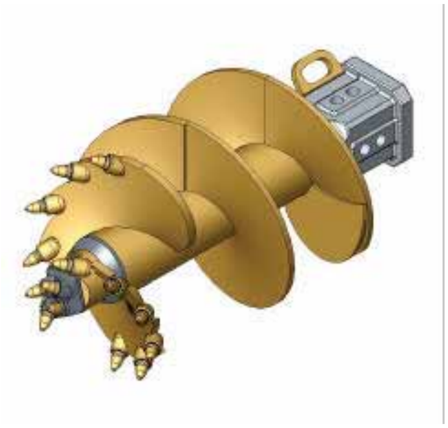
Boden:
- Sand, Kies bis sehr dichte Lagerung
- gebrächer Fels

Features:
- *cutting edge with R- chisels*
- *pilot RP 4-200*
- *collar ring with R-chisel*

Soil:
- *sand and gravel, up to very dense*
- *weak, weathered rock*

SBF-P2-S

Felsausführung mit Progressivschneide *rock type with progressiv edge*



Merkmale:
- Progressivschneide mit R-Meißelbesatz
- Pilot RP 4-200

Boden:
- harter Fels, kompakt

Features:
- *progressiv edge with R- chisels*
- *pilot RP 4-200*

Soil:
- *hard rock, compact*

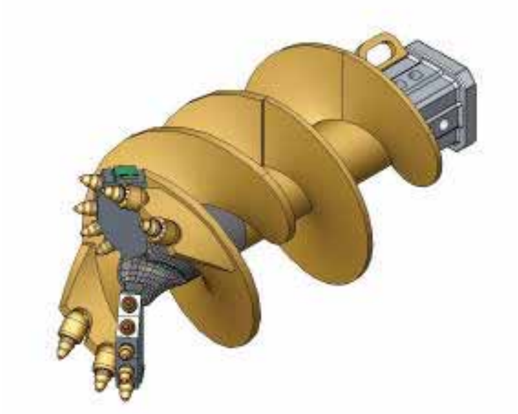
Schneckenbohrer, zweischneidig *Double Start Auger*

Standard Ausführung bis 180 kNm ***Standard Type up to 180 kNm***

SBF-Z2-S

Felsausführung ohne Zentrumspilot

rock type without pilot bit



Merkmale:
- Schneidleiste mit R-Meißelbesatz
- kein Zentrumspilot

Boden:
- verwitterter Fels

Features:
- *Cutting edge with R-chisels*
- *no pilot bit*

Soil:
- *medium hard*
- *weathered rock*

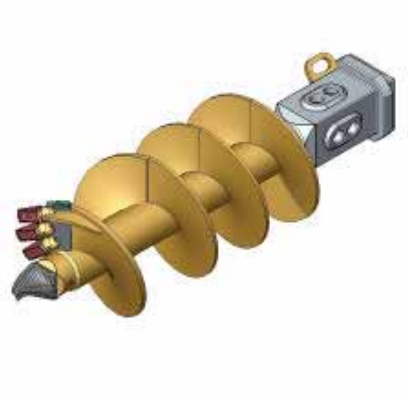
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
520 mm - 1200 mm	1200 mm oder / or 1700 mm (effektive Nutzlänge)	150 mm oder / or 200 mm

Schneckenbohrer, einschneidig *Single Start Auger*

Schwere Ausführung bis 480 kNm *Heavy Duty Type up to 480 kNm*

SB-H



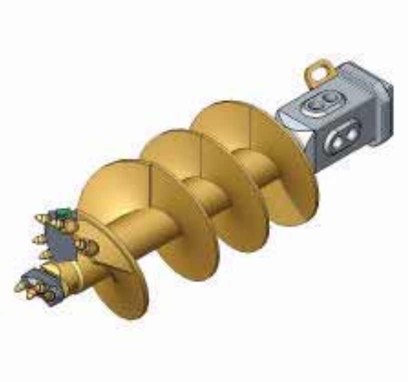
Merkmale:
- Wendelpilot
- Flachzähne FZ 72

Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton

Features:
- *fishtail pilot*
- *flat teeth FZ 72*

Soil:
- *sand and gravel up to dense*
- *silt and clay*

SBF-K-H mit Kaliberschneide *with collar plate*



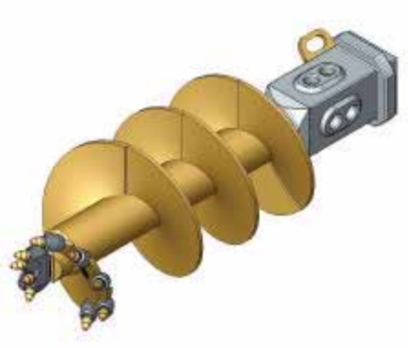
Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-260
- Kaliberring mit R-Meißel

Boden:
- Sand, Kies bis sehr dichte Lagerung
- leichter Fels

Features:
- *cutting edge with R- chisels*
- *pilot RP 4-260*
- *collar ring*

Soil:
- *sand and gravel, up to very dense*
- *weak rock*

SBF-P-H Felsausführung mit Progressivschneide *rock type with progressiv edge*



Merkmale:
- progressive Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-260

Boden:
- bis harter Fels

Features:
- *progressiv cutting edge with R-chisels*
- *pilot RP 4-260*

Soil:
- *up to hard rock*

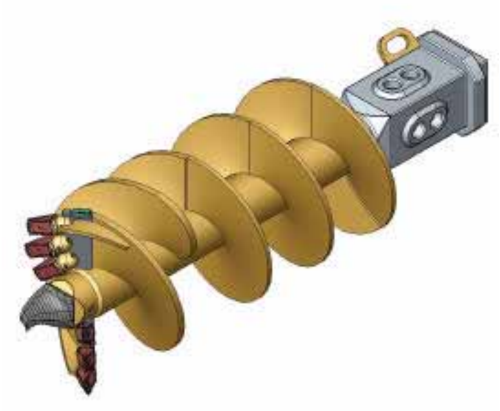
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
520 mm - 1500 mm	1700 mm oder / *or* 2250 mm (effektive Nutzlänge)	200 mm

Schneckenbohrer, zweischneidig *Double Start Auger*

Schwere Ausführung bis 480 kNm ***Heavy Duty Type up to 480 kNm***

SB-2-H



Merkmale:
- Wendelpilot
- Flachzähne FZ 72

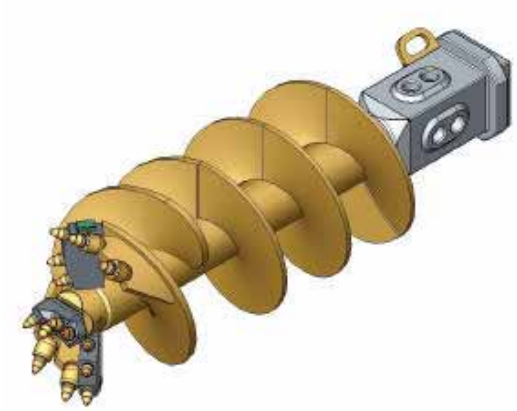
Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton

Features:
- *fishtail pilot*
- *flat teeth FZ 72*
- *vent pipe*

Soil:
- *sand and gravel up to dense*
- *silt and clay*

SBF-K2-H

Felsausführung und Kaliberschneide
rock type with collar plate



Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-260
- Kaliberring mit R-Meißel

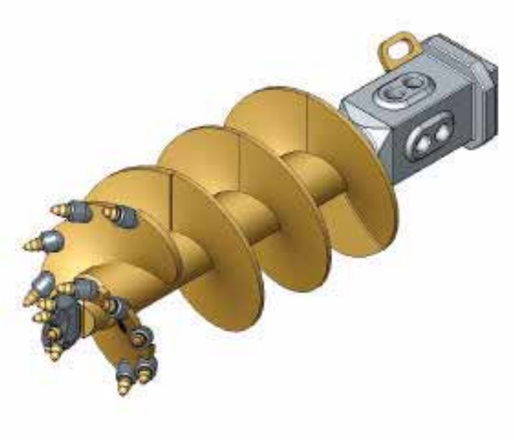
Boden:
- Sand, Kies bis sehr dichte Lagerung
- gebrächer Fels

Features:
- *cutting edge with R-chisels*
- *pilot RP 4-260*
- *collar ring with R-chisel*

Soil:
- *sand and gravel, up to very dense*
- *weak, weathered rock*

SBF-P2-H

Felsausführung mit Progressivschneide
rock type with progressiv edge



Merkmale:
- Progressivschneide mit R-Meißelbesatz
- Pilot RP 4-260

Boden:
- harter Fels, kompakt

Features:
- *progressiv edge with R- chisels*
- *pilot RP 4-260*

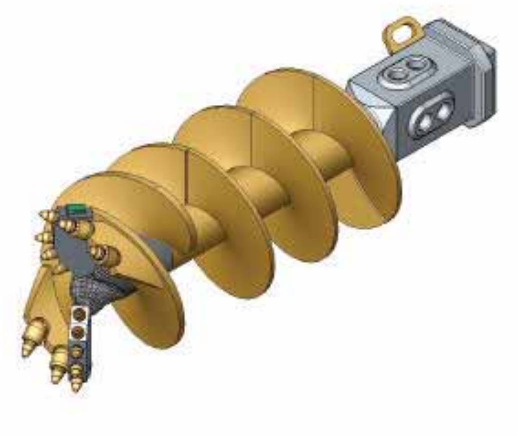
Soil:
- *hard rock, compact*

Schneckenbohrer, zweischneidig *Double Start Auger*

Schwere Ausführung bis 480 kNm *Heavy Duty Type up to 480 kNm*

SBF-Z2-H

Felsausführung ohne Zentrumspilot
rock type without pilot bit



Merkmale
- Schneidleiste mit R-Meißelbesatz
- kein Zentrumspilot

Boden:
- verwitterter Fels

Features:
- *Cutting edge with R-chisels*
- *no pilot bit*

Soil:
- *medium hard,*
- *weathered rock*

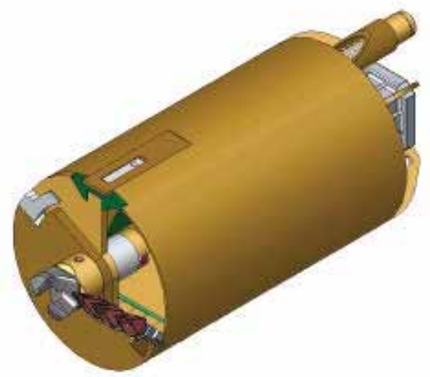
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
650 mm - 2500 mm	1700 mm oder / *or* 2250 mm (effektive Nutzlänge)	200 mm

Bohreimer, einschneidig *Drilling Bucket single edge*

Standard Ausführung bis 180 kNm ***Standard Type up to 180 kNm***

KB-S



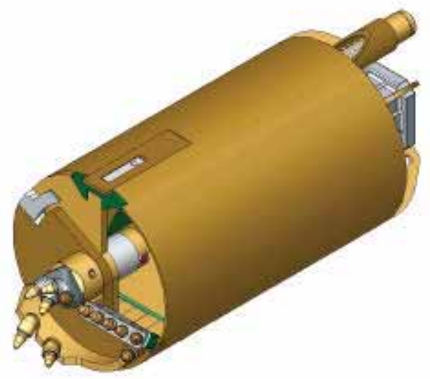
Merkmale:
- Pilot ZP 190
- Flachzähne FZ 54
- Belüftungsschacht

Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton unter Wasser

Features:
- *pilot ZP 190*
- *flat teeth FZ 54*
- *vent pipe*

Soil:
- *sand and gravel up to dense*
- *silt and clay under water*

KBF-K-S Felsausführung und Kaliberschneide *rock type with collar plate*



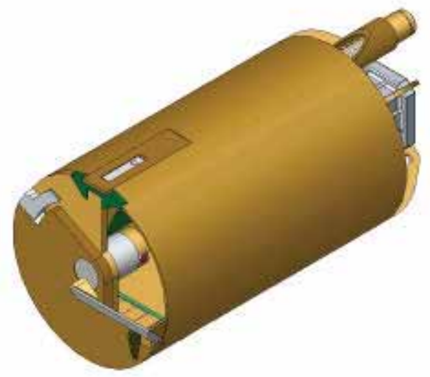
Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-200

Boden:
- mittelharter Fels

Features:
- *cutting edge with R-chisels*
- *pilot RP 4-200*

Soil:
- *medium hard rock*

KB-L-H mit Räumerleiste *with cleaning edge*



Merkmale:
- Schneidleiste als durchgehende Räumerleiste ausgebildet

Einsatz:
- Säubern der Pfahlsohle

Features:
- *Cutting edge designed as continuous cleaning edge*

Used for:
- *Cleaning of pile bottom*

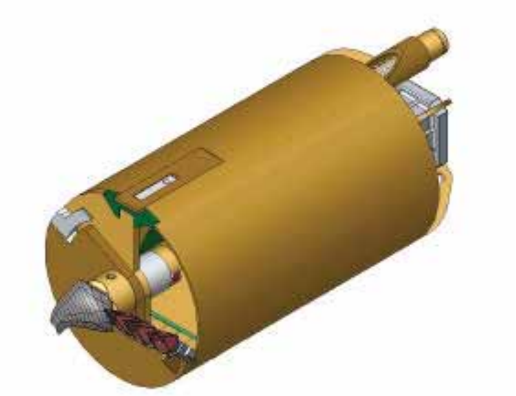
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
520 mm - 1200 mm (∅ 520 mm nur mit Box 150 mm)	1200 mm oder / *or* 1500 mm (Rohrlänge / *Body length*)	150 mm oder / *or* 200 mm

Bohreimer, einschneidig *Drilling Bucket single edge*

Schwere Ausführung bis 480 kNm ***Heavy Duty Type up to 480 kNm***

KB-H



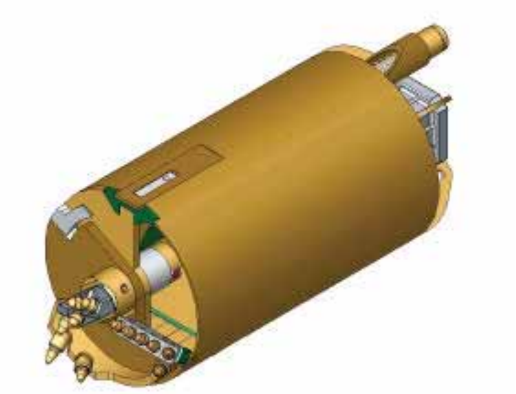
Merkmale:
- Wendelpilot
- Flachzähne FZ 72
- Belüftungsschacht

Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton unter Wasser

Features:
- *fishtail pilot*
- *flat teeth FZ 72*
- *vent pipe*

Soil:
- *sand and gravel up to dense*
- *silt and clay under water*

KBF-K-H **Felsausführung und Kaliberschneide** ***rock type with collar plate***



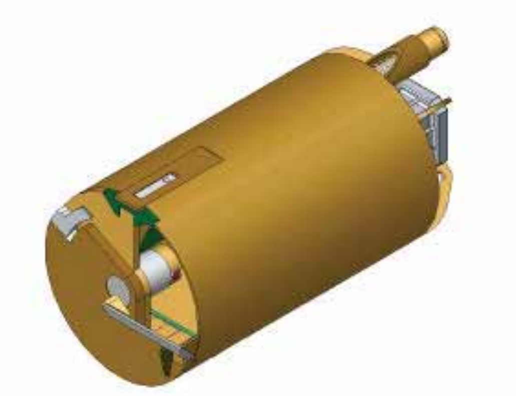
Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Pilot RP 4-260

Boden:
- mittelharter Fels

Features:
- *cutting edge with R-chisels*
- *pilot RP 4-260*

Soil:
- *medium hard rock*

KB-L-H **mit Räumerleiste** ***with cleaning edge***



Merkmale:
- Schneidleiste als durchgehende Räumerleiste ausgebildet
-

Einsatz:
- Säubern der Pfahlsohle

Features:
- *Cutting edge designed as continuous cleaning edge*

Used for:
- *Cleaning of pile bottom*

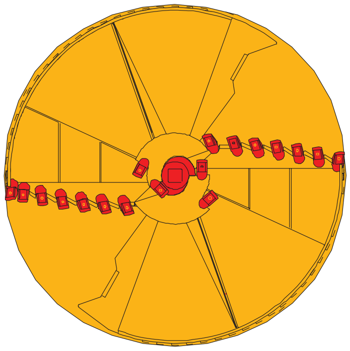
Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
650 mm - 1500 mm	1200 mm oder / *or* 1500 mm (Rohrlänge / *Body length*)	200 mm

Kastenbohrer, zweischneidig *Drilling Bucket Double Edge*

Schwere Ausführung bis 480 kNm *Heavy Duty Type up to 480 kNm*

KB-2-H



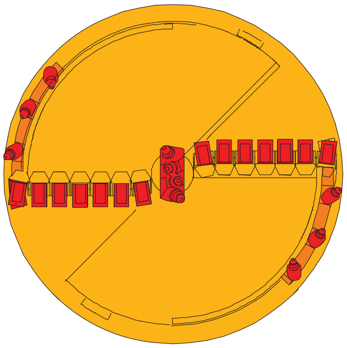
Merkmale:
- Wendelpilot
- Flachzähne FZ 72
- Doppel-Belüftungsschacht

Boden:
- Sand, Kies bis dichte Lagerung
- Schluff und Ton unter Wasser

Features:
- *fishtail pilot*
- *flat teeth FZ 72*
- *double vent pipe*

Soil:
- *sand and gravel up to dense*
- *silt and clay under water*

KB-K2-H mit Kaliberschneiden *with collar plates*



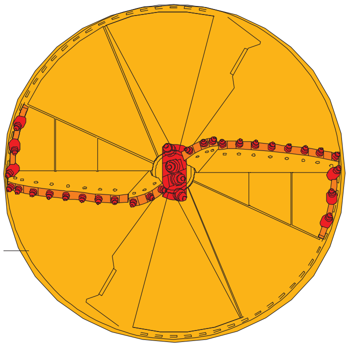
Merkmale:
- Pilot RP 4-260
- Kaliberring mit R-Meißel

Boden:
- Sand, Kies bis sehr dichte Lagerung
- leichter Fels

Features:
- *pilot RP 4-260*
- *collar ring with R-chisel*

Soil:
- *sand and gravel, up to very dense*
- *weak rock*

KBF-K2-H Felsausführung und Kaliberschneide *rock type with collar plate*



Merkmale:
- Schneidleiste mit R-Meißelbesatz
- Kaliberring mit R-Meißel
- Pilot RP 4-260

Boden:
- mittelharter Fels

Features:
- *cutting edge with R-chisels*
- *collar ring with R-chisel*
- *pilot RP 4-260*

Soil:
- *medium hard rock*

Abmessungen / *Dimensions*

Durchmesser / *Diameter:*	**Länge / *Length:***	**Kellybox / *Kelly Box:***
1350 mm - 2500 mm	1200 mm (Rohrlänge / *Body length*)	200 mm

Kernrohre mit Anschweißringen
Core Barrel with weld-on cutting rings

KR-S-S/H
mit Stiftzähnen
with pin teeth

Merkmale:
- Dünnlippig d = 15 mm

Einsatz:
- Sehr harter Fels
- Schwer bewehrter Beton

Features:
- *Thin cutting edge t = 15 mm*

Usage:
- *Very hard rock*
- *Heavy reinforced concrete*

KR-Z-S/H
mit BZ Anschweißzahn
with BZ weld-on teeth

Merkmale
- dünnlippig d = 15 - 20 mm
- Sägezahnanordnung – Schneiden nur in einer Drehrichtung

Einsatz:
- dicht gelagerte Sande
- mittelharter Fels

Features:
- *thin cutting edge t = 15 - 20 mm*
- *sawteeth, cutting in one direction only*

Usage:
- *hard sand*
- *medium hard rock*

KR-AS-S/H
Mit AS Anschweißstollen
with AS weld-on teeth

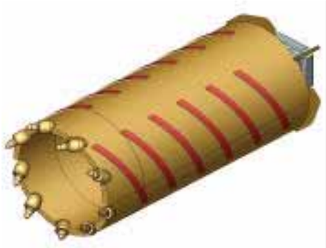
Merkmale:
- dünnlippig d = 28 mm
- leicht zu reparieren

Einsatz:
- harter Fels
- leicht bewehrter Beton

Features:
- *thin cutting edge t = 28 mm*
- *easy to repair*

Usage:
- *hard rock*
- *slightly reinforced concrete*

KR-R-S/H
Mit AS Anschweißstollen
with AS weld-on teeth



Merkmale:
- Schneidring mit R-Meißelbesatz
- Schneidbreite 120 mm

Einsatz:
- harter Fels

Features:
- *cutting ring with R-chisels*
- *groove width 120 mm*

Usage:
- *hard rock*

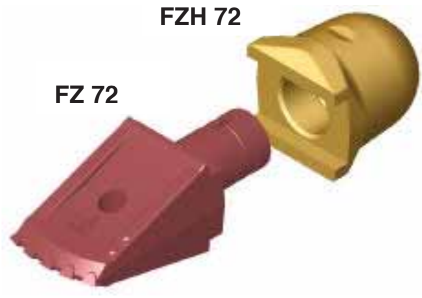
Abmessungen / *Dimensions*

	KR-S	**KR-H**
Ausführung / *Type:*	180 kNm	480 kNm
Kellybox / *Kelly Box:*	150 mm	200 mm
Länge / *Length:*	1200 mm	1200 mm
Durchmesser / *Diameter:*	520 mm - 1200 mm	520 mm - 2000 mm
Rundschaftmeißel / *R-Chisel:*	RM 30	RM C 403

Verschleißteile und Zubehör

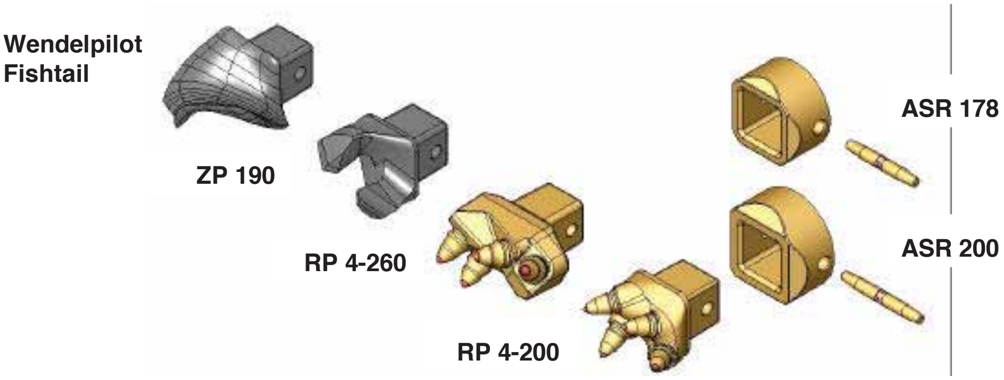
Wear Parts and *Accessories*

Flachzähne — *Flat Teeth*

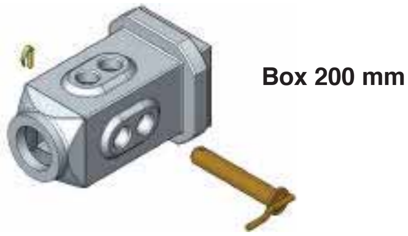


Rundschaftmeißel — *Round Shank Chisel*

Piloten — *Pilot Bits*



Kellybox — *Kelly Box*



CONCRETE MIX DESIGN

WILSONVILLE CONCRETE
4000 PSI CFA MIX

WILSONVILLE CONCRETE PRODUCTS

Mix Design Analysis

Prepared By: Mark Wheeler CCT# 43055
Reviewed By: Frank King
Date: April 5, 2019

Contractor: Pacific Foundation
Project #
Portland OR

Mix Design

Concrete Supplier:	Wilsonville Concrete Products	Mix Number:	H45650014N
Compressive Strength:	4000 PSI	Usage:	Drilled Shafts

Mix Item		Sp. Grav.	Qty (SSD)	Vol (cu.ft.)	Comments
Ash Grove Type I/II		3.150	611	3.11	100% Ash Grove Type I/II
Ash grove Slag		2.890	0	0.00	0% Dura Slag
Silica Fume		2.200	0	0.00	0% Silica Fume
Agg "A"	1 1/2"	2.610	0	0.00	
Agg "B"	3/4" - 3/8"	2.603	0	0.00	AE 90 0 oz./CWT
Agg "C"	3/8"	2.568	1548	9.66	Delvo 8.0 oz./CWT
Agg "D"	Sand	2.568	1548	9.66	Pozz 80 0.0 oz./CWT
Agg "E"					Glenium 3030 8.0 oz./CWT
	Total Add Mixture (gallons)	1.10	0.76	0.011	
Water (gallons)			30.24	4.04	
Air Content (%) +/- 1.5%		---------------------	2.0%	0.54	
			Total	27.02	

Total cementitious content	611	Slump	8.0	+/- 3"
Unit Weight (PCF)	146.5	Water Cement Ratio	0.42	

Aggregate Source Palasades 24-075-2

Aggregate Gradation Analysis

Sieve Size	(Values are expressed in percent passing that sieve size)					Total Combined (%)	Retained On Sieve (%)	Retained Requirement (%)
	A	B	C	D	E			
	1 1/2"	3/4" - 3/8"	3/8"	Sand				
	0.0%	0.0%	50.0%	50.0%	0.0%	100.0%		
1.5"	99.0%	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0-4
1"	51.0%	100.0%	100.0%	100.0%	0.0%	100.0%	0.0%	8-18
3/4"	11.0%	92.0%	100.0%	100.0%	0.0%	100.0%	0.0%	8-18
1/2"	2.0%	44.0%	100.0%	100.0%	0.0%	100.0%	0.0%	8-18
3/8"	1.1%	17.0%	97.0%	100.0%	0.0%	98.5%	1.5%	8-18
4	0.0%	1.0%	8.0%	98.0%	0.0%	53.0%	45.5%	8-18
8	0.0%	0.0%	0.0%	77.0%	0.0%	38.5%	14.5%	8-18
16	0.0%	0.0%	0.0%	62.0%	0.0%	31.0%	7.5%	8-18
30	0.0%	0.0%	0.0%	44.0%	0.0%	22.0%	9.0%	8-18
50	0.0%	0.0%	0.0%	16.0%	0.0%	8.0%	14.0%	8-18
100	0.0%	0.0%	0.0%	4.0%	0.0%	2.0%	6.0%	1.5-5.0
200	0.00%	0.00%	0.0%	2.00%	0.00%	1.00%	1.00%	
FM Value	9.36	7.46	5.95	2.99	11.00	4.47		
Dry Rodded Unit Wieght	102.800	105.000	102.500					

Note: Admixture dosage rates will be adjusted according to manufactures recommendation to accommodate faring field conditions.

