Geotechnical and Foundation Report

Calapooya Creek Bridge, Bridge 20861, M.P. 22.10

OR138W: Dodge Cr/Calapooya Cr Bridge Replacements
Elkton – Sutherlin Hwy (Hwy. 231, M.P. 20.74 – 22.22)
Douglas County

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Oregon Department of Transportation
Region 3 Tech Center
Geo\Environmental Unit

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PROJECT LOCATION

The project site is located along Highway OR138W approximately 1.8 to 3.1 miles west of the city of Sutherlin, Oregon. Calapooya Creek Bridge 20861 is at mile point 22.10. The USGS legal description for the Calapooya Creek Bridge is within the Sutherlin, Oregon, 7.5 Minute Quadrangle, provisional edition 1988, in Township 25 South, Range 6 West, Section 14, Willamette Meridian. See Figure 1 (Project Location Map) showing the bridge sites below.

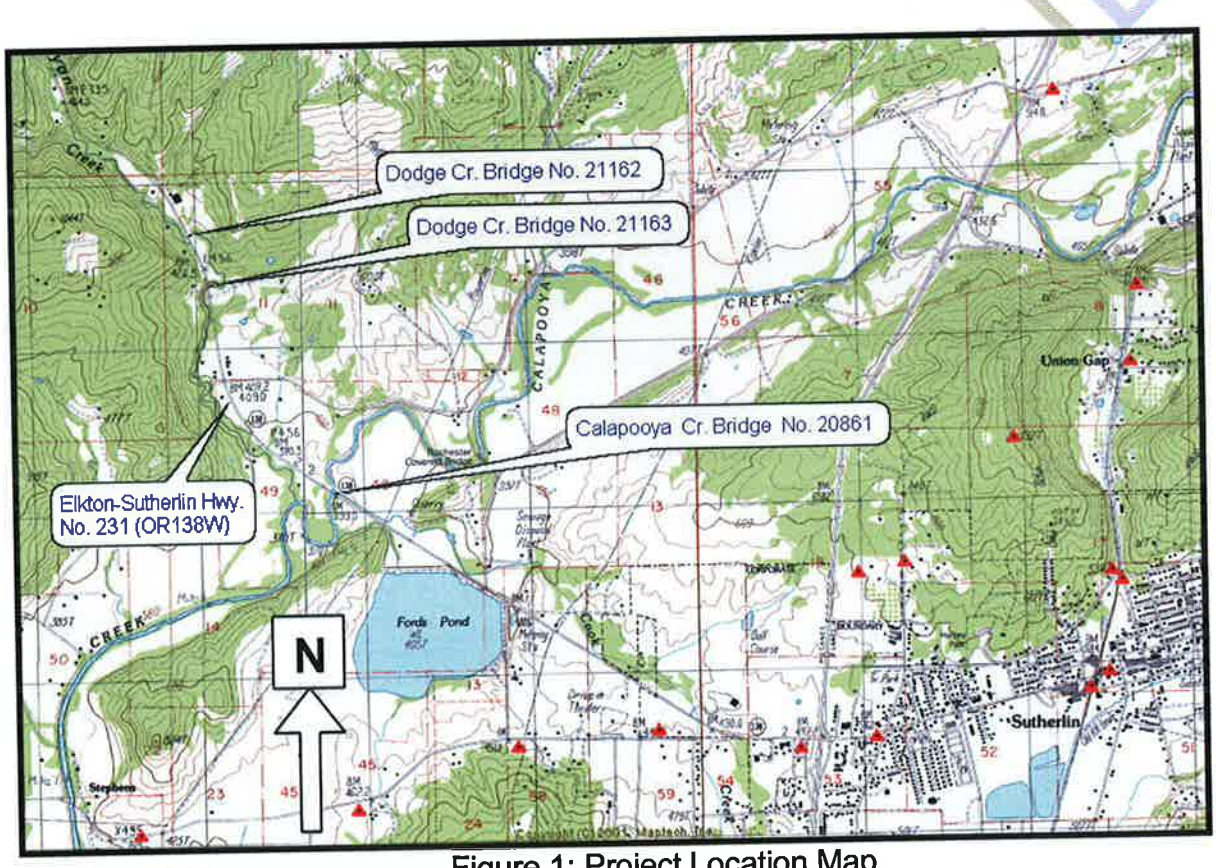

Figure 1: Project Location Map

GEOTECHNICAL AND FOUNDATION REPORT

Calapooya Creek Bridge, Bridge 20861, M.P. 22.10

Dodge Creek and Calapooya Creek Bridge Replacements Section
OR 138W. Elkton-Sutherlin Highway (Hwy. 231, M.P. 20.74 – 22.22)
Douglas County

1.0 INTRODUCTION

The proposed project includes the replacement of three bridges on the Elkton – Sutherlin Highway located at mile points (M.P.) 20.95, 21.15 and 22.10. The purpose of this document is to provide geotechnical recommendations for the support of the proposed Calapooya Creek bridge replacement and associated features.

Directions for this report will reference cardinal directions on the basis that the bridge longitudinal axes are north-south (contrary to the overall highway direction of west-east).

1.1 Calapooya Creek Bridge 20861

The project will replace existing Bridge 07338 at M.P. 22.10 which was constructed in 1953 with a 26 ft. wide (traversable deck width), 332 ft. long, five span structure with cantilever end spans and a pin and hanger center span composed of 6 inch reinforced concrete deck slab construction. Bents 1 and 6 are supported by two individual timber pile caps each supported by 7 timber piles. Bents 2 through 5 are supported by two individual concrete spread footings. Bents 2 through 5 are located in the active channel. Bent 1 is on the western end of the proposed bridge and Bent 6 is on the eastern end of the proposed bridge. Calapooya Creek trends from north to south at the bridge site. Cook Creek trends along the eastern roadway approach embankment and flows into Calapooya Creek immediately north of the proposed bridge location.

Final Plans indicate the proposed replacement structure (Bridge 20861) will be an approximately 47 ft. wide (out to out), 300 ft. long, two span bridge with 54 inch steel beams a 9 ¾" inch cast in place concrete deck. The proposed bridge will be built on the current horizontal and vertical alignments. The proposed replacement structure will have one bent within the active channel. A single-lane 300 ft. long Contractor designed Detour

Bridge will be constructed on the west side of the existing bridge to carry traffic during construction.

2.0 OFFICE STUDY

The following text in subsections 2.1 and 2.2 and related subsections are quoted from the ODOT Engineering Geology Report titled, "Elkton-Sutherlin Highway", Highway 231, Douglas County, Oregon", dated October 2009 as prepared by Dan Raker C.E.G., and Kimberly Wyttenberg, R.G.

2.1 Geologic Setting

The bridge project area is located within the southwest portion of the Coast Range Geologic Province of Oregon. The general geologic units encountered in all three areas are fill, alluvium and bedrock of the Tenmile Formation. The fill material was incorporated from the existing local terrain to bring the highway and approach embankments to grade with the bridges. The alluvium consists of interbedded silt, sand, clay and gravel deposited in the flood plains of Dodge Creek, Calapooya Creek and Cook Creek. The Tenmile Formation is a sequence of marine sedimentary rocks consisting of Sandstone and Mudstone that were formed in submarine turbidite and basinal deposits within the early Eocene epoch. For more detailed information on the geology of the Dodge and Calapooya Creek areas, refer to the Open-File Report 00-376 by Wells, R. E., et al., 2000,

Geologic Map and Database of the Roseburg 30' x 60' Quadrangle, Douglas and Coos Counties, Oregon, USGS prepared in cooperation with the Oregon Department of Geology and Mineral Industries.

2.2 Site Conditions

2.2.1 Calapooya Creek Bridge 20861

The topography along the flood plain of Calapooya Creek consists of flat to gently rolling terrain bordered by moderate to steep hillsides of the mountain ridges. Calapooya Creek is incised into the flood plain between approximately 10 to 25 feet with bedrock visible in the creek channel beneath the existing bridge. The highway crosses perpendicular to the creek and flood plain near approximate creek mile 9.3. The Highway is elevated across the flood plain on embankments for both the north and south roadway approaches to the existing bridge. The width of the flood plain parallel to the highway alignment is approximately 2,500 feet. Dodge Creek flowing in from the north merges with Calapooya Creek approximately 750 feet west of the existing bridge. Cook Creek flowing in from the south was rechannelized for approximately 1,200 feet along the east side of the south roadway approach embankment. The confluence of Cook Creek with Calapooya Creek is presently located northeast of and partially beneath the existing bridge. See Figure 1 for topographic and geographic features of the area. Land use on and around the flood plain consists mainly of residential dwellings, farm and pasture land along with some areas that have been logged for timber production.