WILSONVILLE CONCRETE PRODUCTS
Ready-mix - Sand - Gravel
P.O. Box 37
Wilsonville, Oregon 97070
Phone 503.682.2525 Fax 503.682.1922

Concrete Test Summary

Mix Design Number: **H45650014N**

		Plastic properties		Compressive Strengths				
	Date	slump	air	7 day	28 day	28 day	28 day	3 test avg
1	1	8.00	1.3	5010	5890	6640	6430	6320
2	2	6.00	1.7	4780	5530	6370	6220	6040
3	3	6.00	1.6	4870	5690	6920	6950	6520
4	4	7.50	1.2	4820	5730	6490	6230	6150
5	5	9.00	1.3	4500	5540	5510	5520	5523
6	6	9.00	1.2	5920	7730	7890	7890	7837
7	7	9.00	1.7	4640	6440	6760	6760	6653
8	8	9.00	1.8	3780	6520	6130	6130	6260
9	9	8.50	0.0	4010	4900	5200	5100	5067
10	10	9.50	1.4	4370	6370	5890	6320	6193
11	11	8.75	1.0	3230	4800	4700	5090	4863
12	12	9.00	0.0	3400	4740	4790	4970	4833
13	13	8.00	1.2	4340	5630	5650	5600	5627
14	14	9.00	1.0	4700	5680	5170	5920	5590
15	15	8.50	1.0	3830	5390	5330	5350	5357
16	6/30/16	9.00	1.0	3370	4580	5420	4460	4820
17	6/30/16	7.75	1.4	3730	5900	5930	5880	5903
18	8/3/17	9.00	1.6	3700	5270	5170	5070	5170
19	8/28/17	9.50	1.8	4070	5330	5100	5400	5277
20	1/2/18	9.00	1.2	3670	6320	6420	6760	6500
21	4/05/19	7.00	1.1	4070	6420	6370	6180	6323
22	1/5/19	7.00	1.3	4200	5510	5410	5000	5307
23								
24								
25								
26								
27								
28								
29								
30								
	Average	8.00	1.3	4934	5825			
	Std. Dev.	1.25	0.5	464	774			

ASH GROVE®
A CRH COMPANY

STRONG FOUNDATIONS. STRONG FUTURE.

Durkee Plant
Mill Test Report

Mill Analysis No.: 18-32
Bin No.: 2, 3, 4, Dome
Cement Type: I-II L.A.
Production Period: November 1 thru November 30, 2018
Date: 12-11-2018

STANDARD REQUIREMENTS
ASTM C150

CHEMICAL

Item	(C114)	Spec. Limit	Test Result
SiO2 (%)		A	21.7
Al2O3(%)		6.0 max.	3.8
Fe2O3(%)		6.0 max.	3.2
CaO (%)		A	63.1
MgO (%)		6.0 max.	3.2
SO3 (%)		3.0 max.	2.1
Loss On Ignition (%)		3.5 max.	1.2
Na2O (%)		A	0.20
K2O (%)		A	0.52
TiO2 (%)		A	0.28
P2O5 (%)		A	0.14
Mn2O3 (%)		A	0.08
Insoluble Residue (%)		1.5 max.	0.44
CO2 (%)		A	0.87
Limestone %		5.0 max.	2.5
CaCO3 in Limestone		70 min.	70
C3S + 4.75(C3A)		100 max.	74
Potential Compounds (%)		C	
	C3S	A	55
	C2S	A	20
	C3A	8 max.	4
	C4AF	A	10
	C4AF+2(C3A)	A	18

Tested by C.C.

PHYSICAL

Item			Spec. Limit	Test Result
Air Content of Mortar (volume %)				
C185			12 max.	4.6
Fineness (m^2/kg)				
C204	(Air permeability)		260 min.	396
Autoclave Expansion (%)			0.80 max.	0.10
C151				
Compressive Strength Psi (Mpa)			Min.:	
C109		1 Day	A	2160 (14.9)
		3 Days	1740 (12.0)	3320 (22.9)
		7 Days	2760 (19.0)	4730 (32.6)
Time of Setting (minutes)				
C191	(Vicat)			
	Initial	Not less than	45	129
		Not more than	375	

Tested by A.M.

OPTIONAL REQUIREMENTS
ASTM C150, (other)

CHEMICAL

Item	Spec. Limit	Test Result
Equivalent Alkalies (%)	0.60 max.	0.54
Chloride (%)	B	0.003

A = not applicable
B = Test results represents most recent value and is provided for informational purposes only.
C = Adjusted per A 1.6.
D = Test results for this production period not yet available.

PHYSICAL

Item		Spec. Limit	Test Result
Time of Set - Final (minutes) C191		B	213
False Set (%) C451		50 min.	88
Heat of Hydration (cal /g)	C186		
	7 days	B	76
Compressive Strength (Mpa)			
	28 Days	4060 (28.0)	D
Sulfate Resistance (%)	C452	0.040	0.031 B
Water Expansion (%)	C1038	0.020	0.009
% retain on 45µm sieve		B	0.97

We certify that the above described cement, at the time of shipment, meets the chemical and physical requirement of the ASTM C150-18 or AASHTO M-85 -12 Type I-II specification also will meet CSA A3000-18 Type GU, MS and HS.

NSF
Certified to NSF/ANSI 61

Signature:

Title: Quality Control Manager

We create chemistry

3	03 30 00	**Cast-in-Place Concrete**
	03 40 00	**Precast Concrete**
4	03 70 00	**Mass Concrete**
	04 05 16	**Masonry Grouting**

MasterGlenium® 3030

Full-Range Water-Reducing Admixture

Formerly Glenium 3030 NS*

Description

MasterGlenium 3030 ready-to-use full-range water-reducing admixture is a patented new generation of admixture based on polycarboxylate chemistry. MasterGlenium 3030 admixture is very effective in producing concretes with different levels of workability including applications that require the use of self-consolidating concrete (SCC). MasterGlenium 3030 admixture meets ASTM C 494/C 494M requirements for Type A, water-reducing, and Type F, high-range water-reducing, admixtures.

Applications

Recommended for use in:

- Concrete where high flowability, high-early and ultimate strengths and increased durability are needed
- Self-consolidating concrete
- Concrete where normal, mid-range, or high-range water-reduction is desired
- Concrete where normal setting times are required
- Strength-on-demand concrete, such as 4x4™ Concrete
- Pervious concrete
- Self-consolidating grout

Features

- Dosage flexibility for normal, mid- and high-range water reduction
- Reduced water content for a given slump
- Produces cohesive and non-segregating concrete mixture
- Increased compressive strength and flexural strength performance at all ages
- Providing faster setting times and strength development
- Enhanced finishability and pumpability

Benefits

- Providing economic benefits to the entire construction team through higher productivity and reduced variable costs

Performance Characteristics

The dosage flexibility of MasterGlenium 3030 admixture allows it to be used as a normal, mid-range and high-range water reducer.

Mixture Data: 600 lb/yd^3 of Type I cement (360 kg/m^3); slump, 8.5-9.25 in. (210-235 mm); non-air-entrained concrete; dosage rate adjusted to obtain 25-30% water reduction.

Setting Time

Mixture	Initial Set (h:min)	Difference (h:min)
Plain	4:24	–
Conventional high-range water-reducer	6:00	+ 1.36
MasterGlenium 3030 admixture	5:00	+0.36

Compressive Strength

	1 Day		7 Days	
Mixture	psi	MPa	psi	MPa
Plain	1700	12	4040	28
Conventional high-range water-reducer	3460	24	6380	44
MasterGlenium 3030 admixture	4120	28	7580	52

Slump Retention - in. (mm)

	Minutes		
Mixture	15	30	45
Plain	8.5 (215)	8.5 (215)	7.5 (200)
Conventional high-range water-reducer	8.5 (215)	4.25 (110)	3.5 (90)
MasterGlenium 3030 admixture	9.25 (235)	9.25 (235)	8.25 (210)

Rate of Hardening: MasterGlenium 3030 admixture is formulated to produce normal setting characteristics throughout its recommended dosage range. Setting time of concrete is influenced by the chemical and physical composition of the basic ingredients of the concrete, temperature of the concrete and ambient conditions. Trial mixtures should be made with actual job materials to determine the dosage required for a specified setting time and a given strength requirement.

Guidelines for Use

Dosage: MasterGlenium 3030 admixture has a recommended dosage range of up to 3 fl oz/cwt (195 mL/100 kg) for Type A applications, 3-6 fl oz/cwt (195-390 mL/100 kg) for mid-range use and up to 18 fl oz/cwt (1,170 mL/100 kg) for Type F applications. The dosage range is applicable to most mid- to high-range concrete mixtures using typical concrete ingredients. However, variations in job conditions and concrete materials, such as silica fume, may require dosages outside the recommended range. In such cases, contact your local sales representative.

Mixing: MasterGlenium 3030 admixture can be batched with the initial mixing water or as a delayed addition. However, optimum water reduction is generally obtained with a delayed addition.

Product Notes

Corrosivity – Non-Chloride, Non-Corrosive: MasterGlenium 3030 admixture will neither initiate nor promote corrosion of reinforcing steel embedded in concrete, prestressed concrete or of galvanized steel floor and roof systems. Neither calcium chloride nor other chloride-based ingredients are used in the manufacture of MasterGlenium 3030 admixture.

Compatibility: MasterGlenium 3030 admixture is compatible with most admixtures used in the production of quality concrete, including normal, mid-range and high-range water-reducing admixtures, air-entrainers, accelerators, retarders, extended set control admixtures, corrosion inhibitors, and shrinkage reducers.

Do not use MasterGlenium 3030 admixture with admixtures containing beta-naphthalene-sulfonate. Erratic behaviors in slump, slump flow, and pumpability may be experienced.

For directions on the proper evaluation of MasterGlenium 3030 admixture in specific applications, contact your local sales representative.

Storage and Handling

Storage Temperature: MasterGlenium 3030 admixture should be stored above freezing temperatures. If MasterGlenium 3030 admixture freezes, thaw at 45 °F (7 °C) or above and completely reconstitute by mild mechanical agitation. **Do not use pressurized air for agitation**.

Shelf Life: MasterGlenium 3030 admixture has a minimum shelf life of 12 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your local sales representative regarding suitability for use and dosage recommendations if the shelf life of MasterGlenium 3030 admixture has been exceeded.

Packaging

MasterGlenium 3030 admixture is supplied in 55 gal (208 L) drums, 275 gal (1040 L) totes and by bulk delivery.

Related Documents

Safety Data Sheets: MasterGlenium 3030 admixture

Additional Information

For additional information on MasterGlenium 3030 admixture or its use in developing concrete mixes with special performance characteristics, contact your local sales representative.

The Admixture Systems business of BASF's Construction Chemicals division is the leading provider of solutions that improve placement, pumping, finishing, appearance and performance characteristics of specialty concrete used in the ready-mixed, precast, manufactured concrete products, underground construction and paving markets. For over 100 years we have offered reliable products and innovative technologies, and through the Master Builders Solutions brand, we are connected globally with experts from many fields to provide sustainable solutions for the construction industry.

Limited Warranty Notice

BASF warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. BASF MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is shipment to purchaser of product equal to the amount of product that fails to meet this warranty or refund of the original purchase price of product that fails to meet this warranty, at the sole option of BASF. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. BASF WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. BASF reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

NSF

Certified to NSF/ANSI 61

* Glenium 3030 NS became MasterGlenium 3030 under the Master Builders Solutions brand, effective January 1, 2014.

BASF

We create chemistry

3

03 30 00	**Cast-in-Place Concrete**
03 40 00	**Precast Concrete**
03 70 00	**Mass Concrete**

MasterSet® DELVO

Hydration Controlling Admixture

Formerly DELVO Stabilizer*

Description

MasterSet DELVO ready-to-use, liquid admixture is used for making more uniform and predictable high-performance concrete. MasterSet DELVO admixture retards setting time by controlling the hydration of portland cement and other cementitious materials while facilitating placing and finishing operations. MasterSet DELVO admixture meets ASTM C 494/C 494M requirements for Type B, retarding, and Type D, water-reducing and retarding, admixtures.

Applications

Recommended for use in:

- Stabilization of concrete washwater
- Stabilization of returned plastic concrete
- Stabilization of freshly batched concrete for long hauls
- 4x4™ Concrete
- Pumped concrete, shotcrete (wet mix) and conventionally-placed concrete
- Plain, reinforced, precast, prestressed, lightweight and normal weight concrete
- Pervious concrete

Features

- Reduced water content required for a given workability
- Retarded setting time characteristics
- Improved workability

Benefits

- Provides flexibility in the scheduling of placing and finishing operations
- Offsets the effects of slump loss during extended delays between mixing and placing
- Reduces waste associated with concrete washwater and returned concrete
- Increased strength – compressive and flexural

Performance Characteristics

Rate of Hardening: The temperature of a concrete mixture and the ambient temperature (forms, earth, air, etc.) affect the hardening rate of concrete. At higher temperatures, concrete hardens more rapidly which may cause problems with placing and finishing.

One of the functions of MasterSet DELVO admixture is to retard the set of concrete. Within the normal dosage range, it will generally extend the working and setting times of concrete containing normal portland cement, fly ash, slag cement and silica fume approximately 1 hour to 5 hours compared to a plain concrete mixture. This depends on job materials and temperatures. Trial mixtures should be made under approximate job conditions to determine the dosage required.

Compressive Strength: Concrete produced with MasterSet DELVO admixture will develop higher early (within 24 hours) and higher ultimate strengths than plain concrete when used within the recommended dosage range and under normal, comparable curing conditions. When MasterSet DELVO admixture is used in heat-cured concrete, the length of the preheating period should be increased until the initial set of the concrete is achieved. The actual heat-curing period is then reduced accordingly to maintain existing production cycles without sacrificing early or ultimate strengths.

MASTER®
BUILDERS
SOLUTIONS

Guidelines for Use

Dosage: MasterSet DELVO admixture is recommended for use at a dosage of 4 ± 1 fl oz/cwt (260 ± 65 mL/100 kg) of cementitious materials for most concrete mixtures using average concrete ingredients. Because of variations in job conditions and concrete materials, dosages other than the recommended amounts may be required. In such cases, contact your local sales representative. For concrete washwater and returned concrete stabilization, utilize MasterSet DELVO charts to determine the appropriate dosage rates.

Product Notes

Corrosivity – Non-Chloride, Non-Corrosive: MasterSet DELVO admixture will neither initiate nor promote corrosion of reinforcing steel in concrete. This admixture does not contain intentionally-added calcium chloride or other chloride-based ingredients.

Compatibility: MasterSet DELVO admixture may be used in combination with any BASF admixture. When used in conjunction with another admixture, each admixture must be dispensed separately into the mixture.

Storage and Handling

Storage Temperature: MasterSet DELVO admixture should be stored above freezing temperatures. If MasterSet DELVO admixture freezes, thaw at 35 °F (2 °C) or above and completely reconstitute by mild mechanical agitation. Do not use pressurized air for agitation.

Shelf Life: MasterSet DELVO admixture has a minimum shelf life of 12 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your local sales representative regarding suitability for use and dosage recommendations if the shelf life of MasterSet DELVO admixture has been exceeded.

Packaging

MasterSet DELVO admixture is supplied in specially designed 55 gal (208 L) drums, 275 gal (1040 L) totes and by bulk delivery.

Related Documents

Safety Data Sheets: MasterSet DELVO admixture

Additional Information

For more information on MasterSet DELVO admixture, contact your local sales representative.

The Admixture Systems business of BASF's Construction Chemicals division is the leading provider of solutions that improve placement, pumping, finishing, appearance and performance characteristics of specialty concrete used in the ready-mixed, precast, manufactured concrete products, underground construction and paving markets. For over 100 years we have offered reliable products and innovative technologies, and through the Master Builders Solutions brand, we are connected globally with experts from many fields to provide sustainable solutions for the construction industry.

Limited Warranty Notice

BASF warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. BASF MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is shipment to purchaser of product equal to the amount of product that fails to meet this warranty or refund of the original purchase price of product that fails to meet this warranty, at the sole option of BASF. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. BASF WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. BASF reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

Certified to NSF/ANSI 61

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* Delvo Stabilizer became MasterSet DELVO under the Master Builders Solutions brand, effective January 1, 2014.

CAL PORTLAND
4000psi Drilled Shaft Mix

CALPORTLAND®

CalPortland

01/10/2022

PACIFIC FOUNDATION INC
OR217: OR10 ⍰OR99W

The enclosed concrete mix designs are being submitted for use on the above project. All mix designs are designed based on specification information provided. These mix designs will be produced in conformance with applicable codes and specification and shall be tested in accordance with ASTM, AASHTO, ODOT and/or WSDOT procedures.

ASTM C94 Section 4.6 states "…The purchaser shall ensure that the manufacturer is provided copies of all reports of tests performed on concrete samples…Reports shall be provided on a timely basis." In accordance with the specification, approval of these mix designs carries with it CalPortland's inclusion on the distribution list for all concrete test reports.

ACI 301 16.7.4.3 states "to facilitate testing and inspection, the contractor shall provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hours as required by ASTM C31." CalPortland does not guarantee field cured cylinders. Proper curing for early strength is the responsibility of the contractor.

The cement used on this project will conform to ASTM C150, AASHTO M85, and are approved per ODOT and/or WSDOT Standard Specifications.

Pozzolanic materials used on this project will conform to ASTM C618, AASHTO M295, and are approved per ODOT and/or WSDOT Standard Specifications.

Ground Granulated Blast Furnace Slag used on this project will conform to ASTM C989, AASHTO M302, and are approved per ODOT and/or WSDOT Standard Specifications.

Aggregates used on this project will conform to ASTM C33 and are approved per ODOT and/or WSDOT Standard Specifications.

Air-entrainment used on this project will conform to ASTM C260 and are approved per ODOT and/or WSDOT Standard Specifications.

All other chemical admixtures used on this project will conform to ASTM C494 and are approved per ODOT and/or WSDOT Standard Specifications.

When ordering concrete, it is the customer's responsibility to order the approved mix number for the project and application. When ice, hot water, accelerator, retarder, or high-range water reducer is needed to meet project specifications, it is the contractor's responsibility and cost to order the proper materials.

CalPortland mix designs (strength, slump, air, and unit weight) are based on testing at the truck discharge per ASTM standards. CalPortland will not be responsible for these plastic and hardened qualities due to pumping or other methods of conveying.

If you have any questions please contact, Tony Allison CCT #40014 at 503-535-7779 in our Technical Services Department.

CALPORTLAND®

Concrete Design Submittal Summary

01/10/2022

To: **PACIFIC FOUNDATION INC**
RE: **OR217: OR10 �OR99W**

Thank you for the opportunity to provide materials for this project. The mixes chosen for this submittal were based on the documents provided by and conversations had with the requesting party.
The mixes below have been included with this submittal for your review:

Mix	Use	Slump	Air	W/CM
0003FS WSDOT 4000P/5000P W/GGBFS	Drilled shafts	7"+/-2"	1.5%+/-1.5%	0.43

Concrete mix designs are submitted to meet project specifications. Acceptable material performance is based on proper testing and protection of concrete and concrete samples. Concrete mix design ingredients may be adjusted to maintain yield, consistency and performance. Similar materials, with proven performance, may be substituted at the supplier's discretion. Concrete will be batched in accordance with the applicable portions of the ASTM C94 standards unless otherwise agreed upon.

Additional Project Submittal Information:

Sincerely,
Tony Allison CCT #40014
tallison@calportland.com

CALPORTLAND®

Front Ave
5075 Front Ave
Portland, OR 97228
503-535-7708

Concrete Mix Submittal

Submittal Information

Submittal Name	OR217: OR10 – OR99W
Date Submitted	01/10/2022
Customer	PACIFIC FOUNDATION INC
Project Name	OR217: OR10 – OR99W
Use	Drilled shafts

Mix Information

Mix ID	0003FS
Mix Name	WSDOT 4000P/5000P W/GGBFS
Compressive Strength (f'c)	5000 psi @ 28 Days
Aggregate Nominal Size	3/8" (9.5mm)
Air Entrained	☐

Mix Properties

Slump	7"+/-2"	Sack Content	7.4	94 lb/sack	Total Mass	3991	lb
Air	1.5%+/-1.5%	Total Water	36.0	gal	Total Volume	27.00	ft3
W/CM Ratio	0.43	Water/Sack	4.8	gal	Unit Weight	147.8	lb/ft3

Group	Material Description	Supplier	Absorption	Specific Gravity	Mass lb	Volume ft3
Cement	Portland Type I/II CEMENT	CalPortland		3.15	595	3.027
Additive	Slag DURA SLAG	Ash Grove		2.89	105	0.582
Aggregate	Coarse Aggregate 3/8" - #8 DRUW: 100 lb/ft3	CALPORTLAND #05-004-1 - SANTOSH	2.1	2.68	1600	9.568
	Fine Aggregate CON SAND DRUW: 102.9 lb/ft3	CALPORTLAND #05-004-1 - SANTOSH	2.9	2.59	1388	8.589
Water	Potable Water WATER-1			1	300	4.808
Admixture	Water Reducer ZYLA 630 Dosage: 21 fl oz/yd3	GCP Applied Technologies		1		
	Hydration Control RECOVER Dosage: 21 fl oz/yd3	GCP APPLIED TECHNOLOGIES		1	1.369	0.02193
Air	Air					0.405

Submittal Notes Fine Agg FM 2.63

Contact Tony Allison CCT #40014
Phone 503-535-7779
Email tallison@calportland.com

CALPORTLAND®

Concrete Mix Evaluation Report

ACI 318 Required Average Strength

Mix ID	0003FS	Number Of Tests	30
Mix Name	WSDOT 4000P/5000P W/GGBFS	Average Strength	6968 psi
Design Strength (f'c)	5000 psi @ 28 Days	St Dev	780 psi
Required Strength (f'cr)	6320 psi @ 28 Days	St Dev (Modified)	780 psi

Test Date	Mix	Lab	Temp (Concrete) (°F)	Slump (in)	Air Content (%)	Comp Strength (3-Day) (psi)	Comp Strength (7-Day) (psi)	Acceptance Strength (28-Day) (psi)	Moving Average (psi)
05/13/2020	0003FS	CWE Lab	70	6.75	1.4		4990	7740	
05/14/2020	0003FS	CWE Lab	72	6.25	1.4		4160	6340	
05/19/2020	0003FS	CWE Lab	69	5	1.5		4250	5980	6687
05/19/2020	0003FS	CWE Lab	71	7.25	1.3		4170	6470	6263
05/20/2020	0003FS	CWE Lab	65	7	1.9		4920	7030	6493
05/21/2020	0003FS	CWE Lab	66	6	1.2		4410	6810	6770
05/22/2020	0003FS	CWE Lab	69	7	1.1		3900	6200	6680
05/25/2020	0003FS	CWE Lab	66	5.75	1.1		4160	5510	6173
07/28/2020	0003FS	CWE Lab	73	7	0.9		4080	6160	5957
09/14/2020	0003FS	CP	81	6.75	1.6	3280	4790	7410	6360
11/06/2020	0003FS	CP	75	9.25	1.3			8790	7453
12/10/2020	0003FS	CWE Lab	60	6	2		5780	7380	7860
12/15/2020	0003FS	CWE Lab	71	4	1.6		4850	7360	7843
12/22/2020	0003FS	CWE Lab	69	5	1.8		5550	7750	7497
02/12/2021	0003FS	Carlson Testing Lab	68	7	1.8		4810	7550	7553
02/18/2021	0003FS	Carlson Testing Lab	69	3	1.3		5130	7710	7670
05/18/2021	0003FS	CWE Lab	77	7	1.8		4910	6920	7393
05/19/2021	0003FS	CWE Lab	72	5.25	2		5500	7400	7343
05/25/2021	0003FS	CWE Lab	86	7.5	1.1		4110	6060	6793
06/02/2021	0003FS	Carlson Testing Lab	80	7.25	1.9		4350	5830	6430
06/07/2021	0003FS	CWE Lab	69	6	1.7		4780	7070	6320
07/07/2021	0003FS	CWE Lab	75	7.25	1.5			7740	6880
07/21/2021	0003FS	CWE Lab	81	7.5	1.5		5070	7020	7277
08/06/2021	0003FS	CWE Lab	81	8.25	1.2		4730	6890	7217
08/12/2021	0003FS	CWE Lab	88	7	1.9		5310	7420	7110
08/19/2021	0003FS	CWE Lab	86	7	1.7		5940	8080	7463
08/26/2021	0003FS	Carlson Testing Lab	91	7.25	2		4180	6090	7197
09/01/2021	0003FS	Carlson Testing Lab	8	7	1.6		4890	6580	6917
09/09/2021	0003FS	Carlson Testing Lab	88	6	1.6		4610	6040	6237
11/11/2021	0003FS	CWE Lab	64	8	1.4		5310	7710	6777

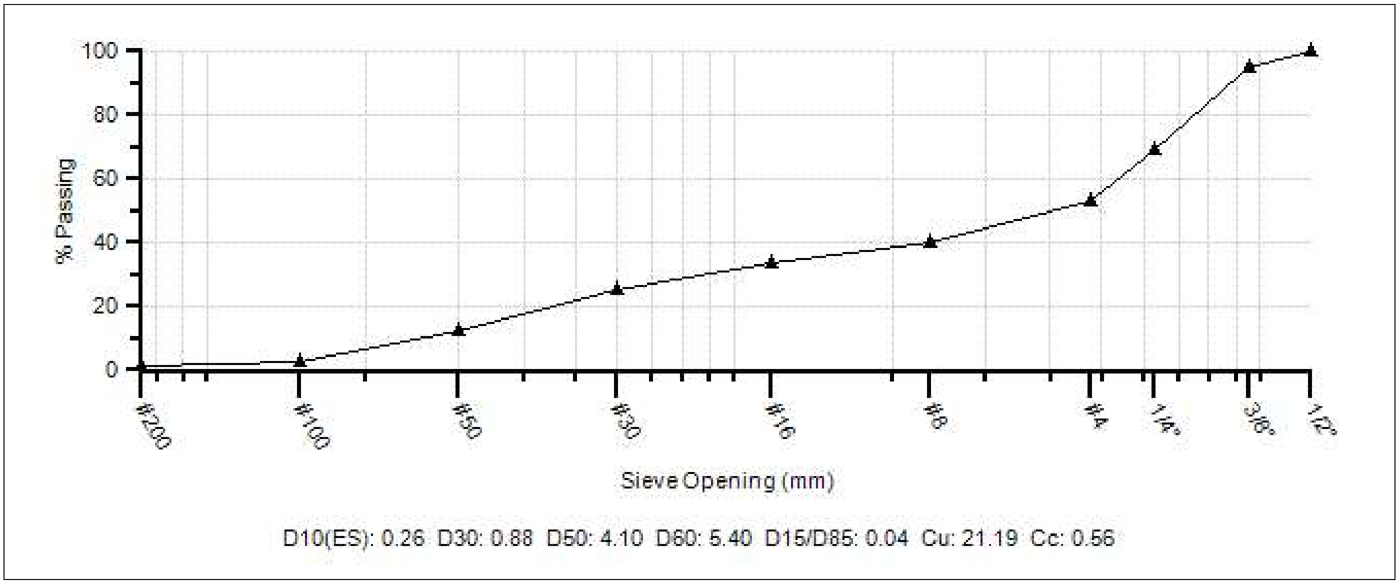
Combined Aggregate Blend Report

Mix ID	0003FS	Nominal Max Size	3/8" (9.5mm)
Mix Name	WSDOT 4000P/5000P W/GGBFS	Aggregate Volume	18.2
Design Strength (f'c)	5000 psi @ 28 Days	Coarse Aggregate %	53.5
Specification		Fine Aggregate %	46.5

% Passing Gradations

Aggregate Type	Coarse	Fine
% Contribution	53.6	46.4

Sieve/Test	Spec	Result	3/8" - #8	CON SAND
1/2" (12.5mm)		99.8	99.7	100.0
3/8" (9.5mm)		94.7	90.1	100.0
1/4" (6.3mm)		68.8	42.6	99.0
#4 (4.75mm)		52.6	13.2	98.0
#8 (2.36mm)		40.3	1.5	85.0
#16 (1.18mm)		33.7	1.3	71.0
#30 (.6mm)		25.3	1.2	53.0
#50 (.3mm)		12.2	1.1	25.0
#100 (.15mm)		2.8	1.0	5.0
#200 (75µm)		1.30	0.86	1.80
Pan		0.00	0.00	0.00



CALPORTLAND®

Manufacturer's Certification

Report Date: 1/5/2022

We hereby certify that CalPortland Type I/II Cement meets the standard requirements of ASTM C150 and AASHTO M85 specification for Type I and Type II cements. Reported are the average chemical and physical data for the lot.