2.3 Bridge As-Built Information

2.3.1 Calapooya Creek Bridge 7338

According to ODOT's Bridge Data System, the existing seven span structure was constructed in 1953. The existing structure is described in subsections 1.3, further described as having seven span lengths of 15 ft., 54 ft., 64 ft., and 66 ft., symmetrical about the 66 ft. span. Based on ODOT Bridge Drawing 10396, dated 1952, in Appendix C, Bents 1 and 6 are each supported by two columns on separate pile caps supported by 7 timber piles each. The pile caps are hexagonal in shape and are 8 ft. wide by 7.5 ft. long. The "as constructed" timber pile lengths could not be determined from the available information. The interior bents are supported by two columns with separate 6 ft. square spread footings founded on "shale". The per plan foundation elevations on ODOT Bridge Drawing 10396 for Bents 2 through 5 ranged from 355.5 ft. to 357 ft. The allowable footing pressure indicated on ODOT Bridge Drawing 10392 is 5 tons per square foot.

3.0 SUBSURFACE FIELD INVESTIGATIONS AND CONDITIONS

The subsurface exploration at the proposed bridge sites has been completed. The number and spatial coverage of test holes as well as the extent and sampling of materials in test holes are in accordance with, or exceed, AASHTO guidelines and ODOT practices. The subsurface investigation consisting of thirteen test holes (at least one per bent of the proposed structures and one along the proposed fill section) was directed by the Region 3 Tech Center Geo/Environmental Unit. Soil and rock samples recovered in the explorations were classified on site utilizing the methods described in ODOT's Soil and Rock Classification Manual. Subsequently independent checks of the samples were made by a Certified Engineering Geologist for quality control (Dan Raker, C.E.G.). Laboratory testing was also performed to verify soil classifications and engineering properties.

3.1 Subsurface Investigation Summary

The following text in subsections 3.1.1, 3.1.2 and 3.1.3 are quoted from the ODOT Engineering Geology Report titled, "Elkton-Sutherlin Highway", Highway 231, Douglas County, Oregon", dated October 2009 as prepared by Dan Raker C.E.G., and Kimberly

Wyttenberg, R.G. References made in those quotes to appendix items are to the appendix of the original Engineering Geology Report.

3.1.1 Calapooya Creek Bridge 20861

A total of seven borings were advanced for the proposed Calapooya Creek Bridge 20861. See The Foundation Data Sheet in Appendix B for test hole locations and detailed subsurface informaiton. Test holes 14813-03 (45.0 ft.), 14813-04 (35.0 ft.), 14813-05 (56.0 ft.) and 14813-07 (81.4 ft.) were advanced from the existing bridge deck at or near the proposed bent locations to depths as indicated. Drill holes 14813-01 (35.7 ft.) and 14813-02 (45.7 ft.) were advanced to depths as indicated to evaluate the proposed widening of the proposed approach embankment to the northeast of the proposed bridge. A vibrating wire transducer was installed in test hole 14813-01 at 20 feet (elev. 365.3) below the surface and connected to a data logger on October 10th 2007 to record ground water fluctuations. Test hole 14813-06 (45.7 ft.) was advanced to evaluate the proposed widening of the roadway approach embankment which requires a wall at the southeast corner of the proposed bridge. The subsurface investigation was directed by the Region 3 Geo/Environmental Unit. The drilling for Test Holes 14813-01 through 14813-06 was conducted between September 13th, and the 29th, 2007 utilizing Cascade Drilling from Clackamas, Oregon. A CME-75 truck mounted drill rig was used equipped with an automatic Standard Penetration Test (SPT) hammer. The drilling methods used to advance the holes were 4" (inside diameter) Hollow Stem Auger in the upper soils with a SPT taken at 5 foot intervals, and HQ-3 wire line system to core bedrock. The drilling for Test Hole 14813-07 was conducted on June 8, 2010 utilizing the ODOT Region 4 Drill Crew from Bend, Oregon. A CME-75 truck mounted drill rig was used equipped with an automatic Standard Penetration Test (SPT) hammer. The drilling method used to advance the hole was an HQ-3 wire line system to core bedrock in an HWT casing between the bridge deck and the ground surface. Portions of the text in this subsection are as taken from the "Engineering Geology Report Elkton-Sutherlin Highway 231 (OR138W)" by Dan Raker. C.E.G and Kim Wyttenberg, dated October 2009.