Lot #: 22-001

Type I / II Cement

Source: SsangYong, So. Korea

	ASTM C150 and AASHTO M85 Requirements		Analysis	Limestone
Chemical Properties	**Type I**	**Type II**	**Results**	**Analysis**
Silicon dioxide (SiO_2), %	---	---	**19.7**	**8.6**
Aluminum oxide (Al_2O_3), max, %	---	6.0	**4.7**	**3.3**
Ferric oxide (Fe_2O_3), max, %	---	6.0	**3.3**	**1.6**
Calcium oxide (CaO), %	---	---	**62.0**	**45.4**
Magnesium oxide (MgO), max, %	6.0	6.0	**4.3**	**3.3**
Sulfur trioxide (SO_3), max, %	3.0	3.0	**2.7**	**0.0**
Loss on ignition (LOI), max, %	3.5	3.5	**1.6**	
Insoluble residue (IR), max, %	1.5	1.5	**0.5**	**Base**
Alkalies ($Na_2O+0.658*K_2O$), %	---	---	**0.53**	**Cement**
Tricalcium silicate (C_3S), %	---	---	**56**	**58**
Dicalcium silicate (C_2S), %	---	---	**14**	**14**
Tricalcium aluminate (C_3A), max, %	---	8	**7**	**7**
Tetracalcium aluminoferrite (C_4AF), %	---	---	**10**	**10**
CO_2, %	---	---	**1.2**	
Limestone addition, max, %	5.0	5.0	**3.3**	**Chloride content - 0.02%**
$CaCO_3$ in Limestone, min, %	70	70	**84**	

Physical Properties			
Air content of mortar, max, volume %	12	12	**8**
Blaine Fineness, min, m²/kg	260	260	**433**
Autoclave expansion, max, %	0.80	0.80	**0.07**
Compressive Strength, min			
1 Day, psi	---	---	**2140**
3 Day, MPa	12.0	10.0	**31.3**
3 Day, psi	1740	1450	**4540**
7 Day, MPa	19.0	17.0	**33.4**
7 Day, psi	2760	2470	**4850**
28 Day (from previous lot), MPa	---	---	**44.5**
28 Day (from previous lot), psi	---	---	**6450**
Vicat Setting Time, min-max, minutes	45 - 375	45 - 375	**136**

Apparatus and methods used in this laboratory have been checked by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology. A copy of the report detailing their findings is available upon request. Major oxides are analyzed in accordance with ASTM C114.

Kevin Wolf

Kevin Wolf - Director of Technical Services

ASH GROVE
A CRH COMPANY

Location Portland **Slag Product** Dura Slag **Date** 25-May-21

Certification No. Slag 1-21

STANDARD REQUIREMENTS
ASTM C989 & AASHTO M302

CHEMICAL

Item	Spec. Limit	Test Result
Slag Cement		
Sulfide sulfur as S, %	2.5 max	1.03
Sulfate sulfur as SO3, %	[A]	4.16
Aluminum oxide as Al2O3, %	[A]	15.3
Chloride as Cl, %	[A]	0.01
Equivalent alkalies, %	[A]	0.60
Reference Type I Portland Cement		
Equivalent alkalies, %	0.60 min 0.90 max	0.79

[A] Not applicable

PHYSICAL

Item		Spec. Limit	Test Result
Slag Cement			
325 mesh, % retained		20 max	3.0
Blaine fineness, m^2/kg		[A]	461
Air content of mortar, %		12 max	4.6
Specific Gravity		[A]	2.91
Reference Type I Portland Cement			
Compressive strength, MPa (PSI)		min:	
	7 Days	[A]	28.3 (4100)
	28 Days	35 (5000)	35.9 (5210)
50-50 Blend of Slag and Reference Cement			
Compressive strength, MPa (PSI)		min:	
	7 Days	[A]	25.0 (3630)
	28 Days	[A]	43.6 (6318)
Slag Activity Index, %			
Grade 120		min:	
Average of Last 5 Samples	7 Days	[A]	88
Any Individual Sample	7 Days	[A]	86
Average of Last 5 Samples	28 Days	115	121
Any Individual Sample	28 Days	110	120

The slag cement meets the chemical and physical requirements of the ASTM C989/C989M-18a and AASHTO M 302-19 specifications for Grade 120.

Signature:

Title: Technical Services Manager

3737 N. Port Center Way, Portland, OR 970217; Ph; 503-207-2109

ZYLA® 630

Water-reducing admixture -- ASTM C494 Type A and D

Product Description

ZYLA® 630 water-reducing admixture is a proprietary formulation incorporating highly purified specialty organic chemicals. ZYLA® 630 promotes more complete hydration of Portland cement and has no effect on concrete air entrainment.

The ZYLA® product line of water reducers is specially formulated to have a synergistic effect with polycarboxylate-based mid-range and high-range water reducers that improve flat-work finishability. This product contains no intentionally added chloride and as such is essentially chloride free. It is manufactured under rigid controls that provide uniform, predictable performance. ZYLA® 630 is supplied as a light brown, low viscosity liquid, and is ready-to-use as received. One gallon weighs approximately 9.1 lbs (1.1 kg/L).

Product Advantages

- No impact on concrete air content
- Better control of water reduction and setting times as compared to traditional lignin-based water reducers
- Synergistic performance of polycarboxylate-based mid-range and high-range water reducers, which includes water reduction, concrete strength and air control
- In the hardened state, improves the compressive and flexural strengths at all ages of concrete versus traditional lignin-based water reducers

Uses

ZYLA® 630 is used to produce concrete mixes with lower water content (typically 3% to 10% reduction), greater plasticity and higher compressive strengths. ZYLA® 630 is suitable for normal weight and light weight concrete in ready-mix, precast and prestressed applications.

Finishability

The unique chemistry of ZYLA ® 630 positively impacts the finishability of concrete by providing a creamier and more homogenous texture, with more uniform bleed rate relative to traditional lignin-based water reducers. The influence of ZYLA® 630 on the finishability of lean mixes has been particularly noticeable. Floating and troweling, by machine or hand, imparts a smooth, close tolerance surface.

Addition Rates

The addition rate range of 3 to 5 fl oz/100 lbs (195 to 325 mL/ 100 kg) of cement or cementitious is typical for most applications. However addition rates of 2 to 7 fl oz/100 lbs (130 to 455 mL/100 kg) of cement or cementitious may be used if local testing shows acceptable performance. Pretesting is required to determine the appropriate addition rate for desired performance. The optimum addition rate depends on the other concrete mixture components, job conditions, and desired performance characteristics.

Compatibility with Other Admixtures and Batch Sequencing

ZYLA® 630 is compatible with most GCP admixtures as long as they are added separately to the concrete mix, usually through the water holding tank discharge line. In general, it is recommended that ZYLA® 630 be added to the concrete mix near the end of the batch sequence for optimum performance. Different sequencing may be used if local testing shows better performance. Please see GCP Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations.

Pretesting of the concrete mix should be performed before use, as conditions and materials change in order to assure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. For concrete that requires air entrainment, the use of an ASTM C260 air-entraining agent (such as DARAVAIR® or DAREX® product lines) is recommended to provide suitable air void parameters for freeze-thaw resistance. Please consult your GCP Applied Technologies representative for guidance.

Packaging & Handling

ZYLA® 630 is available in bulk, delivered by metered tank trucks, in totes, and in drums.

ZYLA® 630 will freeze at about 28°F (-2°C), but will be completely uniform after thawing and thorough agitation.

Dispensing Equipment

A complete line of accurate, automatic dispensing equipment is available. ZYLA ® 630 may be introduced to the mix through the water holding tank discharge line. The ZYLA® product line is formulated to be free of sediment.

Specifications

Concrete shall be designed in accordance with *Standard Recommended Practice for Selecting Proportions for Concrete*, ACI 211.

The water-reducing admixture shall be ZYLA ® 630, as manufactured by GCP Applied Technologies, or equal. The admixture shall not contain calcium chloride as a functional ingredient. ZYLA® 630 will not promote corrosion of reinforcing steel embedded in concrete. It shall be used in strict accordance with the manufacturers' recommendations. The admixture shall comply with ASTM Designation C494, Type A and D water-reducing admixtures. Certification of compliance shall be made available on request.

The admixture shall be delivered as a ready-to-use liquid product and shall require no mixing at the batching plant or job site.

gcpat.com | North America Customer Service: 1 877-4AD-MIX1 (1 877-423-6491)

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate, and is offered for consideration, investigation and verification by the user, but we do not warrant the results to be obtained. Please read all statements, recommendations, and suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation, or suggestion is intended for any use that would infringe any patent, copyright, or other third party right.

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Last Updated: 2018-08-24

gcpat.com/solutions/products/zyla-water-reducing-admixtures/zyla-630

gcp applied technologies

RECOVER®

Hydration stabilizer

ASTM C494 Type D

Product Description

Recover® is a ready-to-use aqueous solution of chemical compounds specifically designed to stabilize the hydration of Portland cement concretes. The ingredients are factory pre-mixed in exact proportions under strict quality control to provide uniform results. One gallon weighs approximately 9.6 lbs (1.15 kg/L).

Uses

Recover is used to stabilize mixer wash water and returned or leftover concrete for extended periods, allowing for use of the materials when specified or allowed. It is also used where controlled extended set of concrete is needed. It is the concrete user's responsibility to determine if leftover, returned or extended-set concrete is specified or allowed.

Wash Water

For wash water applications, Recover is used to eliminate the need to discharge wash water from the mixer. This allows the wash water to be used as mix water in the next batch of concrete produced and prevents the residual plastic concrete from hardening. Stabilization of up to 96 hours is possible depending on dosage rate.

Returned Concrete

For returned or leftover concrete, Recover is used to prevent plastic concrete from reaching initial set. This allows the concrete to be stored in a plastic state and then used when specified or allowed. The use of this concrete may require the addition of freshly batched concrete and/or an accelerator such as Daraccel® or PolarSet®.

Stabilization of concrete for up to 96 hours is possible depending on dosage rate. Use prevents the waste of unused concrete.

Product Advantages

- Eliminates the need to discharge wash water from the mixer
- Prevents the waste of unused concrete
- Provides predictable extended set for continuous placement on mass concrete and tremie projects, or on long hauls to remote sites

Set Time Control

Recover is also used in situations where a controlled set time extension is required. Examples include: extended hauls, large continuous pours or pre-batching of concrete for later use.

Performance

Recover stabilizes the hydration process of Portland cement preventing it from reaching initial set. This stabilization is not permanent and is controlled by dosage rate. For wash water, the Recover treated water is mixed or sprayed in a specific manner to thoroughly coat the interior of the mixer. The water is used as mix water in the next batch of concrete produced, which then scours the unhardened material from the interior of the mixer. Stabilization of returned or leftover concrete with Recover maintains the plasticity of the concrete for the desired storage duration. This stabilized concrete then resumes normal hydration when the Recover dosage effects subside, or when it is activated by the addition of fresh concrete and/or an accelerator. The result can be concrete with normal plastic and hardened properties.

Addition Rates

Addition rates of Recover for wash water range from 6 to 128 fl oz (180 to 3800 mL) per treatment. The amount used will depend on the specific materials involved, mixer type and stabilization period. Addition rates for returned or leftover concrete will range from 3 to 128 fl oz/100 lbs (195 to 8350 mL/100 kg) of cement. The amount used will depend on the specific materials involved, concrete age, temperature conditions and stabilization period. For applications requiring set time extensions well in excess of 4 hours, Recover may be used at addition ranges from 5 to 50 oz/100 lbs (325 to 3260 mL/100 kg) of cement For use as a traditional ASTM Type D retarder, Recover may be used at addition rates of 2 to 6 oz/100 lbs (130 to 390 mL /100 kg) of cement. Proper dosage rate selection can only be achieved through pretesting. Consult your local GCP Applied Technologies admixture representative.

Compatibility with Other Admixtures and Batch Sequencing

Recover is compatible with most GCP admixtures as long as it is added separately to the concrete mix, usually through the water holding tank discharge line. In general, it is recommended that Recover be added to the concrete mix near the end of the batch sequence for optimum performance. Different sequencing may be used if local testing shows better performance. Please see GCP Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations.

Pretesting of the concrete mix should be performed before use, as conditions and materials change in order to ensure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. For concrete that requires air entrainment, the use of an ASTM C260 air entraining agent (such as Daravair® or Darex® product lines) is recommended to provide suitable air void parameters for freeze-thaw resistance. Please consult your GCP Applied Technologies representative for guidance.

Packaging & Handling

Recover is available in bulk, delivered by metered tank trucks, totes and drums.

Recover will freeze, but will return to full effectiveness after thawing and thorough mechanical agitation.

Dispensing Equipment

A complete line of GCP dispensing equipment is available for Recover. This includes the Reach 360TM System which uses an innovative spray wand technology to simplify wash water procedures.

GCP Applied Technologies Inc., 62 Whittemore Avenue, Cambridge, MA 02140 USA.

In Canada, 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

GCP0083 RECOVER-5-1216

gcp applied technologies

PACIFIC FOUNDATION
DRILLED SHAFT JHA

PACIFIC FOUNDATION INC
JOB HAZARD ANALYSIS

PROJECT: OR 217

SCOPE OF WORK: 72" Dia. Drilled Shafts

CLIENT: Cascade

GENERAL PPE: Safety orange (vest, shirt, sweatshirt), eye protection, work gloves, work boots. White Hard Hat.

WELDING PPE: Cutting: welding gloves, cutting shield. Welding: leathers, welding gloves, welders helmet

CHAIN SAW PPE: Gloves, chaps, face protection shield

KEY JOB STEPS	TOOLS USED	POTENTIAL HEALTH AND INJURY HAZARD	SAFE PRACTICE, APPAREL & EQUIPMENT
POSITIONING EQUIPMENT	Bauer BG40/BG24/BG22/BG12	CONTACT WITH OR ELECTRICAL SHOCK FROM UTILITIES	Call underground service alert prior to start. Locate all above and below ground utilities. Any existing lines must be removed prior to start of work Clear area of obstructions, stand clear of moving obstructions.
	Bauer BG40/BG24/BG22/BG12	CAUGHT IN OR BETWEEN MOVING EQUIPMENT OR PARTS	Use clear hand signals. Walk around equipment prior to moving. Barricade off area for all swinging equipment within 3 feet of hard surface. Do not put hands between osciallator ring and casing. Stay clear of moving parts on and below oscillator. Be sure travel area is clear and stable. Ensure stable ground conditions.
DRILLING SHAFT	Bauer BG40/BG24/BG22/BG12	SLIPS, FALLS, CONTACT WITH, SPIN-OFF MATERIAL	Cover open holes and secure. Barricade off area. Use OSHA Approved Hand rails or top casing 42" above ground. Keep work area clear of obstructions.
	Bauer BG40/BG24/BG22/BG12	PINCHING, CRUSHING	Stay clear of swing radius
RIGGING STEEL	Bauer BG40/BG24/BG22/BG12 Rigging FORKLIFT	CONTACT WITH, ABRASION, LACERATION, PUNCTURE DROPPING LOAD	Use one trained signal person to signal operator. Inspect and use appropriate rigging for activity. Dispose of damaged or frayed rigging. Use appropriate protection, I.E. gloves, hard hat, etc. Consult rigging chart for proper angles, loads and distances. Foreman is responsible for proper rigging techniques.
INSTALLING STEEL CASING **TREMIE LINE**	Bauer BG40/BG24/BG22/BG12 FORKLIFT	CONTACT WITH OR BETWEEN, SLIPS, FALLS	Use one trained signal person to signal operator. Use tag lines on all loads. Keep walkway clear and away from open hole area. Avoid contact with tied steel and pinch points. Do not wear loose fitting clothing.
		FALLING INTO SHAFT	Watch footing, cover&secure open holes, use top casing as safety rail or use guard rail to prevent workers within 6' of shaft. All personnel within 6' without a top casing (42" above ground) will require to be tied off.
ENTERING SHAFT	--NOT ALLOWED --	SLIPS, FALLS	Not Permitted on this Project
PLACING CONCRETE	GRAVEL TRUCKS, BUCKETS	SLIPS, FALLS, CONTACT WITH EQUIPMENT & GRAVEL	Watch footing, clear area of obstructions. Be aware of concrete chute swing radius. Be aware of placement and movement. Do not wear loose fitting clothing. Wear protective clothing, footware and eyewear. Check hoses, clamps, whip checks, e.t.c for wear. Stay clear of electrical lines and overhead obstructions. Use proper lifting techniques.
		FALLING INTO SHAFT	Watch footing, cover&secure open holes, use top casing as safety rail or use guard rail to prevent workers within 6' of shaft. All personnel within 6' without a top casing (42" above ground) will require to be tied off.
	TRUCKS, BUCKETS		Use proper hand signals Monitor spoils for odor and color changes
ACCESS	Bauer BG40/BG24/BG22/BG12	OVERTURNING/LOSS OF CONTROL	Ensure that access roads / Trestles are stable and dry
	FORKLIFT		Do not exceed safe angles for equipment on slopes
HOISTING	Bauer BG40/BG24/BG22/BG12	FAILURE	Check line loading Verify quality/location of pick holes Inspect Rigging Daily Use Proper Rigging Use trained spotter and established hand signals Verify ground stability

DRILLED SHAFT
DRILL LOGS

DRILLED SHAFT SOIL EXCAVATION LOG

Project Name ______________________________ Page ______ of ______
FIN Project No. ______________________________ Pier No. ______
Contractor ______________________________ Shaft No. ______
Inspected By ______________ Date ______________ Station ______
Approved By ______________ Date ______________ Offset ______

Casing Information

ID	OD	Top Elev.	Length	Bot. Elev.

Soil Auger Diam. ______
Grnd. Surf. Elev. ______
Water Table Elev. ______
Reference Elev. ______
Drilling Mud ______

Notes: ____

Depth	Elevation	Time		Soil Description & Notes
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
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			Out	
			In	
			Out	
			In	
			Out	

DRILLED SHAFT INSPECTION REPORT

BRIDGE NAME				PROJECT:			CONTRACT NO.:
BRIDGE NO.	BENT	STATION	SHAFT NO.	SHAFT DIAMETER	INSPECTED BY	CERTIFICATION NO.	DATE
DRILLED SHAFT CONTRACTOR				PRIME CONTRACTOR			

Time Excavation Started: ____________ STOPPED ____________

Date/Time Bottom Inspected: ________________________

Date Concreting Started: ____________ STOPPED ____________

	Plan Measurements	"As-Built" Measurements
Top Elevation		
Bottom Elevation		
Shaft Diameter		
Rock Socket Diameter (if appl.)		
Shaft Length*		
Concrete Volume (cy)		
Concrete Mix Design		

*Was longer shaft approved for payment? ☐ Yes ☐ No

Concrete Placement Method ☐ Tremie ☐ Free Fall

Concrete Slump @ time or pour ________________

Water Inflow Rate ____________ gal/min (est.)

Bottom of Shaft Cleanliness Meets Specification? ☐ Yes ☐ No

Proper reinforcement and CSL tubes installed: __________

Description of bottom of shaft: ________________

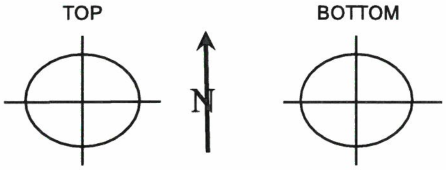
COMMENTS (Obstructions Encountered, etc.):

CSL Test Performed: ☐ Yes ☐ No

CSL Test Results Approved: ☐ Yes ☐ No* *If not approved, describe results and resolution

Shaft Approved by:

INSPECTOR SIGNATURE DATE



Mark Deviation from Plan

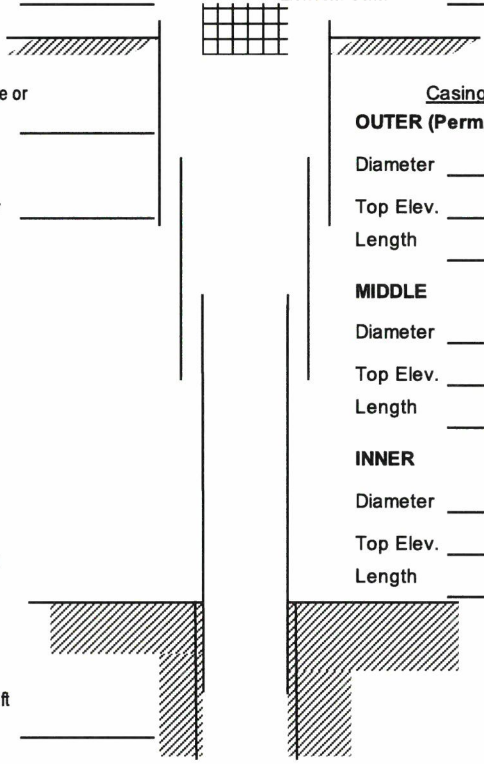
As-built location within tolerances? __________

Reinforcement

Elev. Before Conc. __________

Elev. After Conc. __________

Ref. Elev. __________



Ground Surface or Mudline Elev. __________

Groundwater Elev.: __________

Top of Rock Elevation

Bottom of Shaft Elevation __________

Casing

OUTER (Perm/Temp)

Diameter __________

Top Elev. __________

Length __________

MIDDLE

Diameter __________

Top Elev. __________

Length __________

INNER

Diameter __________

Top Elev. __________

Length __________

Note: Forward completed reports to ODOT Bridge Section.

http://www.oregon.gov/ODOT/HWY/CONSTRUCTION/HwyConstForms1.shtml

4-2598 (8-2009)

CSL TUBE PLACEMENT

PROJECT NAME:

GEOTECHNICAL ENGINEER:

PROJECT NUMBER:

SHAFT NO:

BENT:

SUPERINTENDENT:

FOREMAN:

DATE:

PRIME CONTRACTOR:

OWNER:

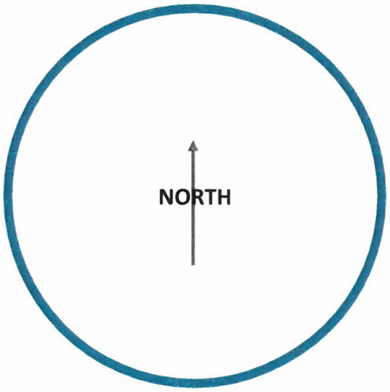
CSL #: ------------- ------------- ------------- ------------- ------------- -------------

TOP: (ELEV.)

TIP:

CSL ORIENTATION

DIAMETER: __________



DRAW IN CSL ORIENTATION AND NUMBER.

TYPICALLY #1 IS NORTHERN MOST TUBE. NUMBER CLOCKWISE.

FILLED OUT BY:

COMMENTS:

DRILLED SHAFT CONCRETE PLACEMENT LOG

PROJECT		BRIDGE NO.	CONTRACT NO	
BENT	STATION	SHAFT NO.	SHAFT DIAMETER	
DRILLED SHAFT CONTRACTOR Pacific Foundation		INSPECTED BY	CERT. NO. N/A	DATE

REFERENCE ELEVATION	SHAFT TOP ELEVATION	REBAR CAGE TOP ELEVATION:	AT START	AT FINISH
DEPTH TO WATER OR SLURRY	SHAFT BOTTOM ELEVATION	REBAR DESIGN ELEV.	WITHIN SPEC? ☐ YES	☐ NO
TOP OF ROCK ELEVATION	SHAFT LENGTH	REBAR CAGE CENTERED WITHIN SPEC?	☐ YES	☐ NO

SHAFT CONCRETE INFORMATION

Placement Method

_____ Free Fall

_____ Tremie

De-Airing Method

_____ Tremie Plug

_____ Tremie Cap

_____ Relief Valve

Volume in Lines

#	ID	Length	Volume
_____	_____	_____	_____ cy
_____	_____	_____	_____ cy
_____	_____	_____	_____ cy

Total Volume in Lines (VL) _____ cy

Estimated Waste Concrete (VW) _____ cy

Begin Pour: Date: ________ Time: ________

End Pour: Date: ________ Time: ________

Shaft Completion Time: ________
(including casing removal)

________ **Total Concrete Volume Delivered (TVD)**

________ **Total Concrete Volume In Shaft; cy (=TVD-VL-VW)**

Truck No.	Concrete Volume	Slump	Arrival Time	Start Time	Finish Time	Tremie Depth	Depth To Concrete	NOTES (delays, additives, breaching, casing removal)

________ **Total Concrete Volume Delivered (TVD)**

INSPECTOR SIGNATURE ________________

DATE ________

NOTES: ________________________________

CASING REMOVAL

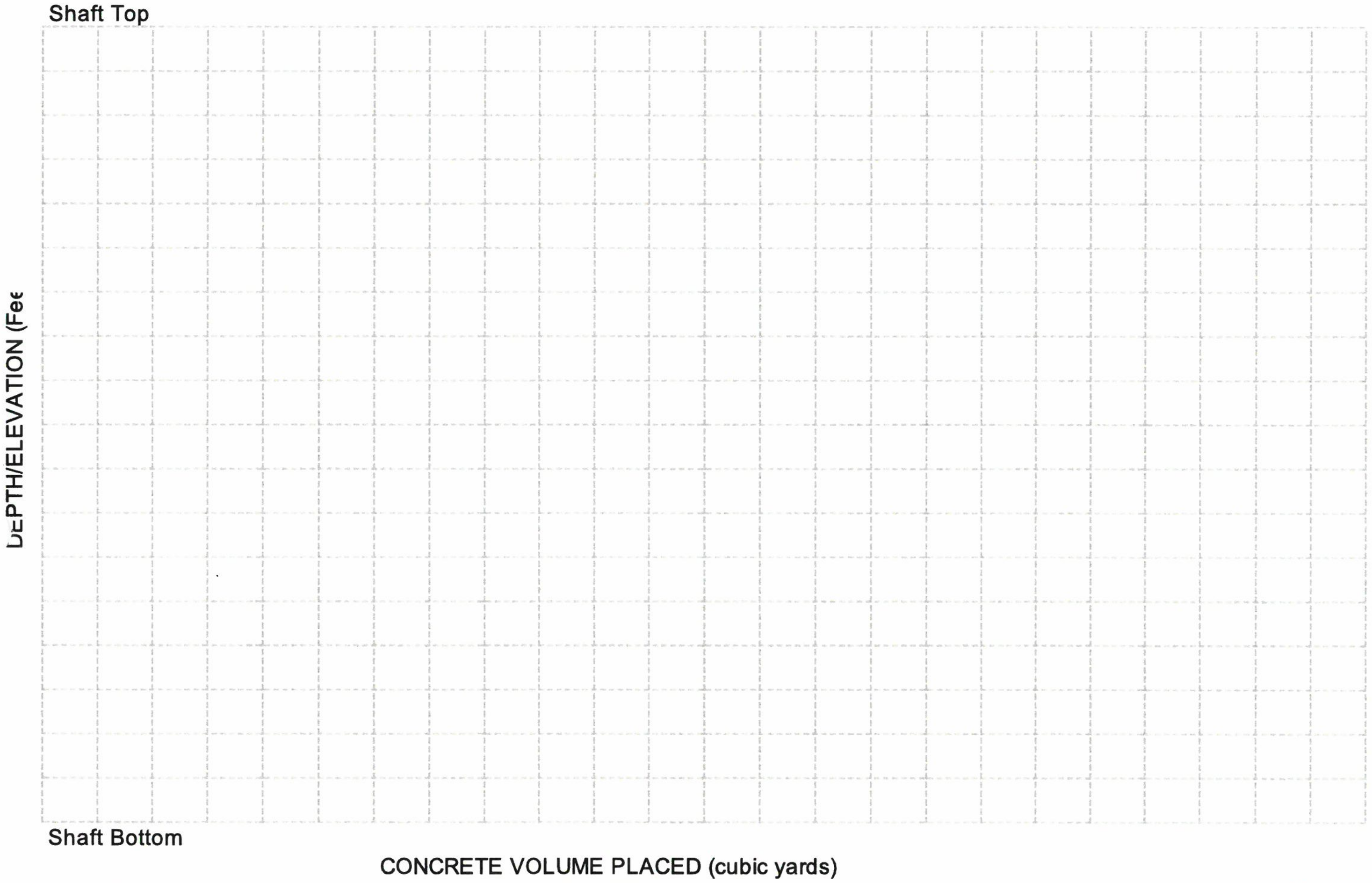
	OD	Top Elev.	Bot. Elev.	Start	Finish
	_____	_____	_____	_____	_____
	_____	_____	_____	_____	_____
	_____	_____	_____	_____	_____
Permanent Casing	_____	_____	_____		

DRILLED SHAFT CONCRETE VOLUMES

PROJECT		**BRIDGE NO.**	**CONTRACT NO**	
ENT	**STATION**	**SHAFT NO.**	**SHAFT DIAMETER**	
DRILLED SHAFT CONTRACTOR Pacific Foundation		**INSPECTED BY**	**CERT. NO.**	**DATE**

CONCRETING CURVE

Prior to pouring concrete, a plot should be made showing the theoretical concrete surface (by depth or elev.) vs. concrete volume placed. During concrete placement the actual concrete surface vs. the actual concrete volume placed is then plotted.