At bent 1 associated with test hole 14813-03, the material encountered from the surface down was approximately 12 feet of clayey silt to silt alluvium that overlies approximately six feet of sand alluvium that overlies approximately two feet of gravel alluvium. The gravel alluvium directly overlies the mudstone bedrock of the Tenmile Formation at the bedrock contact elevation of approximately 366.3 feet or approximately 19.4 feet below the ground surface.

At bent 2 associated with test hole 14813-04 the material encountered from the surface down was approximately 5 feet of gravelly sand alluvium that directly overlies the mudstone bedrock of the Tenmile Formation at the bedrock contact elevation of approximately 368 feet or approximately 5.0 feet below the ground surface.

At bent 3 associated with test hole 14813-05 the material encountered from the roadway surface down was two feet of AC and base rock over approximately 12 feet of gravelly sandy to clayey silt fill material that overlies approximately 9 feet of silt alluvium. The silt alluvium in turn overlies approximately 2 feet of silty sand alluvium that overlies

approximately 6 feet of gravelly silty sand alluvium. The gravelly silty sand alluvium directly overlies the mudstone bedrock of the Tenmile Formation at the bedrock contact elevation of approximately 366.2 feet or approximately 30.4 feet below the roadway surface at highway grade.

Along the eastern edge of the northern approach embankment, drill holes 14813-01 and 14813-02 were placed for that area. Test hole 14813-01 was drilled at the toe of the northern roadway approach embankment approximately 37 feet left and 11 feet lower in elevation than test hole 14813-02. The material encountered in test hole 14813-01 from the ground surface was approximately 1 foot of fill material that overlies approximately 7 feet of clayey silt alluvium. This alluvium in turn overlies approximately 5 feet of silty sand alluvium that overlies approximately 6 feet of sand alluvium which directly overlies the mudstone of the Tenmile Formation at the bedrock contact elevation of approximately 367 feet or approximately 19 feet below the ground surface. Test hole 14813-02 was drilled on the roadway surface. The material encountered from the roadway surface down was two feet of AC and base rock over approximately 10 feet of sandy gravel to gravelly sand fill with trace to some cobbles and boulders that overlies approximately 11 feet of clayey silt alluvium. This alluvium in turn overlies approximately 5 feet of sand alluvium which directly overlies the mudstone bedrock of the Tenmile Formation at the bedrock contact elevation of approximately 369 feet or approximately 27 feet below the roadway surface at highway grade.

Along the eastern edge of the southern roadway approach embankment associated with test hole 14813-06, the material encountered from the roadway surface down was two feet of AC and base rock over approximately 11 feet of gravelly sand to sandy silt with some clay fill that overlies approximately 16 feet sandy silt with some clay to clayey silt with some gravel alluvium which directly overlies the mudstone bedrock of the Tenmile Formation at the bedrock contact elevation of approximately 367 feet or approximately 29 feet below the roadway surface at highway grade.

The bedrock contact elevation difference between bents 1, 2 and 3 is approximately 2 feet with bent 2 at the higher elevation. The bedrock contact elevation difference between all of the test holes drilled for both the roadway approach embankments and the bent locations was approximately 3 feet. The drilling indicates that the bedrock contact has the potential to vary at least 3 feet in the immediate area of the proposed bridge location.

The cobble and boulder material encountered in the roadway approach embankments is composed of mudstone and sandstone material from the surrounding area. It appears that most of the boulder material was placed along the outer slopes of the embankments for erosion and scour protection. However, test holes 14813-02 and 14813-05 did encounter this material in the fill and the 4" (inside diameter)/ 8" (outside diameter) hollow stem auger was able to advance through it with minimal resistance indicated only by rough drilling action.

3.2 Laboratory Testing

Some of the soil and rock core samples recovered from the explorations were tested for engineering properties at the ODOT Material Laboratory located in Salem, Oregon.