VOLUME CALCULATIONS

Volume Delivered TVD ____ cy Notes/Comments: ____________________

Volume in Lines VL ____ cy ____________________

Wastage VW ____ cy ____________________

Volume Placed (= TVD-VL-VW) VP ____ cy ____________________

Theoretical Volume ($\pi(D^2/4)$(Shaft Length,ft)/27) VT ____ cy ____________________

Overpour (VP-VT) OP ____ cy ____________________

Doc Express® Document Signing History

Contract: C15298 - OR217: OR10 - OR99W Document: Submittal 76 BIVarious Drilled Shaft Plan - Structures 20220110

This document is in the process of being signed by all required signatories using the Doc Express® service. Following are the signatures that have occurred so far.

Date	Signed By
01/10/2022	Daley McKay Kerr Contractors Oregon, Inc. Electronic Signature (Submitted)
	(Approved by Prime Contractor)
	(Reviewed by RE Office (New Document option))
	(Recommended by Project RE)
	(Accepted by RE Office)
	(Approved by Project RE)
	(Approved by ODOT RE (CPM/LAL Projects Only))
	(Accepted/Approved by Civil Rights)
	(RE Office Correction Made (Markup and New Document Option))
	(RAS Review Completed)

INSERT TAB

Installation Plan
Current

KERR CONTRACTORS

P.O. Box 1060 Woodburn, OR 97071
Main Office 971 216 0050

SUBMITTAL

TO: Rick Smith Oregon Department of Transportation
6000 SW Raab Rd.
Portland, OR 97221

FROM: Tim Nelson
PROJECT NAME: OR217: OR10-OR99W
CONTRACT#: 15298
KERR JOB# 221018

SPEC SECTION: 00512.40
BID ITEM NO: 2940, 3570, 3980, 4900
SUBMITTAL #: 076.3
SUB/SUPPLIER: Cascade Bridge
DESCRIPTION: Drilled Shaft Plan – Structures REV3 Response to Comments
DATE: 4/13/2022

REMARKS:

Please see the attached submittal.
Structures #09671, 23873, 23874, 23901

Submittal Transmittal

Detailed, Grouped by Each Number

OR217: OR10 - OR99W
ODOT Contract No. 15298

Project # 21110
Tel: Fax:

Cascade Bridge, LLC

Date: 4/13/2022 **Reference Number: 0109**

Transmitted To:
David Finnigan
Kerr Contractors Inc.
PO Box 1060
Woodburn, OR 97071
Tel: (971) 216-0050
Fax: (503) 981-1161

Transmitted By:
Kyle Barber
Cascade Bridge, LLC
14215 NW 3rd Court
Vancouver, Washington 98685
Tel: (360) 737-6576
Fax: (360) 737-6579

Qty	Submittal Package No	Description	Due Date	Package Action
1	0020 - 00512 - 3	Drilled Shaft Installation Plan Rev3	5/4/2022	For Approval

Transmitted For	Delivered Via	Tracking Number
Approval	Email	

Items	Qty	Description	Notes	Item Action
1	1	Drilled Shaft Installation Plan Rev3		For Approval

Cc: Company Name	Contact Name	Copies	Notes

Remarks

Bid Item# 2940, 3570, 3980, 4900
Structure # 09671, 23873, 23874, 23901

See attached comments per Rev2

Signature **Signed Date**

OR 217: OR 10-OR 99W
DRILLED SHAFT SUBMITTAL
SUPPLEMENT 3 – RESPONSES TO EOR COMMENTS

SCOPE:
The information contained in this supplement is intended to address the comments presented in the DOWL submittal supplement 2 response dated 3/31/2022. This information shall be used in conjunction with the original submittal, supplement 1 & supplement 2.

1. **The contractor's proposed sequencing (Clarification Item #1) appears to indicate they will place the reinforcement cage in the shaft excavation after concrete placement is complete. This is not an approved drilled shaft construction method. Reinforcement must be placed in the shaft excavation prior to concrete placement.**

   Pacific Foundation Response – Noted: This was a mistake in the previous write up. Pacific Foundation DOES NOT intend to install any of the reinforcement cages after the concrete has been placed. Pacific Foundation will pick the rebar cage from the staging area, location decided by Cascade Bridge, and install the rebar cage PRIOR to concrete placement. Please refer to submittal Rev. 1 for drilled shaft procedure.

   As a sub-contractor on this project, we look in the direction of Cascade Bridge to come up with the final drilled shaft sequencing plan. In our experience, drilled shaft construction will start on the outer most shaft location of the Bent and will install the shafts in a continuous sequence working to the other side of the Bent. Cascade Bridge will then have access provided to the next Bent location and this will be repeated until all proposed drilled shafts have been installed for the structure. Additional information regarding drilled shaft per Structure start dates, shaft & Bent sequencing, cage tie/staging areas, etc. should be provided in Cascade Bridge's response and/or schedule.

   Cascade Bridge Response – Drilled Shaft rebar will be tied by Willamette Valley Steel adjacent to the Drilled Shaft location. Drilled Shaft rebar shop drawings for structure 23874 were submitted separately as part of submittal 241. Remaining structures #09671, 23873 & 23901 to be submitted at a later date. Additionally, Drilled Shaft spacers will be used around the cages per manufactures recommendations, spacers were submitted as part of submittal 115. The Drilled Shaft sequence by structure is detailed below with the current planned start months:

   - Allen Blvd Str. No. 23874 – April 2022
   - Denney Road Str. No. 23873 – July 2022
   - Hall North Str. No. 09671 – January 2023

- Hall South Str. No. 23901 – September 2023

2. **Drill Rig Operators – Project History & Qualifications**

   Pacific Foundation Response - Duane Beck will likely be the vertical drill operator for this project. Duane has been operating drill rigs for Pacific Foundation for over 5 years and has previous experience as well. See attached relevant project list for Duane.

   Please see attached Project History for Duane Beck.

3. **Excavated Diameter vs. Plan Diameter**

   Pacific Foundation Response – Please refer to the workplans submitted for each Structure number submitted prior for drill tooling, casing diameters, shaft diameters, etc. Shafts that will have slurry will be drilled as per plan shaft diameter. Slurry will be stored in banker tanks provided by Cascade Bridge.

   Cascade Bridge Response – no additional comments.

4. **Cage Shop Drawings**

   Pacific Foundation Response – Cascade Bridge is supplying the rebar cages for this project. Please refer to submittal No. 241 submitted by Cascade Bridge.

   Cascade Bridge Response – Drilled Shaft shop drawings for structure 23874 were submitted as part of submittal 241, remaining structures #09671, 23873 & 23901 will be submitted for approval at a future date. Shaft Spacers were submitted separately as part of submittal 115 and will be installed per manufacturers recommendations for shaft diameter and vertical height.

5. **CSL Grout Placement**

   Pacific Foundation Response – Cascade Bridge will be placing the grout into the CSL test tubes after results have been completed and submitted to the EOR. For additional information, please refer to their response.

Cascade Bridge Response – Upon acceptance and approval of the shaft, CSL tubes will be filled with Oldcastle – Sakrete Type I-II Portland Cement, reference submittal 226. Grout will be mixed per manufacturer recommendations and placed via manual pump.

6. **Existing Structures**

Pacific Foundation Response – The General Contractor will be responsible for protection during of nearby structures, fences, sidewalks, etc. Pacific will coordinate with the G/C to ensure protective measures such as steel plates, plastic sheeting, plywood, etc. are used as needed.

Cascade Bridge Response – no additional comments.

Enclosures:

- Pacific Foundation Drill Operator Project History

DWAYNE BECK
VERTICAL DRILL OPERATOR
PROJECT HISTORY

PACIFIC FOUNDATION PARTIAL PROJECT HISTORY

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
21073	**West Coast Storage**	Portland, OR	Soldier piles (21ea.), lagging (1,450 sf.), and 12"-dia. displacement piles redesigned to 16"-dia. augercast piles, 214 ea. 15' to 45 ft. deep	Rob C	Eric Gambee Construction Inc. 22445 SW Johnson Rd. West Linn, OR 97068	Eric Gambee Construction Inc. 22445 SW Johnson Rd. West Linn, OR 97068	West Coast Self-Storage. 39 Castledown Rd. Pleasanton, CA 94566	$490,138.00	$378,700.00		04/29/21	07/07/21	VAK Construction Engineering Service, LLC, Visser Engineering
21024	**College Place**	College Place, WA	Secant shafts	Jim B	Apollo, Inc. 200 SW Airport Rd. Corvallis, OR 97339		City of College Place 625 S. College Ave. College Olace, WA 99336	$299,721.77			03/08/21	04/09/21	J-U-B Engineers
20465	**Old Supreme Court Building**							$10,000.00			04/05/21	04/28/21	Pacific Structual
20258	**Wapato Creek Bridge Tacoma**	Tacoma, WA	Install 8 ea. 24" shafts (installed as 30") to 79 ft. deoth. West Abutment shafts installed under low overhead (power lines) using BG24, oscillator, grab and Lo-Drll with spliced cages. Temp casing full depth all shafts.	Rob C	Combined Construction 3701 South Road Mukiteo, WA 98275	Combined Construction 3701 South Road Mukiteo, WA 98275	Port of Tacoma One Sitcum Plaza Tacoma, Washington 98421	$391,613.77			10/20/20	11/23/20	KPFF, Carollo, GeoEngineers
20229	**82nd Ave Signal Shafts**	Portland, OR	Install signal shafts.	Sam S	Prarie Electric 6000 NE 88th St. Vancouver, WA 98665		ODOT 355 Capitol St. NE, MS. Salem OR 97301	$91,874.58			02/02/21	02/25/21	
20208	**Asante Medford**	Medford, OR	Install soldier piles with Mait Drill, install wood lagging, furnish handrail, install tieback anchors, backfill wood lagging.	Jim B	Anderson Construction 6712 N Cutler Circle Portland, OR 97217		Asante Regional Medical Center 2825 E Barnett Rd. Medford, OR 97504	$740,538.48			11/23/20	01/23/21	
20200	**Lehto Bridge**	Battle Ground, WA	Complete vertical elements, and vertical testing. Drill and install soild nails. Complete shotcrete facing.	Jim B	NW Consstruction 22317 NE 72nd Ave, Battle Ground, WA 98604		Clark County Public Works. 1800 Franklin St #4, Vancouver, WA 98660	$110,985.16			08/03/20	09/03/20	
20161	**Stony Point Soldier Rile Wall**	Lane County, OR	Drill 30" dia shafts. Install 44 tiebacksranging from anchor lenghts of 65 to 84'.	Sam s	Marcum & Sons LLC 5591 NW Zamba Ave Redmond, OR 97756		Lane County Dept. of Public Works 3050 N Delta Hwy. Eugene, OR 97408 Ph. 541.682.6900	$569,169.98			06/13/20	08/03/20	

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
20129	**CRC Mobility Rock Anchors**	Clackamas, OR	Proejct included drilling and installation of 20 rock anchors, through exisitng bridge footing, 20 feet in length	Sam S	Kerr Contractors, Inc. 9771, 395 Shenandoah Ln. NE Woodburn, OR 97071	Kerr Contractors, Inc. Sam Kennedy 395 Shenandoah Lane NE Woodburn, OR 97071 (503) 981-5393	Clackamas County 2051 Kaen Road Oregon City, OR 97045 (503) 742-5444	$27,000.00			06/04/20	06/15/20	Pacific Structural Rock Anchor Design
20006	**Polk County Radio Tower**	Dalles, OR	Drill 66" shafts, ands inatall cages.	Sam S	Dalke Construction Inc. 2180 16th St. NE, Salem, OR 97301	Dalke Construction Inc. 2180 16th St. NE, Salem, OR 97301	Polk County Sherrif & Public Works Buildings 820 SW Ash St. Dalles, OR	$32,079.02			03/19/20	03/31/20	Valmont Structures
20005	**Intel Aloha**	Beaverton, OR	Drill and set micropiles.	Mike Z	Coffman Excavation 13014 Clackamas River DR. Oregon City, OR 97045	Intel	Intel Corporation Hillsboro, OR 97124	$168,510.66			03/18/20	03/18/20	Design Group Facility Solutions, INC.
19355	**SEA Burnside**	Portland, OR	install soldier piles (30' Dia hole). Install wood laggin, furnish and install handrail, backfill wood lagging.	Sam S	Joseph Hughes Construction 11125 SW Barbur Blvd Portland, OR 97219	Joseph Hughes Construction 11125 SW Barbur Blvd Portland, OR 97219	P7 LLC 2525 E Burnside St Portland, OR 97214 Ph. 503.226.3617	$47,448.99			03/13/20	04/08/20	Pacific Structural
19282	**Lincoln High School**	Portland, OR	Project included using CFA drilling methods to install a soldier pile shoring wall up to 16' & drilling 365 auger cast piles. Reached drilled depths of up to 100' and included installing piles w/ top of cage elevations up to 15' below existing grade.	Mike Z	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 P: (503) 221-8811	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 P: (503) 221-8811	Portland Public Schools 501 N Dixon St. Portland, OR 97227	$2,500,000.00	365		02/03/20	06/15/20	Design Build
19279	**Milltowner**	Portland, OR	Project included installing a cantilever soldier pile wall with a wall height of appox. 12'. Conventional drilling methods were implemented with soil conditions consisiting of lean clay/ sandy	Jim B	Robertson & Olson Construction 4600 NE Camas Meadows Dr. Camas, WA 98607.	Stu Leinman PM Robertson & Olson Co. Ph. 360.699.4724 Email: stu.leinan@reconstruction.com	Findley CM, LLC 12675 NW Cornell RD. Portland, OR, 97229	$92,108.00			05/11/20	05/26/20	Pacific Structural
19202	**Saltwood South**	Portland, OR	Project Included drilling and installing 104 soldier piles, 79 tiebacks, and 16000 SF of wood lagging. Soil conditions consisted of silts, sands and gravels. Soldier pile drill depths up to 40 ft.	Sam S	R & H Construction Co. 1530 SW Taylor St. Portland, OR 97205 P: (503) 228-7177	R & H Construction Co. Mike Kremers 1530 SW Taylor St. Portland, OR 97205 PH: (503) 228-7177	Cairn Pacific Acquisitions, LLC 1015 NW 11th Ave, Suite 242 Portland, OR 97209	$825,627.00			09/23/19	11/07/19	Pacific Structural
19168	**Intel CUB4 / Cluster 6**	Hillsboro, OR	Soldier Pile, Lagging and Tiebacks Shoring Wall	Mike Z	Skanska 1400 N Jantzen Ave. Portland, Oregon 97217		Intel Corporation 6397 NE Evergreen Pkwy. Hillsboro, OR 97124				06/05/19	08/18/20	
19150	**I-5 Roberts Creek Road**	Myrtle Creek, OR	Soldier Pile Installation.	Sam S	Kerr Constractors 395 Shenandoah Ln NE, Woodburn, OR 97071		ODOT 123 NW Flanders St. Portland, OR 97208	$316,683.52			05/01/20	06/09/20	
19102	**Hilton Kings Villag**	Honolulu, HI	CDSM and Jetgrout bathtub seal of city block	Mike Z	Nordic PCL Construction 1099 Alkea St. #100 Honolulu, HI 98613	Nordic PCL Construction 1099 Alkea St. #100 Honolulu, HI 98613	Hilton Resort Corporation 101 Bishop Street, Suite 1340 Honolulu, HI	$ 1,566,119.73			06/27/19	03/20/20	

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
19052	**OR22 Sourgrass Creek**	Salem, OR	Project includes conventional drilling methods and equipment for pre-boring and installing H piles and backfilling w/ concrete.	Sam S	Legacy Contracting Inc. 41850 Kingston-Jordan rd. Stayton, OR 97383 Ph. 360.200.6608	Kathleen Johnson Legacy Contracting, Inc. Ph. 503.749.2203	ODOT 3920 Fairview Industrial Dr. Salem, OR 97302 Ph. 503.324.6210	$220,132.56			05/31/19	06/10/19	
19007	**OR-1 Data Center**	Hillsboro, OR	Project included 1,879 CFA drilled shafts each reaching a depth of	Mike Z	JE Dunn Construction 424 NW 14th Ave	Todd Barnes JE Dunn Construction	Digital Reality Trust 2323 Bryan St.	$2,594,853.00	1879		06/11/19	09/10/19	NV5
18275	**Saltwood North**	Portland, OR	Project Included drilling and installing 104 soldier piles, 208 tiebacks, and 20500 SF of wood lagging. Soil conditions consisted of silts, sands and gravels. Soldier pile drill depths up to 40 ft.	Sam S	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1005	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1005	Cairn Pacific Acquisitions, LLC 1015 NW 11th Ave, Suite 242 Portland, OR 97209	$1,172,909.00			08/05/19	09/11/19	Pacific Structural
18234	**The Canyons**	Portland, OR	Project includes a canitilever soldier pile shoring wall in downtown Portland with a 14.5' wall.	Sam S	R&H Construction 1530 SW Taylor St, Portland, OR 97205	R&H Construction Michael Gillis Ph. 503.866.8368	PDX Canyons LLC 3530 N. Vancouver Ave, Suite 330 Portland, OR 97227	$335,755.29			03/04/19	03/22/19	
18217	**Courtyard at Mt Tabor**	Portland, OR	Install nails one lift at a time. Iinstall reinforcing material and shotcrete with each lift until wall is constructed.	Sam S	R & H Construction Co. 1530 SW Taylor St. Portland, OR 97205 P: (503) 228-7177	Chris Orchard R&H Construction Cell: 503.880.4164	Courtyard Plaza P.O. Box 855 Hood River, Oregon 97031	$118,186.00			10.08.18	11.27.18	
18216	**Yreka Court House CA**	Yreka, CA	Install Soldier piles, wood lagging,tieback anchors,furnish and install handrail, backfill wood lagging install secant shoring pit, and destress tiebacks	Jim B	McCarthy 2665 N 1st St. #102 San Jossse, CA 95134	Kyle Becker McCarthy Ph. 510.684.3488	Judicial Council of California 455 Golden Gate Avenue San Francisco, CA 94102	$665,860.00			04/01/19	5.30.19	
18148	**Manastash Bridge**	Ellensburg, WA	Project included drilling and installation of 4 ea. 60" drilled shafts, in Cobbles Boulders, and Solid rock with depths up to 50 feet.	Sam S	Belsaas & Smith P.O. Box 926. Ellensburg, WA 98926. 509-925-9747	Belsaas & Smith P.O. Box 926. Ellensburg, WA 98926. 509-925-9747	WSDOT 11018 NE 51st Circle Vancouver, WA 98682	$299,285.00			09/04/18	10/19/18	
18089	**3717 NE Columbia Blvd**	Portland, OR	Project Included soldier pile and lagging shoring wall.	Jim B	Perlo Construction 16101 SW 72nd Ave, Suite 200 Portland, OR 97224	Perlo Construction 16101 SW 72nd Ave, Suite 200 Portland, OR 97224	LG Columbia Storage LLC. 807 Las Cimas Parkway, Suite 270 Austin, TX 78746	$255,933.56			04/18/19	06/06/19	Pacific Structural
18009	**Elks Childrens Eye Clinic - Casey Eye**	Portland, OR	Project included tieback and shotcrete shoring wall, and 15 drilled foundations into R2 Basalt	Sam S	Skanska USA 222 SW Columbia St Ste 300 Portland, OR 97229 PH: (503) 747-7342	Skanska USA 222 SW Columbia St, Ste 300 Portland, OR (503) 849 4329	OHSU	$330,189.00			06/19/18	07/19/18	
17280	**35 Club Road**	Eugene, OR	Project includes the intallation of soldier piles, lagging and handrail. 14 CFA Piles.	Mike Z	Essex Construcrtion BO Oswald. 4284 W 7th Ave Eugene, OR 97402	Essex Construcrtion BO Oswald 4284 W 7th Ave Eugene, OR 97403	35 Club LLC PO Box 51505 Eugene, OR 97401	$556,031.00			07/30/18	09/12/18	RhinoOne

Project Info					Contract Info								
Job #	Project Name	Location	Project Description	Estimator Project Manager	General Contractor	Client	Owner	Contract $	CFA SHAFTS	Surety Co if Bonded	Start Date	Finish Date	Engineering Firm
17261	**Rockaway Duplex**	Rockaway, OR	Project includes drilling 25 piles to dense sands at a depth of 20ft below grade with a 24" dia.	Jim B	JLT Construction E. 118 Driftwood Ave. Garibaldi, OR 97118	JLT Construction E. 118 Driftwood Ave. Garibaldi, OR 97119	Anderson/Pearson North 3rd Ave & Pacific St. Rockaway, OR 97136	$154,715.00			10/08/18	10/16/18	LLB
17207	**Wooster Creek Drilled Shafts**	Castle Rock, OR	Project included drilling and installation of 26 ea 36" drilled shafts, and 32 ea 48" drilled shafts with depths up to 45 feet.	Ryan B	Hamilton Construction Aaron Strandeford PO BOX 659 Springfield, OR 97477 PH: (541) 746-2426	Hamilton Construction Aaron Strandeford PO BOX 659 Springfield, OR 97477 PH: (541) 746-2426	WASDOT	$474,932.00			11/14/17	12/02/17	WASDOT
17148	**North Cully Slide Repair**	Salem, OR	Furnish and install cantilever soldier piles and lagging for remediation of a landslide.	Ryan B	K&E Excavating 3871 Langley St SE. Salem, OR 97317 PH: (503) 399-4833	K&E Excavating 3871 Langley St SE. Salem, OR 97317 PH: (503) 399-4833	Linn County Road Dpmt 3010 SW Ferry St Albany, OR 97321	$315,651.00			08/25/17	10/03/18	Linn County
17062	**MLK**	Portland, OR	Project included designing tieback anchors and installing temporary soldier piles.	mike Z	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 PH: (503) 221-8811	Hoffman Construction 805 SW Broadway, Suite 2100 Portland, OR 97205 PH: (503) 221-8812	Gerding Edien Develop. 1477 NW Everett Street. Portland, OR 97209	$1,408,178.00			12/20/17	02/15/19	Geodesign
17042	**HCRT**	Hood River, OR	Project included drilling and setting 53 soldier piles - 30" shafts, aswell as installing 42 DCP bar anchors	Jim B	Stellar J Corporation 1363 Down River Road. Woodland, WA 98674 Office: 360.225.7996	Stellar J Corporation 1363 Down River Road. Woodland, WA 98674 Office: 360.225.7997	Western Federal lands 610 E 5th St. Vancouver, WA 98661	$400,484.00			08/30/17	01/03/18	Cornforth
17004	**Press Blocks Test Drilling**	Portland, OR	Project included drilling a 24" shaft, spoil disposal, and backfill & sidewalk patching.	Ryan B	Lease Crutcher Lewis 550 SW 12th Ave Portland, OR 97206. PH: (503) 223-0500	John Marasco Security Properties	John Marasco Security Properties	$6,350.00			2/21/17	2/21/17	
16076	**Canopy Hotel**	Portland, OR	Soldier Pile, Tieback, & CMS Ground Improvements	Jim B	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1005	Bremik Construction 1026 SE Stark St Portland, OR 97214 PH:503.688.1005	Portland Hotel XXVII Owner LLC	$ 568,565.00			07/04/16	08/08/16	KPFF
16068	**Intel IWW Coolong**	Hillsboro, OR	Desing Build Secant Pile Wall Structure with 36" diameter shafts to createe a 37ft deep wet well &	Mike Z	Skanska USA 222 SW Columbia St, Ste 300 Portland, OR	Coffman Excavation. 13014 Clackamas River Dr. Oregon City, OR 97046	Intel Corporation 3100 NE Shute Road Hillsboro, OR 97124	$ 488,584.00			04/16/16	05/01/16	Berger ABAM
16061	**Holladay Park Plaza**	Portland, OR	Soldier Pile & Tiebacks	Mike Z	Turner Construction 1200 NW Naito Pkway Suite 300 Portland, OR 97209 O: (503) 221-3220	Turner Construction 1200 NW Naito Pkway Suite 300 Portland, OR 97209 O: (503) 221-3221	Holladay Park Plaza 1300 NE 16th Ave Portland, OR 97232	$ 627,364.00			01/17/16	02/17/16	Valor Engineering
16058	**12th & Morrison**	Portland, OR	CFA Soldier Piles, Tieback Anchors, & Wood Lagging	Jim B	Turner Construction 1200 NW Naito Pkway Suite 300	Turner Construction 1200 NW Naito Pkway Suite 300	Menashe Properties 621 Alder St Portland, OR 97205 Barry	$ 180,674.00			09/20/16	10/20/16	Roggenkamp
16057	**YVMH Energy**	Yakima, WA	CFA Soldier Piles for Underpinning	Mike Z	VK Powell Construction PO Box 10295 Yakinma, WA 98909 (509) 248-8148	VK Powell Construction PO Box 10295 Yakinma, WA 98909 (509) 248-8148	Yakima Valley Memorial Hospital	$ 334,640.06			08/31/16	09/14/16	Berger ABAM
16056	**LAM Research**	Tualatin, OR	Project included Design, Furnish, and Installation of a Soldier Pile and	Mike Z	Skanska USA 222 SW Columbia St, Ste 300	Skanska USA 222 SW Columbia St, Ste 300	LAM RESEARCH	$ 334,640.06			05/17/16	06/17/16	Berger ABAM

P.O. Box 1060 Woodburn, OR 97071
Main Office 971 216 0050

SUBMITTAL

TO: Rick Smith Oregon Department of Transportation
6000 SW Raab Rd.
Portland, OR 97221

FROM: Tim Nelson
PROJECT NAME: OR217: OR10-OR99W
CONTRACT#: 15298
KERR JOB# 221018

SPEC SECTION: 02010
BID ITEM NO: 2920, 3550, 3960, 4880
SUBMITTAL #: 226
SUB/SUPPLIER: Cascade Bridge
DESCRIPTION: Oldcastle Sakrete Type I-II Portland Cement Durkee Plant
DATE: 3/24/2022

REMARKS:

Please see the attached.