Recovered soil samples were tested for; Atterberg Limits, natural moisture content, gradation, and engineering characterization of the materials encountered. Rock core sample were tested to unconfined compressive strength, point load testing, natural moisture content and unit weight. Laboratory testing results are located within Appendix A.

3.3 Ground Water

The following subsections provide generalized subsurface conditions encountered at each of the proposed structure sites and in general for the proposed sliver fill areas More detailed information is contained in Appendix A (Test Hole Logs) and Appendix B (Foundation Data Sheets) regarding the subsurface conditions encountered and referenced in the following subsections. The following text in subsections 3.3.1, 3.3.2 and 3.3.3 are quoted from the ODOT Engineering Geology Report titled, "Elkton-Sutherlin Highway", Highway 231, Douglas County, Oregon", dated October 2009 as prepared by Dan Raker C.E.G., and Kimberly Wyttenberg, R.G. References made in those quotes to appendix items are to the appendix of the original Engineering Geology Report.

3.3.1 Ground Water at Bridge 20861

Ground water at this location for Bridge 20861 was encountered and recorded at the time of drilling, September 13th- 29th, 2007. Ground water was encountered in test holes 14813-01, 14813-02, 14813-03, 14813-05 and 14813-06. Test Hole 14813-04 was drilled in the middle of the stream channel surrounded by exposures of bedrock and did not encounter ground water. A vibrating wire transducer was installed in test hole 14813-01 at a depth of 20 feet (elev. 365.3) below the surface. See Appendix D for recorded ground water levels in test hole 14813-01. Also see the drill logs in Appendix B for the recorded ground water levels at the time of drilling and the Interpretive Geologic Profile of Figure 4 in Appendix A for plotted ground water levels.

Along the north roadway approach embankment at the time of drilling, test holes 14813-01, 14813-02 and 14813-03 encountered ground water between approximate elevations 372 feet and 374 feet. Data logger recordings from the transducer in test hole 14813-01 indicate ground water rose to the surface to a maximum elevation of 386.9 feet on December 29th, 2008.

Along the south roadway approach embankment at the time of drilling, test holes 14813-05 and 14813-06 encountered ground water between approximate elevations 371 feet and 373 feet.

The bottom of the stream channel at this location is at approximate elevation 367 feet. Bedrock elevations between all of the test holes ranged between approximate elevations

366 feet and 369 feet. At this site expect ground water to fluctuate with the seasonal levels of the creek.

3.4 Instrumentation

A vibrating wire pressure transducer (VWT) was installed for Calapooya Creek Bridge, this VWT was installed within Test Hole 14813-01 to monitor ground water levels. The VWT was connected to a data logger which collected data on 6 hour intervals, the information collected can be referenced in Appendix A.

4.0 HYDRAULICS INFORMATION

4.1 Calapooya Creek Bridge

The Calapooya Creek Bridge will be a multi span bridge with a center pier located within the stream channel. The total scour depth was calculated to negligible based on the FHWA method for calculating contraction/pier scour. The center pier will be socketed greater than 10 ft. into the bedrock layer and shall also have protection with Class 700 rip-rap. Abutment scour will be mitigated by the use rip-rap protection, for this bridge, a minimum rip-rap size of Class 200 was calculated however common engineering practices calls for the use of 2 to 3 times the calculated minimum size, therefore Class 700 rip-rap abutment protection shall be used. Detailed flow depths, velocities and scour information can be found within the ODOT Hydraulics Report titled "OR 138: Calapooya Creek Bridge, Elkton-Sutherlin Hwy, MP 22.1, Douglas County" dated December 6, 2007 as prepared by Bruce Carmichael, P.E..

5.0 SEISMICITY EVALUATION

The recommended seismic design Acceleration Coefficients (A) for all three bridge sites are 0.14g and 0.24g for the 500-year return period peak horizontal ground acceleration on bedrock (PGA) and 1000-year PGA, respectively. The PGA values are based on United States Geologic Survey (USGS) mapping (2002) adopted in October 2004 as the design standard by the ODOT Bridge Engineering Section. The recommended Site Class is "C" based on Table 3.10.3.1-1 of AASHTO LRFD Bridge Design Specifications, 2007, 4th edition (with 2008 interims), (LRFD), the resulting Seismic Zone is "B" for the 500-year return period and "C" for the 1000-year return period. The response spectra were

generated using the ODOT Design Response Spectrum Program developed by the ODOT Bridge Engineering Section as posted on the internet at www.OREGON.GOV/ODOT/HWY/BRIDGE/standardsmanuals.shtml#Software_Tools_for_Design Inputs to the program are the return period, PGA, Site Class and the site location's latitude and longitude. The 500-year and 1000-year response spectra for the site generated from the ODOT Design Response Spectrum Program are appended in Appendix D for reference.

Liquefaction and lateral spread are considerations given the subsurface conditions described in subsection 3.1 and associated subsections, although design groundwater levels and fines content and plasticity of the soils will factor significantly in these determinations. Typically the 500-year PGA is associated with a serviceability standard which requires that the structure could be traversed by emergency vehicles, albeit, perhaps with some roadway approach work. The 1000-year PGA is typically associated with a non-collapse standard minimizing the potential loss of life. The design seismic event would typically be a magnitude 9.0 earthquake, based on a Cascadia Subduction Zone (CSZ) interface event (as ascertained from the USGS website).

5.1 Bridge 20861, Calapooya Creek Bridge

Liquefaction analyses, incorporating engineering judgment, determined that the Calapooya Creek Bridge site has minimal risk of liquefaction. The design seismic event used for liquefaction analyses were a 500-year PGA of 0.14g and 1000-year PGA of 0.24g. The design groundwater level for seismic analyses is Elevation 374.82 ft. which is the Ordinary High Water level for this bridge site. A groundwater level of Elevation 380.3 ft., the 2-year high water pursuant to the Hydraulics Report, was also assessed, the difference in the analyses conclusions were negligible. A Vibrating Wire Transducer (VWT) and data logger used to monitor groundwater levels with in TH 14813-01 found that water levels are generally below approximately Elevation 375 ft. except for the months of January, February and March when several short duration (one two week) water level periods above Elevation 380 ft. occurred. Although there is loose Sandy and Silty alluvial material overlying the Mudstone bedrock, the fines content and plasticity of the material is such that only isolated instances of liquefaction are anticipated during the 500-year and 1000-year design seismic events. The fines content and plasticity of the soil was not evaluated by

laboratory testing until after preliminary analyses suggested that there was a concern for liquefaction. The additional laboratory data and subsequent evaluations determined that only a small percentage (1 of 15 for the 500-year event and 2 of 15 for the 1000-year event) of the soil samples appeared to have liquefaction potential. Given the disjointed nature of the alluvial stringers which have been deposited and re-cut by the creek, it is believed the samples indicating liquefaction potential are not continuous enough to suggest a layer of soil is subject to appreciable liquefaction risk.

6.0 FOUNDATION DESIGN RECOMMENDATIONS

In accordance with ODOT's design practice, the foundation design was performed using AASHTO LRFD Bridge Design Specifications, 2007, 4th edition (with 2008 interims). Foundation design recommendations for the bridge are discussed below under the subsection following headings.

6.1 Calapooya Creek Bridge 20861

It is recommended that the end bents (Bent 1 & 3) of the proposed two-span bridge be founded on either HP12x53 or HP12x84 driven H-pile with tip protection. Piles are considered the best option for the subsurface conditions encountered. Changes late in the design process lead to the addition of the HP12x84 option. The piling will derive their axial capacity, primarily through skin friction and end bearing on and within the Tenmile Bedrock Formation.

The interior bent of the bridge, located within the wetted channel, is desired to be supported on a drilled shaft to minimize the environmental footprint that either a spread footing or pile cap would have within the ordinary high water. A single large diameter drilled shaft was selected by the Structural Engineering staff for design. The drilled shaft will derive its axial capacity primarily through skin friction within the very soft Mudstone of the Tenmile Bedrock Formation.

6.1.1 Calapooya Creek Bridge 20862 Bent 1 and 3 Pile Foundations

The resistance factor for Bents 1 and 3 is 0.40 as determined from LRFD Table 10.5.5.2.3-1 for nominal resistance of a single pile in compression using static pile analysis with a combination of the Nordlund and Tomlinson methods and pile driving criteria

determined by FHWA Gates Equation or Wave Equation, depending on the required ultimate capacity. Due to driving stress limitations induced during the driving process, the piles are recommended to be ASTM A572, Grade 50 (50 ksi yield strength). Due to driving stress limitations induced during the driving process, the recommended factored resistances are based on ASTM A36 (36 ksi yield strength) and are therefore less than the actual structural capacity of the pile.