Submittal Transmittal

Detailed, Grouped by Each Number

OR217: OR10 - OR99W
ODOT Contract No. 15298

Project # 21110
Tel: Fax:

Cascade Bridge, LLC

Date: 3/24/2022 **Reference Number: 0095**

Transmitted To:
David Finnigan
Kerr Contractors Inc.
PO Box 1060
Woodburn, OR 97071
Tel: (971) 216-0050
Fax: (503) 981-1161

Transmitted By:
Kyle Barber
Cascade Bridge, LLC
14215 NW 3rd Court
Vancouver, Washington 98685
Tel: (360) 737-6576
Fax: (360) 737-6579

Qty	Submittal Package No	Description	Due Date	Package Action
1	0074 - 02010 - 0	Oldcastle - Sakrete Type I-II Portland Cement Durkee Plant	4/7/2022	For Approval

Transmitted For	Delivered Via	Tracking Number
Approval	Email	

Items	Qty	Description	Notes	Item Action
1	1	Oldcastle - Sakrete Type I-II Portland Cement Durkee Plant		For Approval

Cc:	Company Name	Contact Name	Copies	Notes

Remarks

Bid Item: 2920, 3550, 3960, 4880

All Concrete Structures for Patching
Structure# 09671, 23873, 23874, 23901 (CSL Tubes)

To Be Used For Grouting CSL Tubes and Patching Concrete

Signature **Signed Date**

ODOT CONSTRUCTION / MATERIALS SECTION
QUALIFIED PRODUCTS LIST
APPROVED LIST - NO SAMPLES OR TESTS REQUIRED*
QUALIFIED LIST - ADDITIONAL REQUIREMENTS**
JULY 2021

Approved

STANDARD SPEC #	CATEGORY	PRODUCT NAME	LOCAL REPRESENTATIVE AND/OR MANUFACTURER	EFFECTIVE DATE	PRODUCT NUMBER	LIST	REMARKS
02010.10	CEMENT, TYPES I, II, III	ASH GROVE CEMENT - DURKEE	ASHGROVE CEMENT CO. DAVE BURG 503/207-2109	01/14/99	1472	A	DURKEE PLANT ONLY. AASHTO TYPES I, II, & III.
02010.10	CEMENT, TYPES I, II, III	ASH GROVE CEMENT - SEATTLE	ASHGROVE CEMENT CO. DAVE BURG 503/207-2109	01/11/96	1472	A	SEATTLE PLANT ONLY. AASHTO TYPES I, II, III
02010.10	CEMENT, TYPES I, II, III	LEHIGH CEMENT-REDDING WAS CALAVARAS THEN TILBURY	LEHIGH SOUTHWEST CEMENT CO. REDDING 530/275-1581	01/11/96	1473	A	REDDING CALIFORNIA PLANT ONLY. AASHTO TYPES I,II,III
02010.20	CEMENT, TYPE IL	ASH GROVE CEMENT SEATTLE	ASHGROVE CEMENT CO. DAVE BURG 503/207-2109	07/24/20	5285	A	SEATTLE TYPE IL
02010.20	CEMENT, TYPE IL	ASH GROVE CEMENT VISSAI	ASHGROVE CEMENT CO. DAVE BURG 503/207-2109	06/14/21	5346	A	VISSAI VIETNAM TYPE IL
02010.20	CEMENT, TYPE IL	LAFARGE EXSHAW, ALBERTA	LAFARGE CORPORATION ROB SHOGREN 206/923-9953	06/20/17	5056	A	TYPE IL
02010.20	CEMENT, TYPE IL	LAFARGE RICHMOND, BRITISH COLUMBIA	LAFARGE CORPORATION ROB SHOGREN 206/923-9953	04/21/17	5015	A	TYPE IL
02010.20	CEMENT, TYPE IP (15)	LAFARGE CEMENT - SEATTLE	LAFARGE CORPORATION ROB SHOGREN 206/923-9953	12/09/99	1970	A	TYPE F FLY ASH BLENDED-SEATTLE PLANT TYPE 1 CEMENT WITH 15% TYPE F FLY ASH
02010.20	CEMENT, TYPE IS (20)	LAFARGE MAXCEM (20%)	LAFARGE CORPORATION ROB SHOGREN 206/923-9953	02/14/02	2298	A	SLAG BLENDED - SEATTLE PLANT TYPE 1 CEMENT WITH 20% SLAG

***LIST 'A' = APPROVED. MAY BE USED WITHOUT SAMPLES, TESTING, OR QUALITY COMPLIANCE CERTIFICATIONS. MAY NEED A FIELD INSPECTION REPORT.**
****LIST 'Q' = QUALIFIED. USE WITH SAMPLING, TESTING, &/OR QUALITY COMPLIANCE CERTIFICATIONS AS NEEDED. NEEDS A FIELD INSPECTIONS REPORT. CHECK SPECS AND NFTMAG.**

Central Premix- Oldcastle
An **Oldcastle** company

1402 N. River St.
Portland, OR 97227
Phone: (800) 245-3833
Fax: (503) 282-2186

March 21, 2022

Sakrete Type I-II Portland Cement

Sakrete Type I-II Portland cement as packaged by Oldcastle APG's CPM Portland plant, in 47 or 94 lb. bags, meets the American Society for Testing and Materials (A.S.T.M.) C-150 specifications for portland cement.

This product is bagged in Portland, Oregon using exclusively Ash Grove Cement. For this specific project, to be sold by Williams Concrete Accessories, the packaged cement is Ash Grove Durkee type I-II.

If additional information is needed, please contact your sales representative.

Respectfully submitted,

Patrick Sweeney
Sales Manager
Central Premix- Oldcastle

Doc Express® Document Signing History

Contract: C15298 - OR217: OR10 - OR99W Document: Submittal 226 BIVarious Portland Cement Oldcastle Sakrete Type I-II Portland Cement Durkee Plant 20220324

This document is in the process of being signed by all required signatories using the Doc Express® service. Following are the signatures that have occurred so far.

Date	Signed By
03/24/2022	Tim Nelson Kerr Contractors Oregon, Inc. Electronic Signature (Submitted)
	(Approved by Prime Contractor)
	(Reviewed by RE Office (New Document option))
	(Recommended by Project RE)
	(Accepted by RE Office)
	(Approved by Project RE)
	(Approved by ODOT RE (CPM/LAL Projects Only))
	(Accepted/Approved by Civil Rights)
	(RE Office Correction Made (Markup and New Document Option))
	(RAS Review Completed)

DOWL

DATE: 01/20/2022

DOWL Job No. C15298 OR 217: OR 10-OR 99W
DOWL Job No. 0019-0576.00

Submittal No. Submittal 115 - Various Drilled Shaft Reinforcing Foundation Technologies Shaft Spacer Hairpin Offset Product Data

To: ODOT - Sylvan RE Construction Office/

☑ No exceptions taken

☐ Review comments resubmittal not required

☐ Resubmit

Review is for general compliance with contract documents. No Responsibility is assumed for correctness of dimensions or details.

00512.45 Reinforcing Steel

(d) Concrete Cover - Maintain the required concrete cover shown by placing concentric spacer bars or other approved devices around the reinforcing cage. Place spacing devices on maximum 10 foot vertical spacing the full length of the shaft. At each 10 foot level, place spacers on a maximum 30 inch circumferential spacing with at least three spaces per level. Do not use wood spacers or concrete dobies. Provide details of the proposed centering method on the shop drawings submitted according to 00512.40.

By:

For

KERR CONTRACTORS

P.O. Box 1060 Woodburn, OR 97071
Main Office 971 216 0050

SUBMITTAL

TO:	Rick Smith Oregon Department of Transportation 6000 SW Raab Rd. Portland, OR 97221
FROM:	Tim Nelson
PROJECT NAME:	OR217: OR10-OR99W
CONTRACT#:	15298
KERR JOB#	221018
SPEC SECTION:	00512
BID ITEM NO:	Various
SUBMITTAL #:	115
SUB/SUPPLIER:	Cascade Bridge
DESCRIPTION:	Drilled Shaft Reinforcing - Foundation Technologies - Shaft Spacer & Hairpin Offset Product Data
DATE:	1/17/2022

REMARKS:

Bid Items: 2910, 3260, 3540, 3950, & 4870

Please see attached

Submittal Transmittal

Detailed, Grouped by Each Number

OR217: OR10 - OR99W

Project # 21110
Tel: Fax:

Cascade Bridge, LLC

Date: 1/17/2022 **Reference Number: 0035**

Transmitted To:
David Finnigan
Kerr Contractors Inc.
PO Box 1060
Woodburn, OR 97071
Tel: (971) 216-0050
Fax: (503) 981-1161

Transmitted By:
Kyle Barber
Cascade Bridge, LLC
14215 NW 3rd Court
Vancouver, Washington 98685
Tel: (360) 737-6576
Fax: (360) 737-6579

Qty	Submittal Package No	Description	Due Date	Package Action
1	0035 - 00512 - 0	Drilled Shaft Reinforcing - Foundation Technologies - Shaft Spacer & Hairpin Offset Product Data	1/31/2022	For Approval

Transmitted For	Delivered Via	Tracking Number
Approval	Email	

Items	Qty	Description	Notes	Item Action
1	1	Drilled Shaft Reinforcing - Foundation Technologies - Shaft Spacer & Hairpin Offset Product Data		For Approval

Cc:	Company Name	Contact Name	Copies	Notes

Remarks

Bid Item 2910, 3260, 3540, 3950, 4870

Signature

Signed Date

HAIRPIN
SHAFTSPACER EXTENDER

WHY USE IT?
In order to meet a designed clearance requirement that is unusual and cannot be provided with a ShaftSpacer wheel alone.

Hairpins are also used when the close spacing of the horizontal or spiral steel reinforcement prevents the ShaftSpacer wheel from being used as a standalone application.

HAIRPIN
Extension device used in tandem with the ShaftSpacer wheel in order to achieve eccentric spacing requirements and/or meet seismic design considerations.

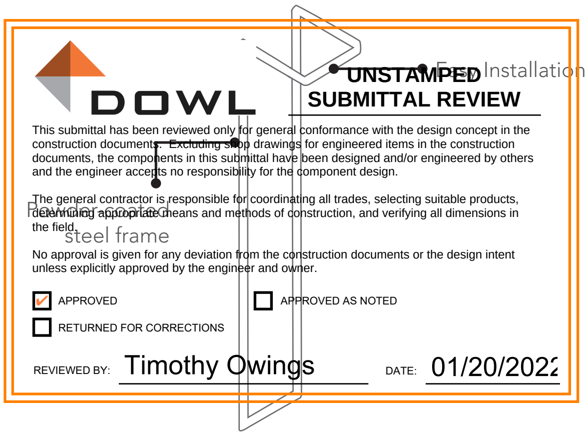
APPLICATIONS
- Bridge Foundations
- Building Foundations
- Retaining Wall Foundations
- Street Light Foundations
- High Mast Foundations
- Transmission Line Foundations
- Sub-station Foundations
- Tower Foundations
- Slurry Walls

ADVANTAGES
- Saves time & money onsite
- Easy to install
- Lightweight, yet strong, durable
- Engineered with the contractor in mind
- Excellent guide system for placement of fabricated rebar cages into drilled or excavated shafts
- Economical with minimal installation costs

CONSTRUCTION BENEFITS
- Customizable to suit any project challenge.
- Insures the bar reinforcement is properly spaced and aligned within the confines of the drilled shaft or excavation.
- Provides quality assurance for the contractor and owner of the sub-contractor’s performance.
- Provides quality assurance for the engineer and owner of the contractor’s performance.
- Installs quickly and easily requiring only unskilled labor.
- Increases job profitability because skilled labor is released for more demanding tasks.
- Has low labor requirements resulting in project cost savings.

UNUSUAL DESIGN CLEARANCE
Example: the project specification and detail states 9 inch clearance. To achieve this clearance with a wheel alone, the wheel would need to have a diameter of approximately 18 inches. By using a Hairpin bar in conjunction with one of our standard model ShaftSpacer wheels, the 9 inch clearance can be achieved.

CLOSE SPACING OF HORIZONTAL STEEL
Example: the project specification and detail states 6 inch clearance, but the pitch of the spiral is 4 or 5 inches. Therefore, the ShaftSpacer wheel that is normally used for 6 inch clearance is too large and will not attach without interfering with the adjacent spiral bars. A Hairpin is then used to resolve the problem.



DOWL

UNSTAMPED SUBMITTAL REVIEW

This submittal has been reviewed only for general conformance with the design concept in the construction documents. Excluding shop drawings for engineered items in the construction documents, the components in this submittal have been designed and/or engineered by others and the engineer accepts no responsibility for the component design.

The general contractor is responsible for coordinating all trades, selecting suitable products, determining appropriate means and methods of construction, and verifying all dimensions in the field.

No approval is given for any deviation from the construction documents or the design intent unless explicitly approved by the engineer and owner.

☑ APPROVED ☐ APPROVED AS NOTED
☐ RETURNED FOR CORRECTIONS

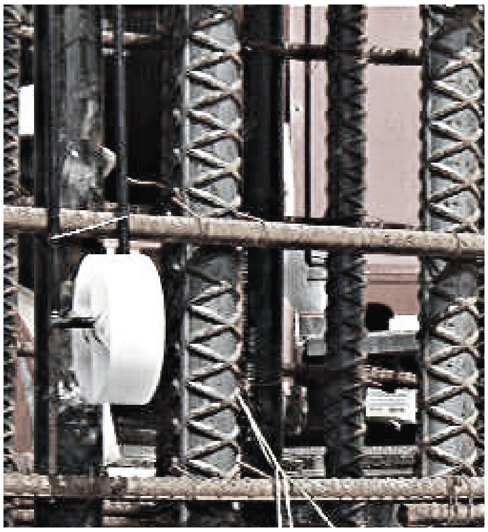
REVIEWED BY: Timothy Owings DATE: 01/20/2022

Guiding rebar cage into drilled shaft with Hairpin and ShaftSpacer system attached

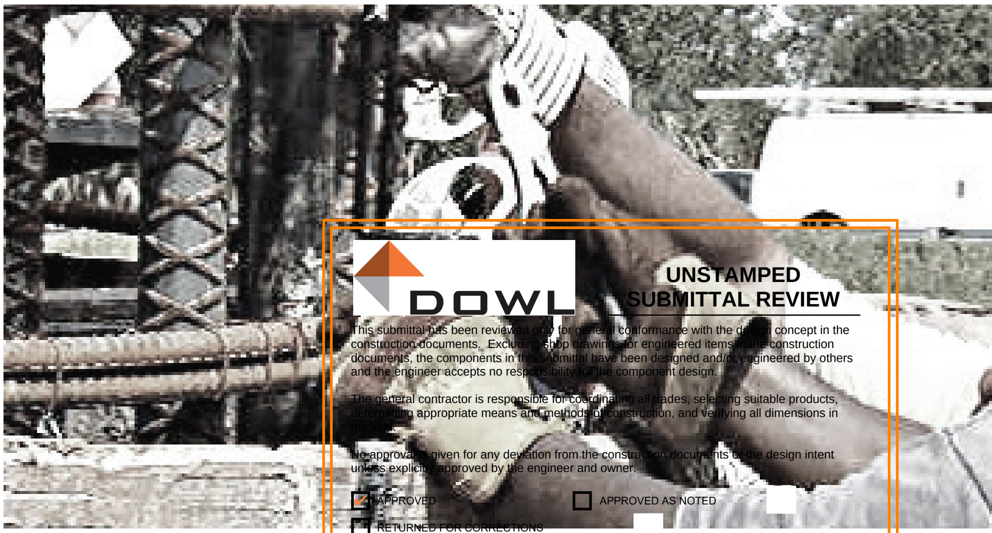
MODEL	OFFSET*	BAR SIZE	PACKAGING	WEIGHT
HP200E	2.0″	NA	25	35 lbs
HP275E	2.75″	NA	25	36 lbs
HP350E	3.5″	NA	25	37 lbs
HP450E	4.5″	NA	25	38 lbs
HP600E	6.0″	NA	25	39 lbs

** When combined with a ShaftSpacer wheel, cover will be increased by this amount. All models are powder coated.*

Hairpin attached to rebar cage



Attaching the Hairpin with tie-wire



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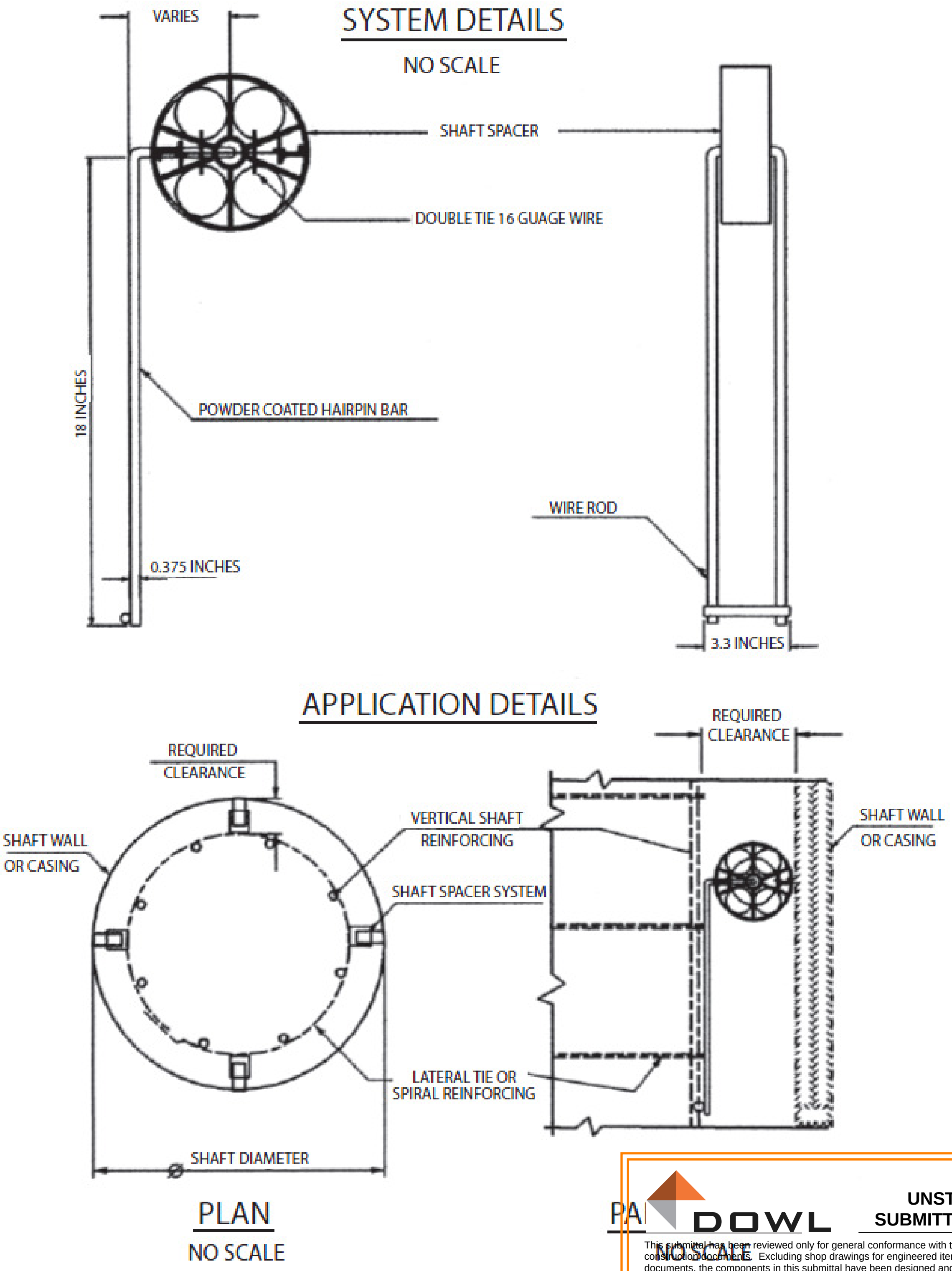
REVIEWED BY: Timothy Owings DATE: 01/20/2022

HAIRPIN

SHAFTSPACER EXTENDER

Detail



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☑ APPROVED ☐ APPROVED AS NOTED

☐ RETURNED FOR CORRECTIONS

REVIEWED BY: Timothy Owings DATE: 01/20/2022

Foundation Technologies, Inc.®

PO Box 491718
Lawrenceville, GA 30049
1.800.773.2368 FAX 678.407.4645
www.foundationtechnologies.com
info@foundationtechnologies.com

SHAFTSPACER®

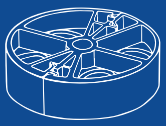
DRILLED SHAFT REBAR CENTRALIZER

WHY USE IT?

In order to ensure fabricated rebar cages are properly positioned for concrete placement every time. The ShaftSpacer aligns and centers rebar cages within the drilled shaft — providing proper clearance between the rebar cage reinforcement and the interior side walls of the shaft or casing.

SHAFTSPACER

A guide and alignment system for lateral positioning of reinforcement cage within caissons, drilled shafts and other geotechnical construction applications.



APPLICATIONS

- Bridge Foundations
- Building Foundations
- Retaining Wall Foundations
- Street Light Foundations
- High Mast Foundations
- Transmission Line Foundations
- Sub-station Foundations
- Tower Foundations
- Slurry Walls

ADVANTAGES

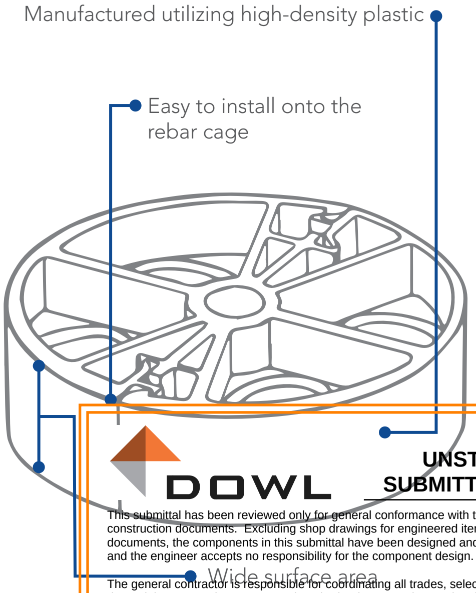
- Saves time & money on site
- Easy to install
- Lightweight, yet strong, durable
- Engineered with the contractor in mind
- Made of high-density plastic, resistant to corrosion, and chemicals common to construction
- Excellent guide system for placement of fabricated rebar cages into drilled or excavated shafts
- Economical with minimal installation costs
- Indefinite shelf-life and easily stored

CONSTRUCTION BENEFITS

- Ensures the bar reinforcement is properly spaced and aligned within the confines of the drilled shaft or excavation.
- Provides quality assurance of the sub-contractor's performance for the contractor and owner.
- Provides quality assurance of the contractor's performance for the engineer and owner.
- Installs quickly and easily, requiring only unskilled labor.
- Increases job profitability because skilled labor is released for more demanding tasks.

SHAFTSPACER MINIMUM PLACEMENT RECOMMENDATIONS

- Use one ShaftSpacer per foot (or 304.8mm) of shaft diameter (minimum of four per tier)
- Maximum six (6) foot (or 1.83m) spacing from the top of the shaft
- Maximum two (2) foot (or 0.61m) spacing from the bottom of the shaft
- Maximum eight (8) foot (or 2.44m) interval spacing along the longitudinal axis of the shaft



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☑ APPROVED ☐ APPROVED AS NOTED

☐ RETURNED FOR CORRECTIONS

REVIEWED BY: Timothy Owings DATE: 01/20/2022

ShaftSpacers attached along large-diameter reinforcing cage

MODEL	COVER	DIAMETER	BAR SIZE	PACKAGING	WEIGHT
SS303	1.5"	3"	#3 - #6	50	7 lbs
SS505	2.5"	5"	#3 - #6	50	16 lbs
SS406	3.0"	6"	#3 - #6	50	22 lbs
SS808	4.0"	8"	#3 - #7	25	20 lbs
SS612	6.0"	10.75"	#3 - #7	24	27 lbs*

** When shipping UPS, use dimensional wt. of 43 lbs.*

Installation of ShaftSpacer

Guiding rebar cage into drilled shaft with ShaftSpacers attached

DOWL

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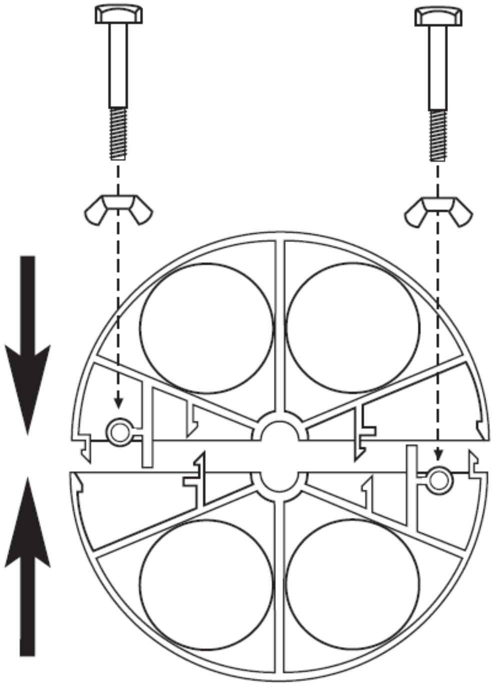
☑ APPROVED ☐ APPROVED AS NOTED

☐ RETURNED FOR CORRECTIONS

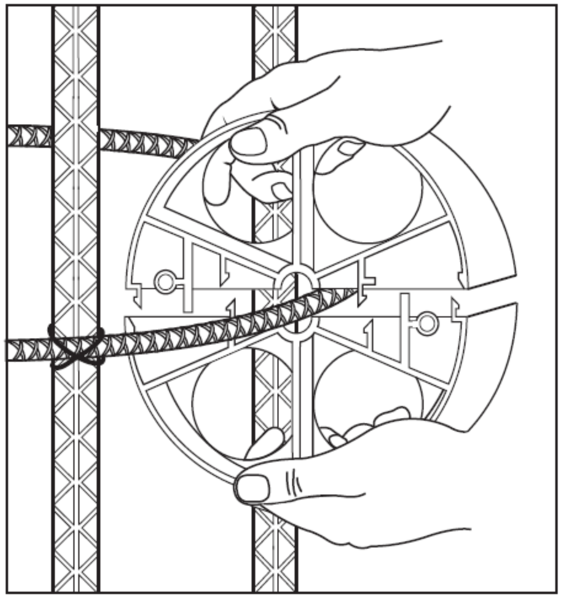
REVIEWED BY: Timothy Owings DATE: 01/20/2022

SHAFTSPACER®
DRILLED SHAFT REBAR CENTRALIZER

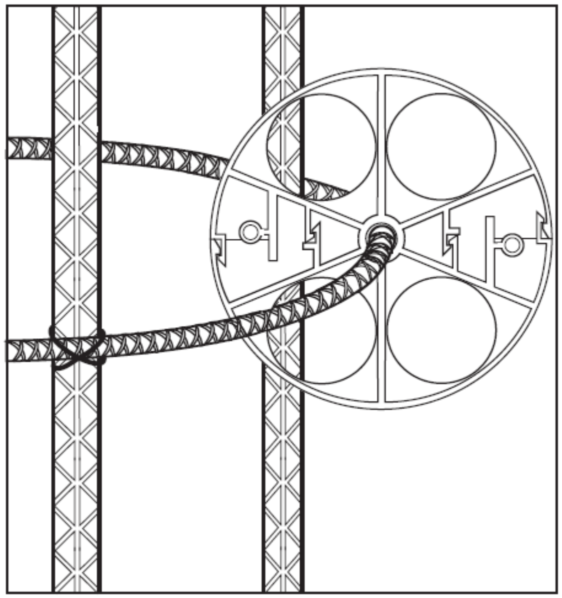
INSTALLATION INSTRUCTIONS



1. Required parts.
   Bolts used for SS808 & SS612 models only.



2. Place spacer halves around exterior tie.
   Close spacer halves around exterior tie and push together to snap in place.
   Once together, insert a locking bolt into hole on each side of spacer and fasten in place with wingnut provided. Make sure wingnuts are finger tight in place.



3. Completed installation.

DOWL

UNSTAMPED
SUBMITTAL REVIEW

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☑ APPROVED

☐ RETURNED FOR CORRECTIONS

REVIEWED BY: Timothy C[illegible]

SHAFTSPACER®
DRILLED SHAFT REBAR CENTRALIZER

Manufactured By:

Foundation Technologies, Inc.®

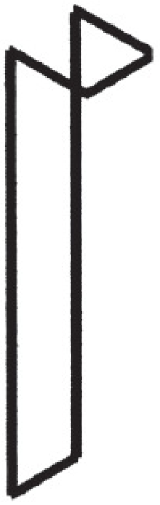
1400 Progress Industrial Boulevard, Lawrenceville GA 30043
800.773.2368   678.407.4640
foundationtechnologies.com

HAIRPIN

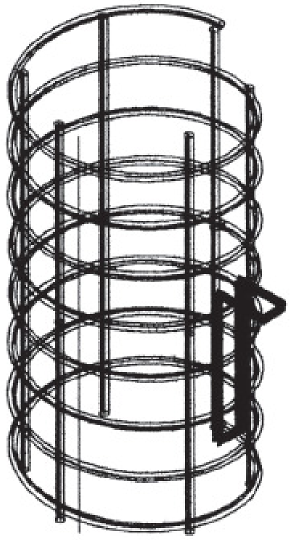
SHAFTSPACER EXTENDER

Installation Instructions

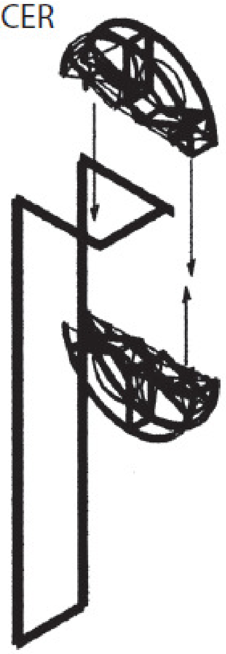
STEP 1:
THE BASIC
OFFSET HAIRPIN



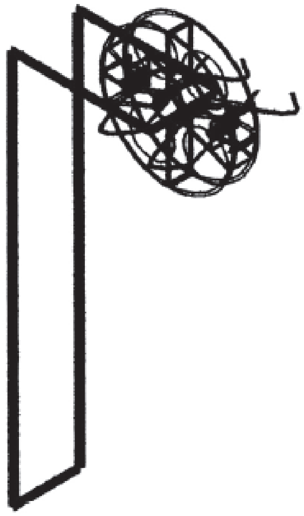
STEP 2:
WIRE HAIRPIN TO CAGE



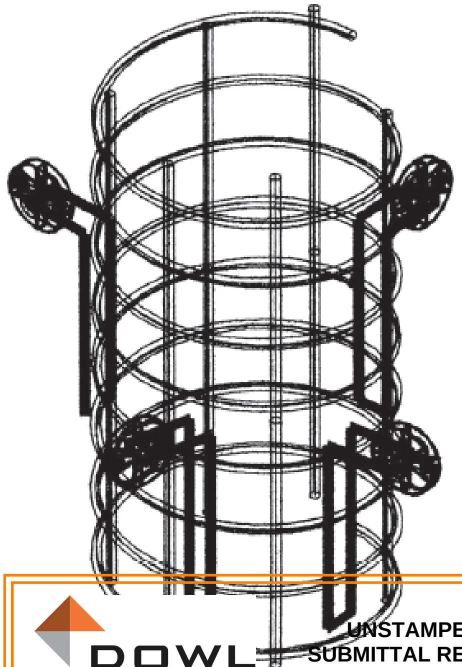
STEP 3: ASSEMBLE
SHAFTSPACER



STEP 4: DOUBLE WIRE HALVES
OF SHAFTSPACER - 16 GUAGE TIE WIRE



STEP 5: MULTIPLE
ASSEMBLY COMPLETED



Foundation Technologies, Inc.®
PO Box 491718
Lawrenceville, GA 30049
1.800.773.2368 FAX 678.407.4645
www.foundationtechnologies.com
info@foundationtechnologies.com

DOWL

UNSTAMPED
SUBMITTAL REVIEW

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☑ APPROVED ☐ APPROVED AS NOTED
☐ RETURNED FOR CORRECTIONS

REVIEWED BY: Timothy Owings DATE: 01/20/2022

Doc Express® Document Signing History

Contract: C15298 - OR217: OR10 - OR99W Document: Submittal 115 BIVarious Drilled Shaft Reinforcing - Foundation Technologies - Shaft Spacer Hairpin Offset Product Data 20220117

This document is in the process of being signed by all required signatories using the Doc Express® service. Following are the signatures that have occurred so far.

Date	Signed By
01/17/2022	Tim Nelson Kerr Contractors Oregon, Inc. Electronic Signature (Submitted)
	(Approved by Prime Contractor)
	(Reviewed by RE Office (New Document option))
	(Recommended by Project RE)
	(Accepted by RE Office)
	(Approved by Project RE)
	(Approved by ODOT RE (CPM/LAL Projects Only))
	(Accepted/Approved by Civil Rights)
	(RE Office Correction Made (Markup and New Document Option))
	(RAS Review Completed)

Doc Express® Document Signing History

Contract: C15298 - OR217: OR10 - OR99W Document: Submittal 76 BIVarious Drilled Shaft Plan - Structures 20220110

This document is in the process of being signed by all required signatories using the Doc Express® service. Following are the signatures that have occurred so far.

Date	Signed By
04/13/2022	Tim Nelson Kerr Contractors Oregon, Inc. Electronic Signature (Submitted)
	(Approved by Prime Contractor)
	(Reviewed by RE Office (New Document option))
	(Recommended by Project RE)
	(Accepted by RE Office)
	(Approved by Project RE)
	(Approved by ODOT RE (CPM/LAL Projects Only))
	(Accepted/Approved by Civil Rights)
	(RE Office Correction Made (Markup and New Document Option))
	(RAS Review Completed)

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MFTP

HOW TO USE
THE FIELD TESTED MATERIALS ACCEPTANCE GUIDE

This guide summarizes the testing requirements for various materials used in the construction of ODOT projects. It indicates what tests must be performed, who must perform them, and how frequently they must be performed. It includes materials which are sampled and tested in the field and materials which are field sampled but sent elsewhere for testing. When a Contract requires quality control (QC) by the Contractor, samples that must be sent elsewhere for testing are delivered to the Project Manager along with the Sample Data Sheet (Form 734-4000). Examples of this and other test report forms are in Section 3 of this MFTP.

Materials in this guide are listed in the numerical order of the Standard Specifications and the project Special Provisions. To find the testing requirements for a particular material, first determine what it will be used for and then refer to the appropriate specifications section for that product. For example, to look up testing requirements for aggregate to be used in asphalt concrete paving, refer to Section 00745.

Definitions

SOURCE REVIEW/PRODUCT COMPLIANCE TESTING – Refer to Section 4(A) for additional explanation. Certain QC tests on aggregates fall into this category. They are identified in this section by the words “Product Compliance.”

SAMPLE SIZES – Refer to Section 4(C) for guidance on material sample sizes, containers, and labeling. Although designed for the ODOT Central Materials Laboratory (ODOT-CML), it is a good guide for samples being sent to any laboratory.

ASPHALT CONCRETE MIX DESIGNS – If the ODOT-CML is preparing the AC mix design, submit samples of the materials shown in Section 4(C) of this MFTP.

TYPES OF TESTS

The following types of tests will be performed by the Contractor or Engineer on materials and products required for contract work:

1. **Source Review –** This test type is addressed in Section 4(A) of this Manual.
   The Engineer will test unprocessed material from an aggregate source, if requested by the Contractor, to provide information about the quality of material. Tests will involve degradation, soundness, and abrasion, but may involve other tests. Favorable test results do not imply that processed material from the source will comply with specifications after it is processed as required for the project.

2. **Product Compliance –** This test type is addressed in Section 4(A) of this Manual. The Engineer will test processed material if process control testing indicates that the processed material meets the contract quality requirements. Tests will involve degradation, soundness, abrasion, and lightweight pieces, but may involve other tests. The material shall not be incorporated into the project unless Product Compliance tests show favorable results.

3. **Quality Control –** The Contractor will perform quality control testing as described in Section 2 and specified in 4(D) of this Manual or as modified by the Special Provisions or Supplemental Standard Specifications.

4. **Verification –** The Engineer will perform Verification testing as described in Section 2 and specified in Section 4(D) of this Manual. **Note: The required 1 per 10 sublot testing of Quality Control by the Region QA is considered a minimum frequency and testing may be increased when deemed necessary by the engineer.** These tests provide the basis for the Engineer's decision on acceptance of materials and products. If Independent Assurance is to be done on a material, a split of the Verification sample will be given to the Contractor for testing.

5. **Independent Assurance –** Where Independent Assurance involves testing, the Engineer will evaluate test results from split samples to assure that Contractor test results meet required parameters.

6. **Visual –** Visual Inspection: Examination and assessment of construction materials, by **OBSERVATION**, to determine if the materials appear to meet the contract requirements and are acceptable for incorporation into ODOT construction projects. Visual inspection, when stated in the contract, is a method generally used by the Project Inspector in lieu of normal sampling and testing of field tested materials as defined in section 00165.00 of the Standard Specifications to document quality. Supporting documentation for visual acceptance is, at a minimum, a field inspection report. Consult the construction contract for other acceptance document requirements.

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

(Revised November2021)

						Same Frequency for all Tests (Minimums)			
MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	QUALITY ASSURANCE			
		ODOT	WAQTC	AASHTO		Contractor Quality Control	Independent Assurance/Verification		
							Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00512 - DRILLED SHAFTS									
Aggregate Production						A Sublot equals 1,000 Tons			
(1) QAE may waive after 5 sublots/shifts	*Sampling Aggregates*			*R 90*		*1/Sublot & Start of Production*		*1 per 10 Sublots*	
	Reducing Aggregates			*R 76*					
	(2)(3)(4) *Sieve Analysis*			*T 27/T 11*	*1792*				
	(4) *Fineness Modulus*			*T 27/T 11*					
(2) *Perform a minimum of 3 tests, QL's required*	(1)(3) *Wood Particles*	*TM 225*							
	(4) *Sand Equivalent*			*T 176*	*1792*				
(3) *Coarse Aggregate (See Section 02690.20)*	*Soundness*			*T 104*	*4000*	*See Section 4A*	*Submit to Lab*		*See Section 4(A)*
	Abrasion			*T 96*					
	Degradation	*TM 208*							
(4) *Fine Aggregate (See Section 02690.30)*	*Lightweight Pieces*			*T 113*					
	Organics			*T 21*	*4000*				
	(3) *Dry Rodded Unit Weight*			*T 19*	*1825 1825C*	*Start of production and when changes in aggregate occurs*			
	(3) *Specific Gravity of Coarse Aggregate*			*T 85*	*1825*				
	(4) *Specific Gravity of Fine Aggregate*			*T 84*					
Portland Cement Modifiers Admixtures	*Materials must meet the requirements of Section 02001.10*								
Drilling Slurry	*Slurry material must meet the requirements of Section 00512.14 & 00512.43(g)*								
Grout	*Material must meet the requirements of Section 02080*								
Mixing Water	*Material must meet the requirements of Section 02020*								

FIELD TESTED MATERIALS ACCEPTANCE GUIDE

(Revised November2021)

MATERIAL AND OPERATION	DESCRIPTION OF TEST	TEST METHOD			FORM 734-	Same Frequency for all Tests (Minimums)			
						QUALITY ASSURANCE			
						Contractor Quality Control	Independent Assurance/Verification		
		ODOT	WAQTC	AASHTO			Project Manager	Region Quality Assurance	Materials Laboratory
SECTION 00512 - DRILLED SHAFTS (CONTINUED)									
Portland Cement Concrete							*QA Testing*		
	Sampling Concrete		*TM 2*			(M) (S) *1 per Shaft and Test at minimum frequencies according to table 00512-1. Review specs.*	***Projects under 100 yd^3 all classes*** 1/Project representing all classes of PCC ***Projects over 100 yd^3 all classes*** 1/500 yd^3 per class minimum 1/class		
	Slump of Concrete			*T 119*	*3573WS or 4000C*				
	Concrete Temperature			*T 309*					
	Density (Unit Weight) of Concrete			*T 121*					
	Yield			*T121*					
	Water/Cement Ratio			*T 121*					
	Fabrication of Concrete Cylinders/Beams			*R 100*	*4000C*				
	Compressive Strength of Concrete			*T 22*					

(S) *1 Set Represents a minimum of 3 Cylinders*

(M) *Per Mix Design & Source*

TABLE 00512-1 Frequency of Quality Control Testing

Minimum frequencies per Class of concrete based on daily production records.

Production	**Frequencies**
0 to 100 yd^3 on a single day	1 Set each day
Quantity Over 100 yd^3	
100 to 600 yd^3 on a single day	1 Set per each 100 yd^3 or portion thereof
over 600 yd^3 on a single day	1 Set per each 200 yd^3 or portion thereof after reaching 600 yd^3

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OREGON DEPARTMENT OF TRANSPORTATION

CONSTRUCTION SECTION

NONFIELD-TESTED MATERIALS ACCEPTANCE GUIDE

2021 STANDARD SPECIFICATIONS

July 2021 UPDATE

Updated versions of this guide are available by printing from the web address listed below. This document is to be used as a guide for documentation required for acceptance of materials on ODOT Construction projects and does not relieve the user of requirements specified in the Construction Project Documents. Please notify the Contract Administration Unit, in the Construction Section at the ODOT Materials Laboratory, of any changes in Standard Drawings, Special Provisions, or Standard Specifications, etc., which would require additions to, deletions from, or changes to this listing.

Internet Address: https://www.oregon.gov/ODOT/Construction/Pages/Structure-Services.aspx

Contact 503-986-3029 to have correction made to this guide. A summary of changes since last publication is found at the end of this document.

*Special Provisions, Contract Plans, and Standard Specifications take precedence over the information in this guide. Refer to the Contract for documentation requirements.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS		REMARKS
				FURNISHED BY CONTRACTOR	FURNISHED BY AGENCY	

This guide provides a summary of acceptance documents for frequently used items. New Materials or Materials which are infrequently used may not be listed in this guide. Consult the Contract Documents for acceptance documentation for these items.

This guide does not have precedence over the Special Provisions, Contract Plans, or Standard Specifications.*

E – Equipment Lists and Drawings / Procedures
L – ODOT Central Materials Laboratory Report
I – ODOT Structure Services Inspection Report
W – Warranty (Manufacture or Workmanship)
P – Proof of License/Certification or Apprentice Application
M – Manufacturer's Field Representative Report

F – Field Inspection Report (FIR)
- *More information in form 734-2605 processing instructions.*

O – Certificate of Materials Origin (CMO)
BG – Blue and Green Sheets (see Sec. 00960, 00970 or 00990)
R – Field Report
P/R – DEQ Permit or Compost Producer Registration

Q - Quality Compliance Certificate – The certificate or equivalent document meeting specification shall be from the manufacturer and shall:

- Verify the Material meets the Specifications, and identify by number any applicable specified test methods used, (ODOT, AASHTO, ASTM, UL, others)
- Permit positive determination that Material delivered to the Project is the same Material covered by the certificate:
  - Be delivered to the Engineer with the shipment of the Material,
  - or be an identification plate or mark, decal, sticker, label, or tag attached to the container or Material.

T – Test Results Certificate – The certificate shall:

- Be from the manufacturer, verifying the Material furnished has been sampled and tested and the test results meet the Specifications
- Include, or be accompanied by, a copy of the specified test results (ODOT, AASHTO, ASTM, UL or other)
- Identify the testing agency and the representative responsible for the test results
- Permit positive determination that Material delivered to the Project is the same Material covered by the test results
- Be delivered to the Engineer with the shipment of the Material.

Small Quantity - A method for accepting relatively small quantities of Materials as noted in this guide without normal sampling and testing. Normal acceptance of Materials may be waived by the Engineer when requested in writing by the Contractor. **Small quantity acceptance requirements are listed in this guide along with the maximum amount of Material that can be accepted as small quantity.**

QPL – For some Materials, this guide will refer to the Qualified Products List (QPL). For QPL Materials, the QPL number must be entered into the Contractor Payment System regardless of the method of documentation.

- When using an "A" listed product, document with an FIR/Pay Note citing the QPL product number.
- When using a "Q" listed product, document with an FIR/Pay Note citing the QPL product number, and attach additional documentation required by this guide.
- When using a product approved after the QPL in effect for the Project, document with an FIR/Pay Note and attach a copy of the product approval letter or page from the later edition of the QPL.

For products submitted by the Contractor that are not listed on the QPL, follow section 00160.05 of the Standard Specifications or Special Provisions.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00490	Work on Existing Sewers and Structures	New Materials	Refer to 00470 in this guide.					
		Salvaged Materials	00490.10				F	"F" must document suitable existing Materials were used.
00495	Trench Resurfacing	Section does not contain any nonfield-tested materials.						
00500 - BRIDGES								
00501	Bridge Removal	Section does not contain any nonfield-tested materials.						
00503	Bridge Deck Cold Plane Pavement Removal	Section does not contain any nonfield-tested materials.						
00504	Concrete Deck Surface Preparation	Portland Cement Concrete Repair Material	00504.10 02015				F, QPL	
00510	Structure Excavation and Backfill	Cofferdam Submittals	00510.03		E			"E" is submittal(s) according to 00510.03 and 00150.35.
		Shoring Submittals	00510.04		E			"E" is submittal(s) according to 00510.04 and 00150.35; for atypical shoring systems allow 120 Calendar Days for Agency review and response.
00512	Drilled Shafts	Submittals - Drilled Shaft Installation Plan	00512.40(a)		E			"E" is submittal(s) according to 00512.40(a) and 00150.35 at least 21 Calendar Days before beginning shaft construction. Do not begin drilled shaft construction Work until all drilled shaft submittals have been approved.
		- Drilled Shaft Repair Plans	00512.40(b)		E			"E" is submittal(s) according to 00512.40(b) and 00150.35 for unacceptable shafts. Do not begin repair operations before remedial procedures or designs are approved.
		- Drilled Shaft Inspection Reports	00512.40(c)		R			"R" is report(s) according to 00512.40(c) within 21 Calendar Days after completion and acceptance of each shaft.
		- Concrete Placement Logs and Volume Curves	00512.40(d)		E			"E" is submittal(s) according to 00512.40(d) within 24 hours after completion of shaft concrete placement for each shaft.
	(continued on next page)	- Personnel	00512.30		E			"E" is personnel qualifications according to 00512.30. Do not begin Work on any drilled shafts until qualifications have been approved.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00512 *(con't)*	Drilled Shafts *(continued)*	Reinforcement	Refer to 00530 in this guide.					
		Permanent Steel Casing	00512.13 00512.40		Q, O		F	"Q" is from manufacturer.
		Drilling Slurry	00512.14(a) 00512.14(b) 00512.14(c)				F, QPL	"QPL" is for synthetic slurry. If synthetic slurry is used, manufacturer's representative and a Contractor's employee trained in the use of synthetic slurry must attend Drilled Shaft Coordination Meeting according to 00512.41.
		Crosshole Sonic Log Access (CSL) Tubes	00512.15 00512.48(b)		R, Q, O		F	"R" is Contractor's crosshole sonic log test reports according to 00512.48(b) within 5 Calendar Days of the performance of the tests. "Q" is from manufacturer.
		CSL Cement Grout – Field Mixed	00512.18 02010.10				F, QPL	Cement from the QPL.
		CSL Cement Grout	00512.18 02080				F, QPL	Non-epoxy or tendon grout from the QPL.
00520	Driven Piles	Submittals - Pile Driving Equipment	00520.20(d)		E			"E" is submittal(s) according to 00520.20(d) at least 14 Calendar Days before pile driving begins. Do not begin test pile or production pile driving without Engineer's written approval.
		- Splices > Welded > Mechanical	00520.43(f) 00520.43(f)(1) 00520.43(f)(2)		E			"E" is submittal(s): - according to 00520.43(f) for welded splices; - according to 00520.43(f) and 00150.35 for mechanical splices.
		- Welding	00520.43(g)(2)		E, P, R			"E" is submittal(s) according to 00530.43(g)(2) prior to welding. Do not begin welding without approval. "R" is welding inspection report(s) according to 00520.43(g)(2) upon completion of welding.
	(continued on next page)	Timber Piles and Preservative Treatment	02120.20 02190		Q		F	"Q" is for timber piling and preservative treatment.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00520 *(con't)*	Driven Piles *(continued)*	Prestressed Concrete Piles	00550 02520.20	T, Q, O		I	F	"T" is from steel manufacturer. "I" is for strand, hardware, reinforcing, concrete and Aggregate in precast concrete units. Structure Services will perform inspection and testing for all Materials and fabrication. Do not place footing concrete until all piles within a footing are inspected by the Engineer. Do not drive precast prestressed piles without Engineer's consent according to 00520.44(c).
		Reinforced Pile Tips	02520.10(e)		T, O		F, QPL	"QPL" is for H-pile tips.
		Steel Piles	02520.10		T, O	I	F	"T" is from steel manufacturer. "F" must document pile markings, heat and lot numbers, AASHTO or ASTM designation, grade, brand and quantity. Engineer to submit documents to Structure Services which will perform inspection and review of documents for all Materials and fabrication. Contact ODOT Milwaukie Materials Lab (971-673-7002) to coordinate inspection.
		Steel Pile Protective Coating	Refer to 00594 in this guide.					
		Steel Reinforcement for Concrete	Refer to 00530 in this guide.					
		Timber Pile Straps	02120.30		Q, O		F	
00530	Steel Reinforcement for Concrete	Order Lists and Bending Diagrams Submittals	00530.11		E			"E" is submittal(s) according to 00530.11, 00150.35, and 00150.37 before ordering material.
	(continued on next page)	Deformed Bar Reinforcement ASTM A706 & A615 (from QPL approved manufacturer)	02510.10		O		F, QPL	"F" must document steel manufacturer's identification markings rolled into the bar. "QPL" is for rebar manufacturer.

*Special Provisions, Contract Plans and Standard Specifications take precedence over the information in this guide. Refer to your Contract for documentation requirements.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00530 (con't)	Steel Reinforcement for Concrete *(continued)*	Deformed Bar Reinforcement ASTM A706 & A615 (not from QPL approved manufacturer)	02510.10	T	T, O	L	F	"T" is from steel manufacturer. "L" is test results from ODOT Salem Central Materials Lab. Obtain from each manufacturer, three 4 ft. field sample of the size representing the greatest quantity needed for the Project. Submit samples to ODOT Salem Central Materials Lab. Include manufacturer's name and heat number. "F" must document steel manufacturer's identification markings rolled into the bar.
		Deformed Bar Reinforcement ASTM A1035 alloy CM & CS (from QPL approved manufacturer)	02510.10	T	T, O	L	F, QPL	"T" is from steel manufacturer. "L" is test results from ODOT Salem Central Materials Lab. Obtain from each manufacturer, three 4 ft. field sample of the size representing the greatest quantity needed for the Project. Submit samples to ODOT Salem Central Materials Lab. Include manufacturer's name and heat number. "QPL" is for rebar manufacturer. "F" must document steel manufacturer's identification markings rolled into the bar.
		Dowels	02510.50		Q, O		F	"Q" is from steel manufacturer.
		Epoxy Coated Reinforcement	02510.11(a)		Q, O		F	"Q" is for CRSI epoxy coating plant certification.
		Headed Bar Reinforcement	00530.35 00530.47 02510.25	T	Q, O	L	F, QPL	"Q" is from headed bar manufacturer. "L" is test results from ODOT Salem Central Materials Lab. Submit three (3) 4 ft. field samples for installer qualification according to 00530.35 to ODOT Salem Central Materials Lab. Submit quality control samples according to 00530.47(b)(4). "F" must document steel manufacturer's identification markings rolled into the bar. "QPL" is for rebar manufacturer.
	(continued on next page)	Galvanized Coating	02510.30		Q, O		F	"Q" is from galvanizer.

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00530 *(con't)*	Steel Reinforcement for Concrete *(continued)*	Mechanical Splices	00530.30 00530.42(c) 02510.20	T	Q, E, O	L	F, QPL	“Q” is from splice manufacturer. "E" is submittal(s) according to 00530.42(c)(1) at least 14 Calendar Days before splice installation when grout sleeve mechanical splices allowed. “L” is test results from ODOT Salem Central Materials Lab. Submit three 8 ft. field samples for installer qualification according to 00530.30 to ODOT Salem Central Materials Lab. Submit quality control samples according to 00530.42(c)(2)(d). "QPL" is for splice manufacturer. Do not begin mechanical splice installation until the Engineer confirms, in writing, the qualification of each mechanical splice installer.
		Stainless Steel Chairs and Supports	02513.30		Q, O		F	
		Stainless Steel Concrete Inserts	02513.35		Q, O		F	
		Stainless Steel Dowels	02513.50		Q, O		F	
		Stainless Steel Mechanical Splices	00530.30 00530.42(c)(1) 02513.20	T	Q, E, O	L	F, QPL	“Q” is from splice manufacturer. "E" is submittal(s) according to 00530.42(c)(1) at least 14 Calendar Days before splice installation when grout sleeve mechanical splices allowed. “L” is test results from ODOT Salem Central Materials Lab. Submit three 8 ft. field samples for installer qualification according to 00530.30 to ODOT Salem Central Materials Lab. Submit quality control samples according to 00530.42(c)(2)(d). "QPL" is for splice manufacturer. Do not begin mechanical splice installation until the Engineer confirms, in writing, the qualification of each mechanical splice installer.
	(continued on next page)	Stainless Steel Deformed Bar Reinforcement (A955)	02513.10		Q, O		F	

SECTION	TYPE OF CONSTRUCTION	MATERIALS	SUBSECTION	ACCEPTANCE DOCUMENTS				REMARKS
				FURNISHED BY CONTRACTOR TO		FURNISHED BY AGENCY		
				LAB	ENGR.	MATERIALS LAB	FIELD PERSONNEL	
00530 *(con't)*	Steel Reinforcement for Concrete *(continued)*	Stainless Steel Tie Wire	02513.60		Q, O		F	
		Welded Wire Fabric	02510.40	T	T, O	L	F	"T" is from steel manufacturer. "L" is test results from ODOT Salem Central Materials Lab. Submit minimum of one full width of sheet by 3 ft. field sample for each size of reinforcement per Project to ODOT Salem Central Materials Lab.
		Wire Reinforcement	02510.60	T	T, O	L	F	"T" is from steel manufacturer. "L" is test results from ODOT Salem Central Materials Lab. Submit minimum of one full width of sheet by 3 ft. field sample for each size of reinforcement per Project to ODOT Salem Central Materials Lab.
		Concrete Inserts	00530.14		Q, O		F	"Q" is from galvanizer.
		Galvanized Tie Wires	00530.41(b)		Q, O		F	"Q" is from galvanizer.
00535	Resin Bonded Anchor Systems (March 1, 2021 renamed to Post-Installed Anchor Systems)	**Note:** Beginning March 1, 2021 this section was renamed to Post-Installed Anchor Systems and the boiler plate Special Provisions replaced 00535 of the Standard Specifications.						
	Resin Bonded Anchor System 00535.10(a) **Special Provision - March 2021**	Resin Bonded Anchor System Submittals	00535.01 00535.30		P			"P" is personnel qualifications according to 00535.01 and 00535.30 at least 21 Calendar Days before starting Work for anchor installation horizontally or upwardly inclined.
	(continued on next page)	High-Strength Anchor Bolts	00535.10 02560.30(b) 02560.40(b) 02560.60(b)	T	T, Q, O	L	F	"T" is from steel manufacturer. "Q" is from galvanizer. "L" is test results from ODOT Salem Central Materials Lab. Sample and test according to 02560.60(b). Submit to ODOT Salem Central Materials Lab. Prior to installation contact Structure Services (503-986-3056). Do not begin installing the anchor system until the installation process is approved.

INSERT TAB

QPL

OREGON DEPARTMENT OF TRANSPORTATION
CONSTRUCTION SECTION

QUALIFIED PRODUCTS LIST

PUBLISHING DATE:
JULY 2021

Oregon
Department
of Transportation

The Qualified Products List is updated every six months or amended as needed.

QUALIFIED PRODUCTS LIST
OREGON DEPARTMENT OF TRANSPORTATION

The **"QUALIFIED PRODUCTS LIST"** (QPL) is a comprehensive list of all finished products which have been evaluated and/or used by the Oregon DOT.

The "QUALIFIED PRODUCTS LIST" is made up of two types of lists:

1. The **QUALIFIED LIST - "Q"** is for products that have been reviewed and found to be suitable for use in a specific category. Job control testing may still be necessary. Consult the ODOT Nonfield-Tested Materials Acceptance Guide", the "ODOT Field-Tested Materials Acceptance Guide", and the Project Specifications.

2. The **APPROVED LIST - "A"** is for commercially available products having a low consequence of failure. These products are only usable for appropriate applications. May Require a Field Inspection Report. State existence on the Approved List and recognition of the product. No additional sampling or testing is needed.

Specific questions regarding products on the un-published **CONDITIONAL LIST** can be answered by calling **503/986-3059.**

"Conditionally Approved" products need specific, prior approval for each project. Approval is given for one project at a time.

The use of all products is restricted to the category in which they are listed. Products should be used and installed as the manufacturer recommends. The QPL does not distinguish between domestic and foreign steel. Use of this list by **ODOT Maintenance** Personnel as an *information resource* is encouraged not required.

Note: *Any change to a product on the QPL, without prior approval, will be cause for rejection of the product.*

The "QPL" and submittal forms are accessible from the Internet:

Qualified Products Web Page

Although the products listed may be approved for use, they are not exempt from State Purchasing Rules, practices and guidelines, or manufacturer's warrantees or guarantees.

If you have questions, contact:

Oregon Department of Transportation
800 Airport Rd SE, Salem, OR 97301-4798
Dean Chess, Phone: 503/986-3059
E-Mail: dean.m.chess@odot.state.or.us

FAX: 503/986-3096

OREGON DEPARTMENT OF TRANSPORTATION

"QPL" INDEX BY CATEGORY TO GET SPECIFICATION NUMBERS

CATEGORY	SPEC #
ANTI-GRAFFITI COATING - SIGNS	02910.70
ASPHALT COLD PATCH - HI PERF	00745.00
ASPHALT RELEASE AGENT	00745.22
AUTOMATED FLAGGER ASSIST. DEVICE	00223.23
BACKER ROD	02440.14
BARRICADE, TEMPORARY	00224.15
BARRIER PANELS, REFLECTIVE	00226.11
BARRIER, CABLE	00811.00
BEARINGS, BRIDGE	00582.10
BICYCLE CHANNELIZING DEVICES	00228.12
BIRD SPIKES	00907.10
BOLT GRADE ADJUSTMENT SYSTEM	00470.42
BONDING AGENT, EPOXY	02070.10
BONDING AGENT, NON-EPOXY	02070.20
CEMENT, BLENDED	02010.20
CEMENT, PORTLAND	02010.10
CEMENTITIOUS PIPE LINER	00413.10
CFRP STRENGTHENING WET LAY UP	00565.00
CHEMICAL ADMIXTURES	02040.10
CHLORIDE REMOVER	00594.13
CONCRETE & CRACK SEALER HIGH MOD.	02060.20
CONCRETE & CRACK SEALER LOW MOD.	02060.10

CATEGORY	SPEC #
CONCRETE ANCHOR, MECHANICAL	00535.10B
CONCRETE ANCHOR, RESIN	00535.10A
CONCRETE BARRIER GATE	00820.00
CONCRETE MODIFIER - LATEX	02035.00
CONCRETE SCM - BLENDED	02030.60
CONCRETE SCM - FLY ASH	02030.10
CONCRETE SCM - GGBF SLAG	02030.40
CONCRETE SCM - METAKAOLIN	02030.50
CONCRETE SCM - SILICA FUME	02030.20
CONCRETE SEALER - WATER REPELLENT	02060.30
CONCRETE SURFACE RETARDER	02055.10
CRACK INJECTION, EPOXY	00538.10
CURING BLANKET, CONCRETE	02050.30
CURING COMPOUND, CONCRETE	02050.10
DAMP PROOFING, CLEAR	00597.11
DELINEATORS - (TYPES 2, 3 & 5)	00840.10
DELINEATORS, TEMP	00224.14
DETECTABLE WARNING DEVICES	00759.12
DRAINS, TRENCH (PREFORMED)	00446.00
ELASTOMERIC CONCRETE	00584.10
ELECTRONIC CUTTABLE FILM	02910.60
EROSION CONTROL	00280.00

CATEGORY	SPEC #
EXPANSION JOINTS, BRIDGE	00585.10
FENCING, WORKZONE	00221.13
FLAGGER STATION LIGHTING	00223.22
FLAGGER STOP/SLOW PADDLE	00223.21
FLY ASH	02030.10
GALVANIZING REPAIR OF HOT-DIP	02530.71
GEOGRIDS - SUBGRADE REINFORCEMENT	02320.10
GEOGRIDS - TYPE I MSEW	02320.10
GLARE SHIELDS	00822.00
GLARESCREEN TEMPORARY	00226.11
GROUT, EPOXY	02080.10
GROUT, KEYWAY	02080.30
GROUT, NON-EPOXY (NON SHRINK)	02080.20
GROUT, STRUCTURAL	02080.60
GROUT, TENDON	02080.50
GUARDRAIL BLOCKS, PLASTIC	02110.20
GUARDRAIL TERMINALS	00810.10
HOT APPLIED JOINT SEALANT	02440.30
IMPACT ATTENUATOR, PERM.	00830.00
IMPACT ATTENUATOR, TEMP.	00226.12
IMPACT ATTENUATOR, TRUCK MTD	00226.23
JOINT FILLER, PREFORMED	02440.10

OREGON DEPARTMENT OF TRANSPORTATION

"QPL" INDEX BY CATEGORY TO GET SPECIFICATION NUMBERS

CATEGORY	SPEC#
LATEX EMULSION PAINT	02210.30
LOOP SEALANTS, TRAFFIC	00990.43
LUBE FOR FASTENERS	02560.70
LUBE FOR GALV FASTENERS	02560.70
LUBE FOR STAINLESS FASTENERS	02560.70
MAILBOX SUPPORTS	01070.00
MANHOLE RISER RINGS	00470.00
MANHOLE STEPS	02450.30
MARKERS, CONICAL	00224.11
MARKERS, TUBULAR	00224.10
MARKERS, TUBULAR, SURF. MTD, PERM.	00856.10
MARKERS, TUBULAR, SURF. MTD, TEMP.	00224.12
MARKINGS, LONGITUDINAL - DURABLE	00865.00
MARKINGS, LONGITUDINAL - HIGH PERF	00866.00
MARKINGS, LONGITUDINAL - PAINT	00860.00
MARKINGS, TRANSVERSE	00867.00
MECHANICAL ANCHOR	00535.10B
MEMBRANE, SPRAY WATERPROOFING	00591.00
METAKAOLIN	02030.50
MOISTURE RETENTION CHEM FOR SOIL	01040.22
MPCO AGGREGATE	00556.10B
MULTI - LAYER POLY. CON. OVERLAY	00556.10A

CATEGORY	SPEC#
PAINT STRIPING BEADS, TEMP	00225.12B
PAINT STRIPING, TEMP	00225.12A
PAVEMENT MARKER ADHESIVE	00855.00
PAVEMENT MARKER, FLEXIBLE	00225.10
PAVEMENT MARKER, PERMANENT	00855.00
PCC REPAIR	02015.20
PCC REPAIR POLYMER MODIFIED	02015.30
PCC REPAIR, SURFACE	02015.50
PCMS / PVMS - CHNGABLE MESSAGE SIGN	00222.15B
PEDESTRIAN CHANNELIZING DEVICE	00228.10
PERFORATED STEEL SQ TUBE - ANCHORS	00930.00
PERFORATED STEEL SQ TUBE - SLIP BASE	00930.00
PERFORATED STEEL SQ TUBE - SUPPORTS	00930.00
PILE TIPS	00520.00
PIPE - POLYETHYLENE	02415.10
PIPE - POLYPROPYLENE	02415.40
PIPE - PVC	02415.50
PIPE- SOLID WALL POLYETHYLENE	02415.20
PIPE, MASTIC	00445.12
PIPE, POLYMER COATINGS FOR METAL PIPE	02420.20
PIPE-STEEL REINFORCED POLYETHYLENE	02415.30
PLASTIC DRUMS, TEMPORARY	00224.13

CATEGORY	SPEC#
POROUS PAVER	00760.00
POURED SEALANT, SILICONE (2 PART)	02440.11
PSST SIGN SUPPORTS, TEMP	00222.11E
RADAR SPEED TRAILER	00222.15C
RAMPS, TEMPORARY SIDEWALK	00228.13
RAPID SET CEMENT	02011.10
REBAR MANUFACTURERS	02510.10
REBAR SPLICE, MECHANICAL	02510.20
REFLECTIVE ELEMENTS FOR MARKINGS	00850.00
REINFORCEMENT, HEADED BAR	02510.25
ROCK BOLTS	00398.00
SEQUENTIAL ARROW SIGN	00222.15A
SIGN COVERS, TEMPORARY	00222.12A
SIGN SHEETING, TYPES I - X	02910.20
SIGN SHEETING, WORKZONE RIGID	00222.10B
SIGN SHEETING, WORKZONE ROLL-UP	00222.10D
SIGN SUPPORTS, PORTABLE	00222.11B
SILICA FUME	02030.20
SLAG (GGBFS)	02030.40
SMART WORK ZONE SYSTEM VENDOR	00229.10
SOIL BIO AMENDMENT	01040.17
SOIL STERILIZATION	01040.21

OREGON DEPARTMENT OF TRANSPORTATION

"QPL" INDEX BY CATEGORY TO GET SPECIFICATION NUMBERS

CATEGORY	SPEC#
STORMWATER CONTROL FACILITIES	01010.03
STRUCTURAL STEEL CAULKING	00594.12
STRUCTURAL STEEL COATINGS	00594.10
SYNTHETIC FIBER, MACRO, MICRO, BLEND	02045.00
SYNTHETIC SLURRY	00512.14
TAPE, NON-REFLECTIVE	00225.11
TAPE, TEMPORARY	00225.11
TEMPORARY BARRIER	00226.11A
TEMPORARY WALKS	00228.14
TIMBER COATING	02210.20
TRAFFIC SIGNAL, PORTABLE	00227.13
TRANSVERSE RUMBLE STRIPS, TEMP.	00225.14
WATERPROOFING - CAP	00597.11
WOOD PRESERVATIVE, FIELD	02190.30

ODOT CONSTRUCTION / MATERIALS SECTION
QUALIFIED PRODUCTS LIST
APPROVED LIST - NO SAMPLES OR TESTS REQUIRED*
QUALIFIED LIST - ADDITIONAL REQUIREMENTS**
JULY 2021

STANDARD SPEC #	CATEGORY	PRODUCT NAME	LOCAL REPRESENTATIVE AND/OR MANUFACTURER	EFFECTIVE DATE	PRODUCT NUMBER	LIST	REMARKS
00512.14	SYNTHETIC SLURRY	BIG-FOOT SLURRY SYSTEM	MATRIX CONSTRUCTION PRODUCTS 630/364-3231	09/22/17	5067	A	
00512.14	SYNTHETIC SLURRY	SHORE PAC	CETCO CONSTRUCTION DRILLING 800/527-9948 OR 847/392-5800 WAS CALLED SHORE PAC GCV 5/08	08/10/06	3345	A	
00512.14	SYNTHETIC SLURRY	SLURRY PRO CDP	KB INTERNATIONAL 423/266-6964 SINCLAIR 562/403-3559	08/10/06	3343	A	
00512.14	SYNTHETIC SLURRY	SUPER MUD	PDS COMPANY 562/634-8180	08/10/06	3344	A	
00512.14	SYNTHETIC SLURRY	TERRAGEL	GEO-TECH SERVICES 210/587-4758	08/10/06	3346	A	Was Novagel Name Change 2013
00520.00	PILE TIPS HP10X42	HP77600-B-18# 10"	ASSOCIATED PILE & FITTING 800/526-9047	08/08/07	3359	Q	EACH CAST STEEL POINT SHALL BE LEGIBLY MARKED W/HEAT OR LOT# MILL CERTS REQUIRED.
00520.00	PILE TIPS HP10X42	HP77750-B 10"	ASSOCIATED PILE & FITTING 800/526-9047	08/08/07	2500	Q	EACH CAST STEEL POINT SHALL BE LEGIBLY MARKED W/HEAT OR LOT # MILL CERTS REQUIRED.
00520.00	PILE TIPS HP10X42	SUPER BITE POINT PAR10T	ASSOCIATED PILE & FITTING 800/526-9047	05/12/11	4364	Q	VERIFY HEAT OR LOT # ON TIP. MILL CERTS REQUIRED.
00520.00	PILE TIPS HP10X42	VERSA STEEL VS310N	VERSA STEEL 800/678-0814	03/13/03	2770	Q	VERIFY HEAT OR LOT # ON TIP. MILL CERTS REQUIRED.

***LIST 'A' = APPROVED. MAY BE USED WITHOUT SAMPLES, TESTING, OR QUALITY COMPLIANCE CERTIFICATIONS. MAY NEED A FIELD INSPECTION REPORT.**
****LIST 'Q' = QUALIFIED. USE WITH SAMPLING, TESTING, &/OR QUALITY COMPLIANCE CERTIFICATIONS AS NEEDED. NEEDS A FIELD INSPECTIONS REPORT. CHECK SPECS AND NFTMAG.**
LIST PUBLISHED BY: ODOT MATERIALS LAB; 800 AIRPORT RD SE; SALEM, OR 97301-4798; (503) 986-3059. PLEASE REPORT ANY PROBLEMS USING THESE PRODUCTS.

Appendix A—Approved Reinforcing Steel Producers

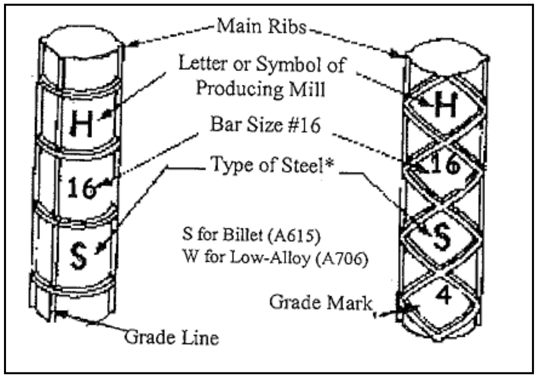
The ASTM specifications for billet-steel and low-alloy reinforcing bars (A615 and A706, respectively) require identification marks to be rolled into the surface of one side of the bar to denote the producer's mill designation, bar size, type of steel and minimum yield designation. Grade 420 bars show these marks in the following order:

1st ---Producing Mill (usually a letter)

2nd --- Bar Size Number (# 4 through # 18)

3rd --- Type of Steel: **S** Billet (A 615)
W for Low Alloy (A 706)

4th ---Minimum Yield Designation



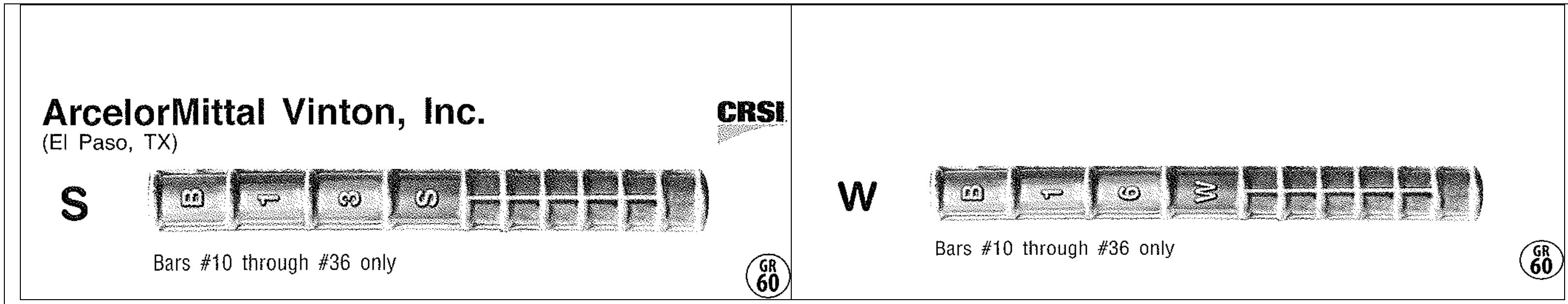
The minimum yield designation for Grade 420 bars is either one (1) single, longitudinal line (grade line) or the number 4 (grade mark).

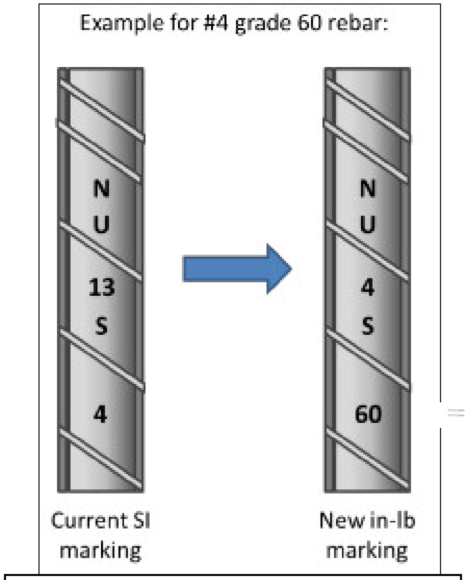
A grade line is smaller and is located between the two main ribs, which are on opposite sides of all bars made in the United States. A grade line must be continued through at least 5 deformation spaces, and it may be placed on the side of the bar opposite the bar marks. A grade mark is the fourth mark on the bar.

VARIATIONS: Bar identification marks may also be oriented to read horizontally (90° to those illustrated). Grade numbers may be placed within consecutive deformation spaces to read vertically or horizontally.

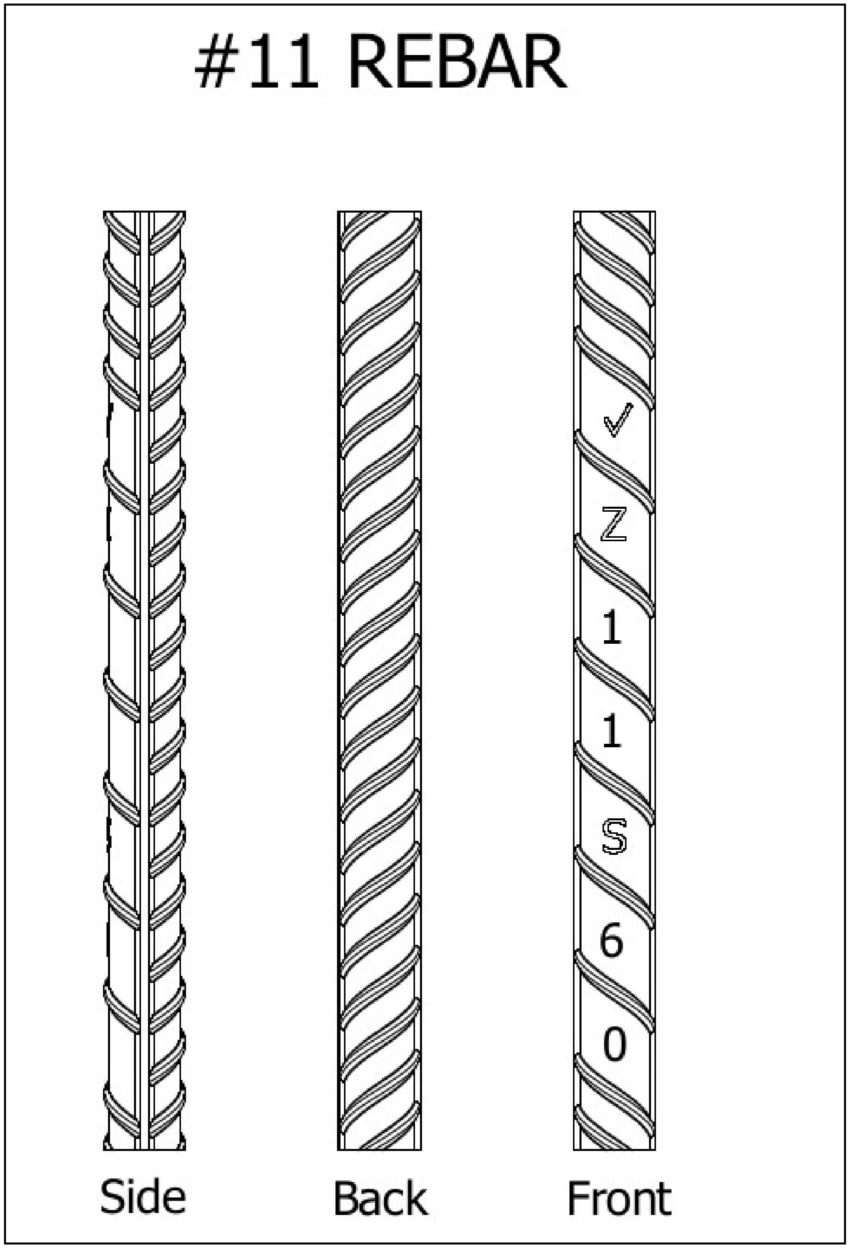
The Identification marks for the Approved Producers are shown in the following figures. Rebar grades shown on these pages are for reference only. Check the specs for the appropriate requirements.

ArcelorMittal Vinton, Inc. El Paso Texas ODOT # 1841

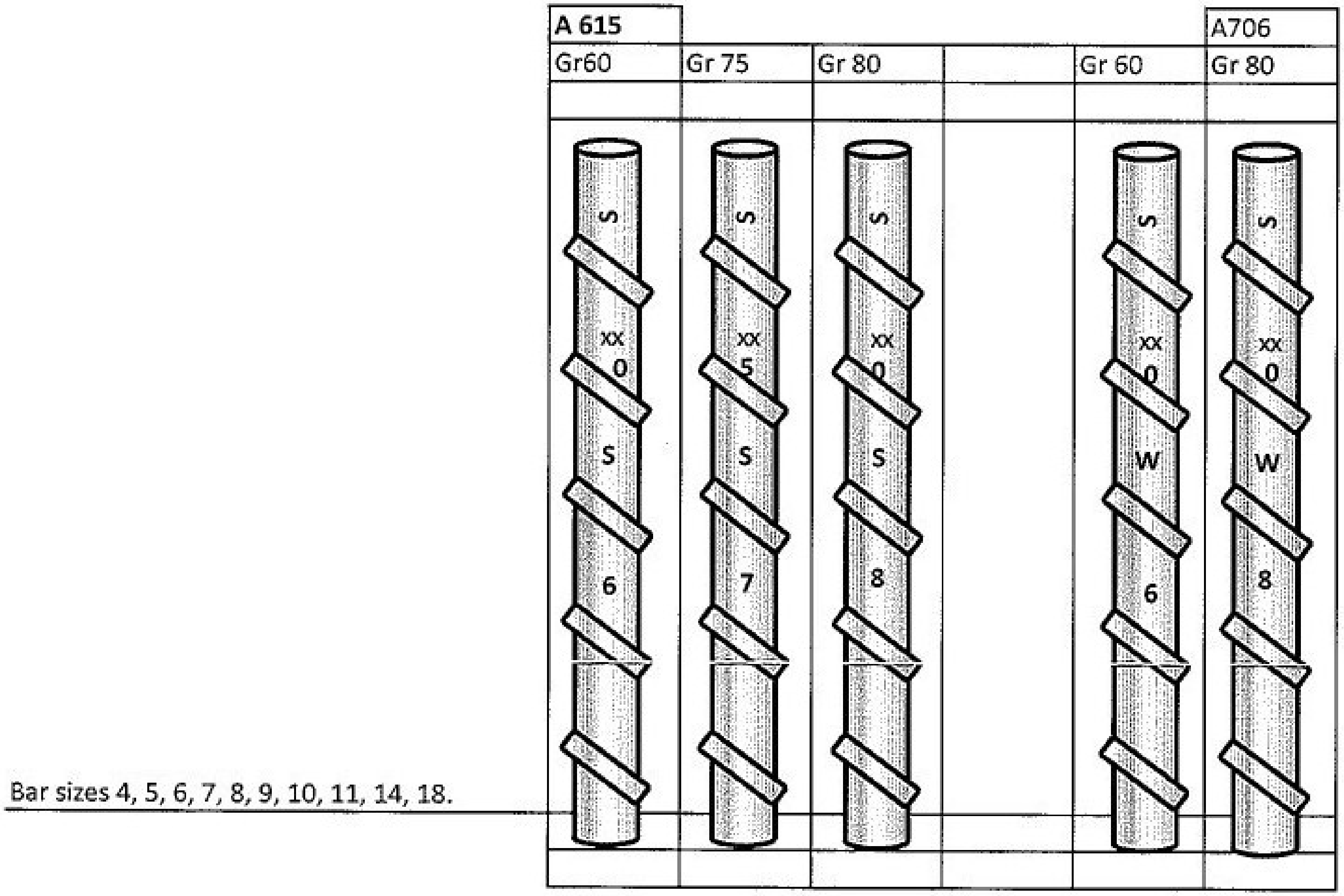




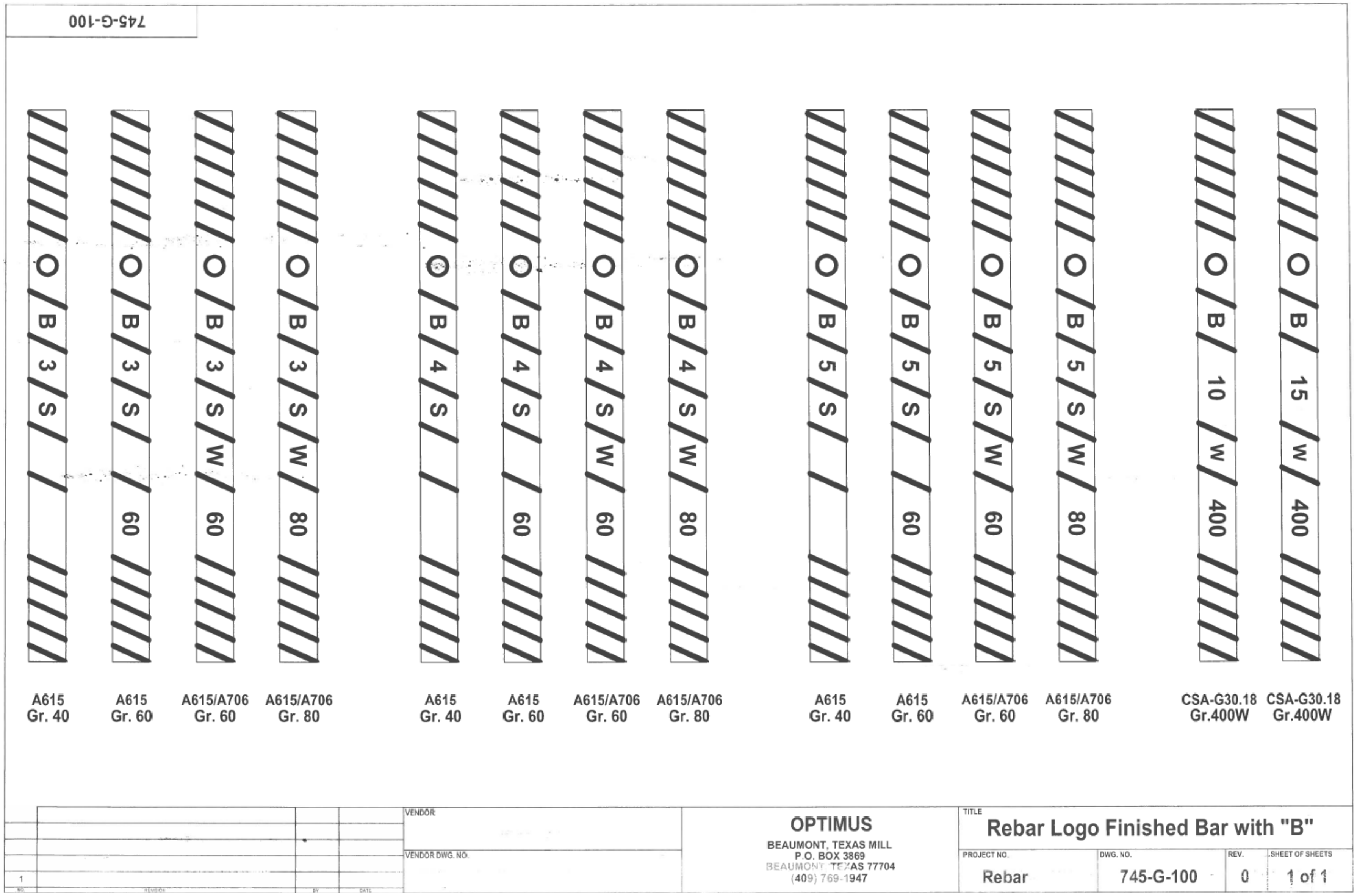
Nucor Steel Utah ODOT # 1112



CMC Steel Mesa Arizona ODOT #4118



Nucor Steel Seattle Washington ODOT # 2935

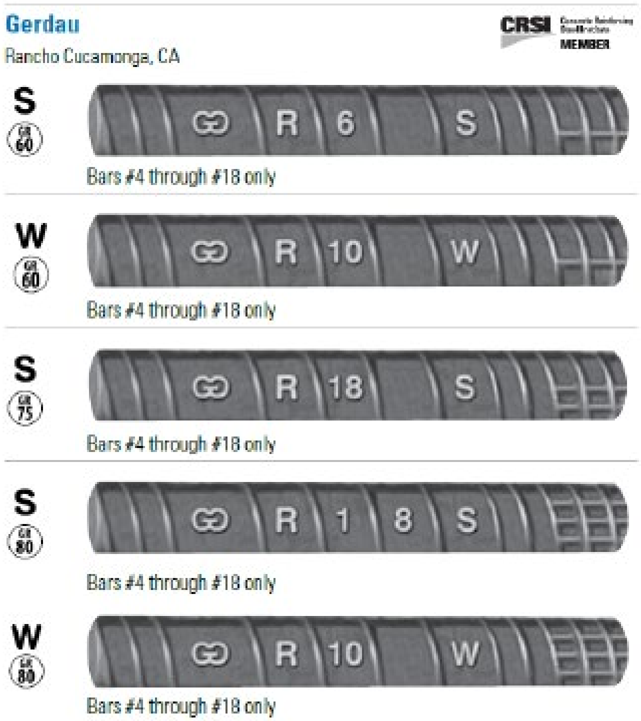


OPTIMUS
BEAUMONT, TEXAS MILL
P.O. BOX 3869
BEAUMONT, TEXAS 77704
(409) 769-1947

TITLE
Rebar Logo Finished Bar with "B"

PROJECT NO.	DWG. NO.	REV.	SHEET OF SHEETS
Rebar	745-G-100	0	1 of 1

Optimus Beaumont Texas ODOT #4838



Gerdau
Rancho Cucamonga, CA

Bars #4 through #18 only

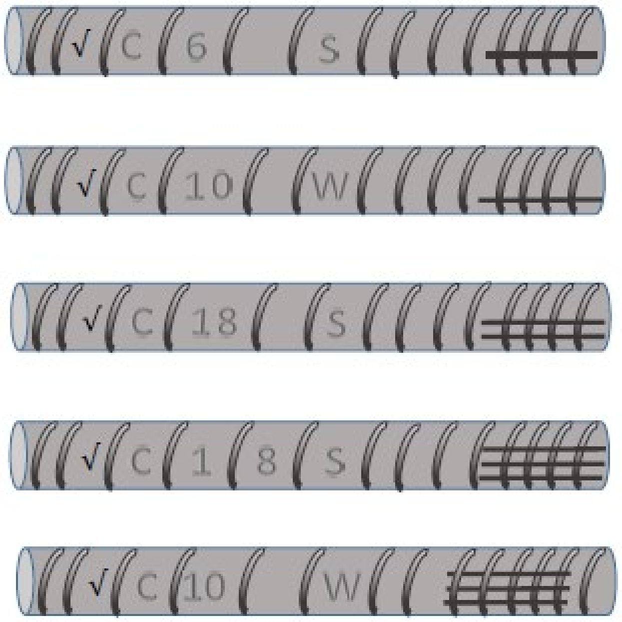
Bars #4 through #18 only

Bars #4 through #18 only

Bars #4 through #18 only

Bars #4 through #18 only

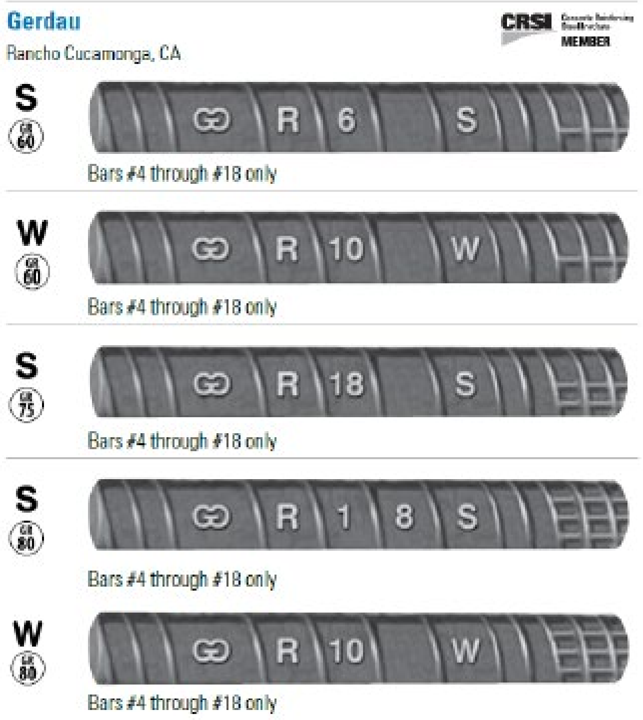
CMC Steel California - Interim Period.



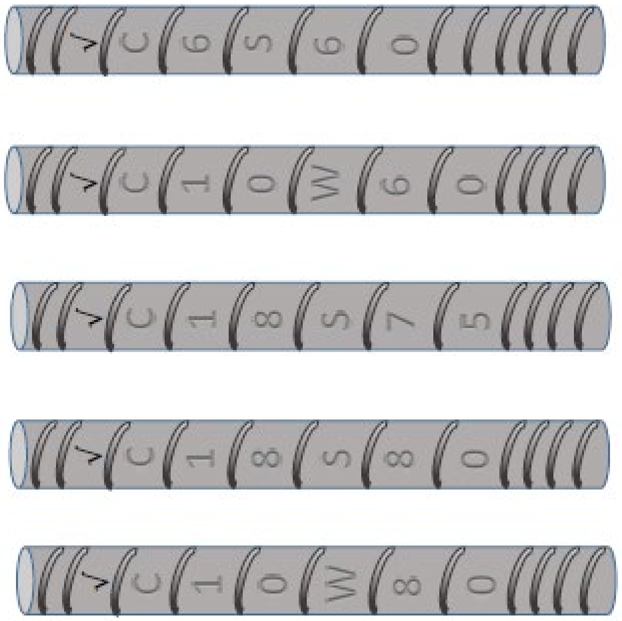
Gerdau (cont.)
Rancho Cucamonga, CA

Bars #4 through #18 only

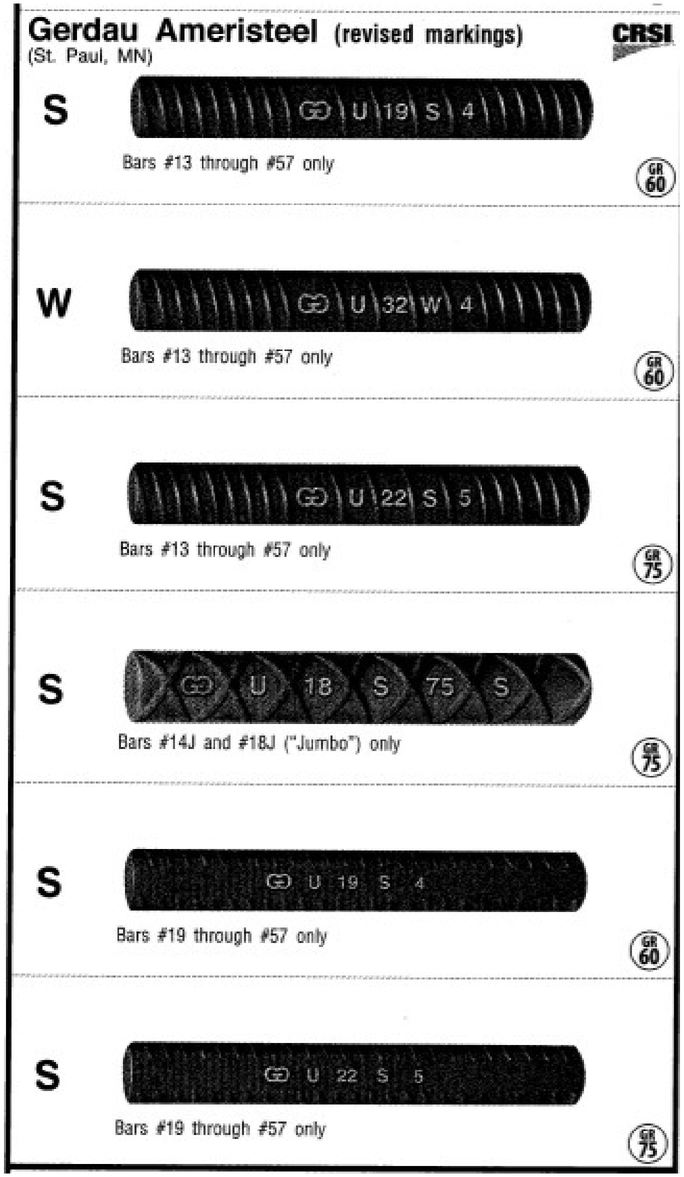
CMC Steel California ODOT #1842
Was Gerdau @ Rancho Cucamonga California



CMC Steel California – Post Interim Period.



CMC Steel California ODOT #1842
Was Gerdau @ Rancho Cucamonga California



Gerdau St. Paul Minnesota ODOT # 1623

Cascade Steel Rolling Mills, Inc.
(McMinnville, OR)

CRSI Concrete Reinforcing Steel Institute MEMBER

Cascade Steel Mc-Minnville Oregon
ODOT # 1111

S GR 60

Bars #3 through #6 only

W GR 60

Bars #3 through #6 only

W GR 60

Bars #14 and #18 only

SW GR 60

Bars #3 through #11 only
(#3 through #6 coiled)

SW GR 60

Bars #14 and #18 only

S GR 75

Bars #3 through #11 only
(#3 through #6 coiled)

S GR 75

Bars #14 and #18 only

S GR 80

Bars #3 through #11 only

S GR 80

Bars #14 and #18 only

W GR 80

Bars #3 through #11 only

W GR 80

Bars #14 and #18 only

SW GR 80

Bars #3 through #6 coiled

NUCOR STEEL – KINGMAN, AZ
ODOT #4356

A706/A615 GRADE 60 REBARS MARKINGS
Rebar sizes: #3 thru #6

Current SI Marking

New IN-LBS

EVRAZ INC, NA PUEBLO, COLORADO
ODOT #1621 (COILED REBAR #3-#6)

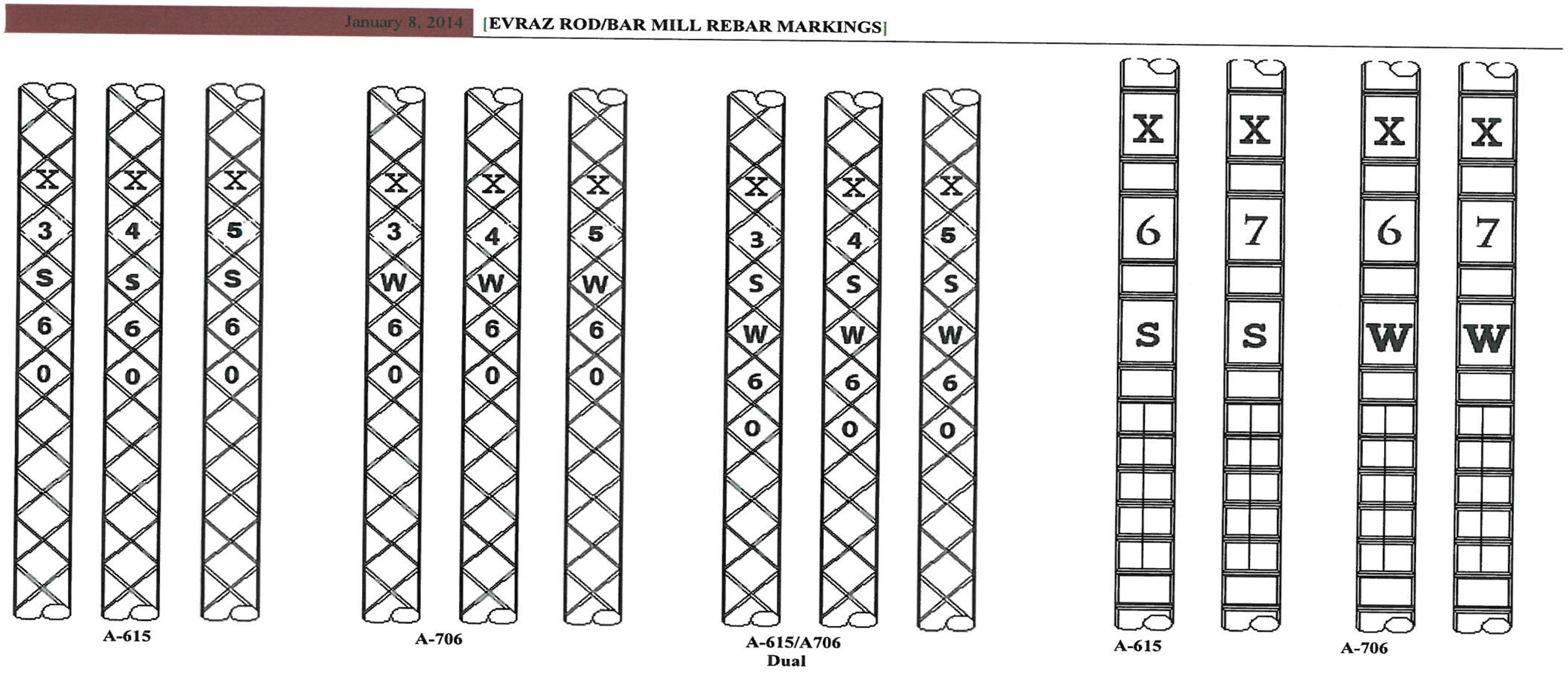
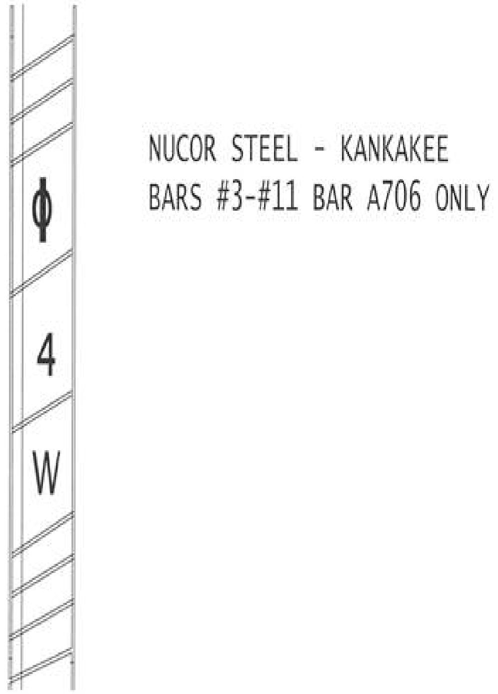

January 8, 2014 [EVRAZ ROD/BAR MILL REBAR MARKINGS]

Table-RB-700-8 Rev 2

NUCOR-BAURBONNAIS (KANKAKEE)
BAR SIZE #3-#11
ODOT #4943

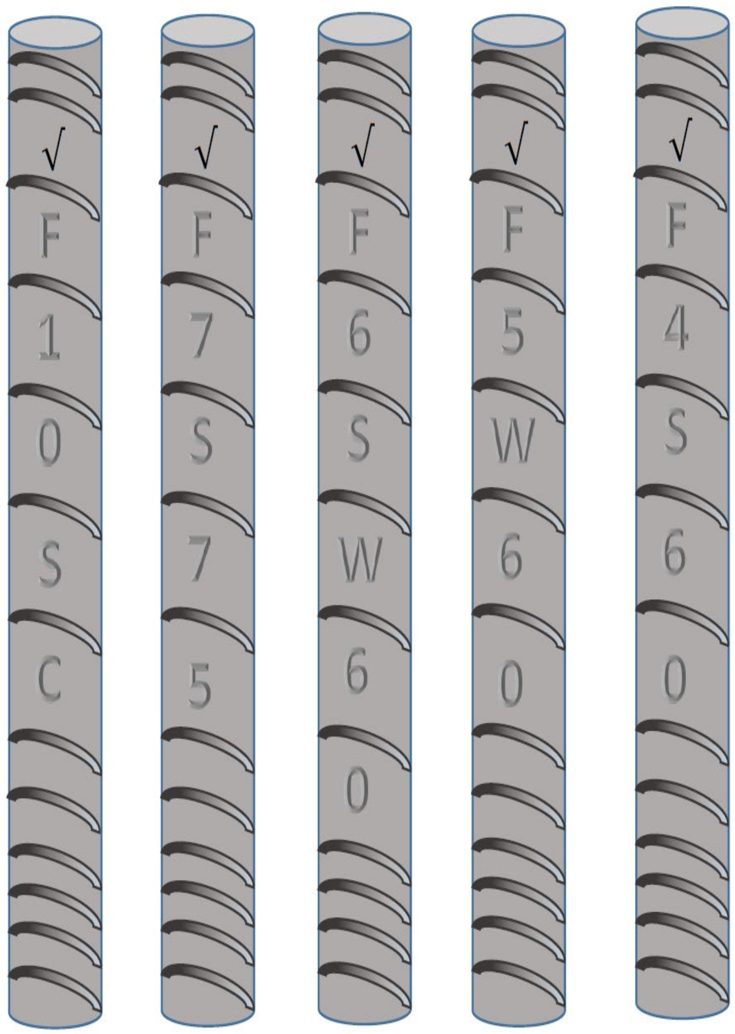


NUCOR STEEL - KANKAKEE
BARS #3-#11 BAR A706 ONLY

CMC STEEL-DURANT OKLAHOMA
#4-#11 STRAIGHT #3-#6 COILED
ODOT #5138

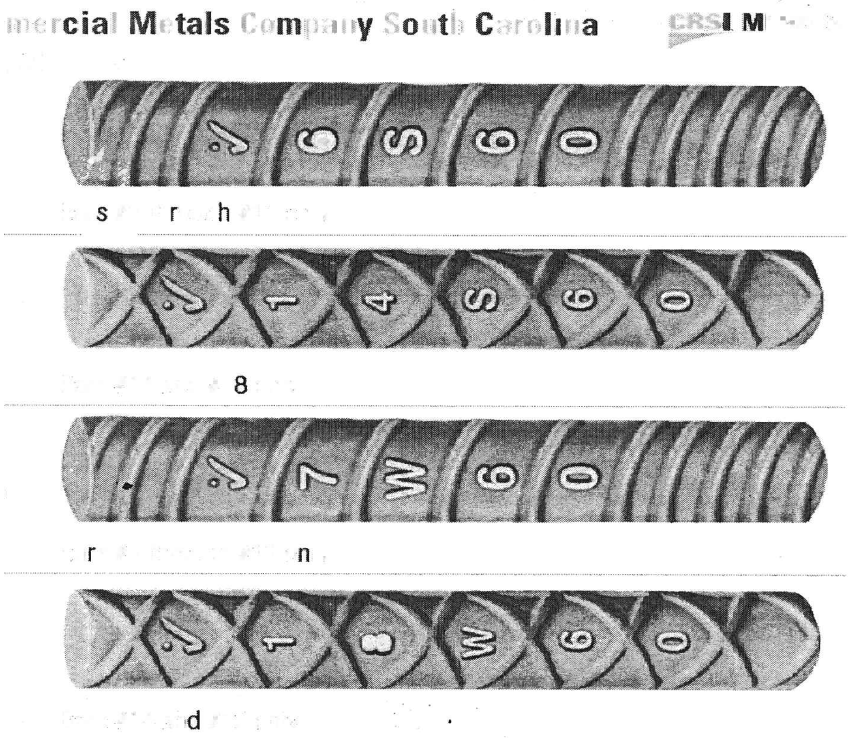
STEEL DYNAMICS ROANOKE BAR DIVISION
#4-#11 STRAIGHT
ODOT #5261

CMC STEEL FLORIDA
#3-#5 COILED
ODOT #5262



CMC STEEL TEXAS
A615 GRADE 60, #3-#11 STRAIGHT
A706 GRADE 60, #3-#11 STRAIGHT
ODOT #5313

CMC STEEL FLORIDA
A615 GRADE 60, 80, 100 #3-#18 STRAIGHT
A706 GRADE 60, 80 #3-#18 STRAIGHT
ODOT #5263



ASTM A1035 CS (AAHSTO M334)

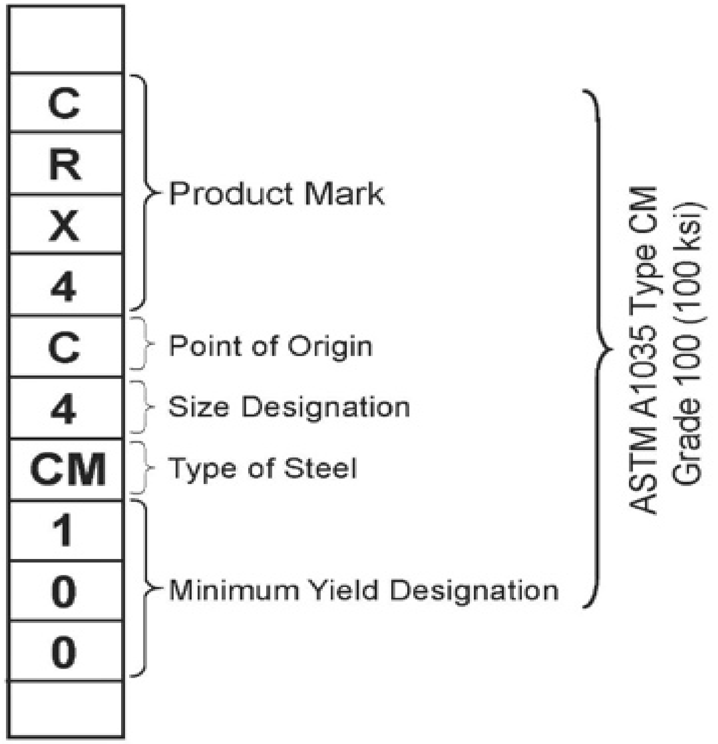
ChrōmX 9100 CS
SIZE #3-#11
PRODUCED BY:
CASCADE STEEL ROLLING MILLS, INC.
ODOT #3517

ChrōmX 4100 CM
SIZE #4-#11
PRODUCED BY:
CASCADE STEEL ROLLING MILLS, INC.
ODOT #5249

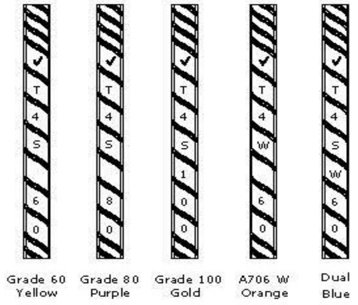
Bars #3 through #9 (#3 through #6 coiled)

Bars #10 and #11 only

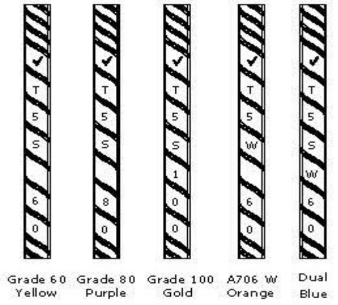
Bars #14 and #18 only



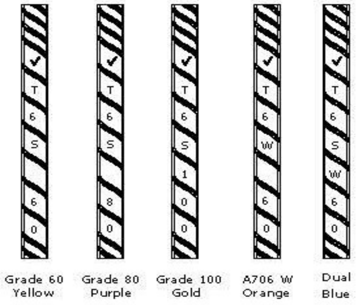
#4 REBAR



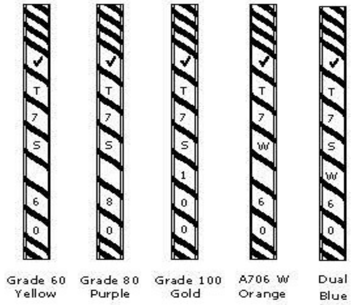
#5 REBAR



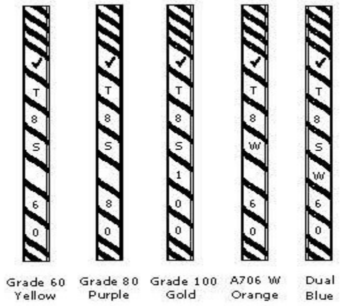
#6 REBAR



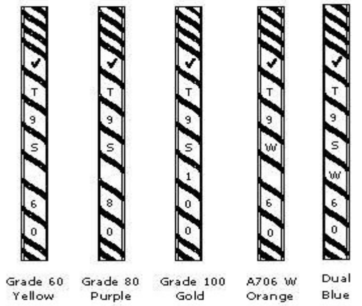
#7 REBAR



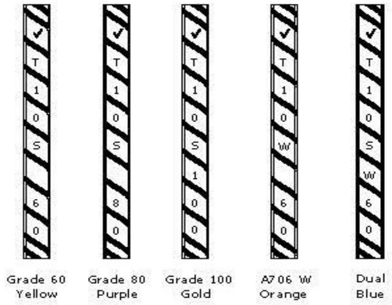
#8 REBAR



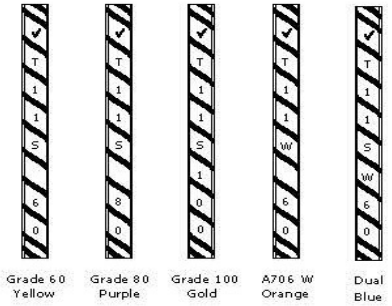
#9 REBAR



#10 REBAR



#11 REBAR



CMC STEEL Tennessee

CMC STEEL TENNESSEE KNOXVILLE
A615 GRADE 60, (#3-#11) A615 GRADE 80, 100 (#4-#11)
A706 GRADE 60, 80 (#3-#11) A615/A706 GRADE 60 (#4-#11)
ODOT #5333