The pile are anticipated to obtain the predominate portion of their capacity within the upper 5 ft. to 10 ft. of the mudstone bedrock which underlies the bridge site. The mudstone bedrock within the extent of the anticipated pile penetration was modeled as a stiff clay with an undrained shear strength (cohesion) of 32,400 psf. With the mudstone modeled in this manner the pile will reach "end bearing" in the rock within the embedded distance in the rock.

Table 5 provides detailed information for the piling recommended for Bents 1 and 3.

Bent	Pile Type, Size, Material Specification & Tip Treatment	Ultimate (Nominal) Capacity (kips)	LRFD Resistance Factor	Factored Resistance (kips)	Pile Driving Criteria	Estimated Average Cutoff Elevation (ft)	Estimated Length (ft)	Minimum Required Tip Elevation (ft)
1	Option A HP 12x53 ASTMA572 Grade 50 Reinforced Tip	560	0.40	225	FHWA Gates Equation	389	40	361
3						389	40	361
1	Option B HP12x84 ASTM A572 Grade 50 Reinforced Tip	890	0.40	355	Wave Equation	389	40	361
3						389	40	361

Table 5 – Calapooya Bridge 20861, Axial Pile Capacity Information

The pile sizes provided in Table 5 are based on axial loading of the pile. If controlling loads other than axial loads, such as lateral loads from earth pressures or seismic loading conditions, are anticipated, then the pile should be evaluated for those loads and sized accordingly. The cutoff elevation was estimated by assuming 2 ft. embedment into the pile cap. The estimated length is based on the difference between the estimated cutoff elevation and the estimated tip elevation, rounded up based on engineering judgment.

The estimated tip elevation is based on penetration of approximately 5 to 10 ft. into the very soft mudstone bedrock. The minimum required tip elevation is based on 5 ft. of penetration in to the rock contact at each bent location, which was uniform throughout the bridge site.

For pile foundations designed in accordance with the above recommendations, settlement is estimated to be less than approximately 1 inch and to be elastic in nature, occurring as the load is applied.

6.1.2 Calapooya Creek Bridge 20862 Bent 2 Drilled Shaft Foundation

The factored Bent 2 loads for the proposed 8 ft. diameter drilled shaft provided by the Structural Engineering staff were as follows:

Service (load factors = 1.00):
Dead Load = 1997 kips, Live Load 589 kips, Total Service Factored Load = 2586 kips

Strength (dead load factor = 1.25, live load factor = 1.75):
Dead Load = 2496 kips, Live Load 1031 kips, Total Strength Factored Load = 3527 kips

The resulting factored load (and factored resistance) for geotechnical design purposes is 3527 kips, although appropriate adjustments were made when considering strain compatibility with the design methodologies and settlement at the service load state. The resistance factor for Bent 2 is 0.36 as determined from LRFD Table 10.5.5.2.3-1 for nominal resistance of a single drilled shaft in compression using a variety of static capacity analyses methods. The resistance factor of 0.36 incorporates a reduction factor of 20% relative to the typical resistance factor of 0.40 due to a lack of redundancy (a single shaft vs. two or more shafts).

Difficulty in the drilled shaft analyses arose modeling the mudstone rock because it is very weak. On the basis of 12 unconfined compression tests performed on rock core samples recovered from Test Hole 14813-07, an unconfined compressive strength value of 450 psi was selected for design. Due to the fissile nature of the rock, it loses strength quickly as the moisture content decreases. Rock core samples for laboratory testing were delivered

to the laboratory and tested within 32 hours of the samples being recovered from the ground.

The drilled shaft analyses were conducted on the basis that the axial capacity of the drilled shaft will be predominantly (in not solely) from skin friction. Three different methods for estimating the required factored resistance of the drilled shaft within the mudstone bedrock were employed. These included two methods in the computer program SHAFT (version 5.0) for clay and weak rock, and a method from the 1988 FHWA Manual "Drilled Shafts: Construction Procedures and Design Methods" for weak rock. The SHAFT method for clay suggested that a 26 ft. rock socket would be adequate, as verified by a hand calculation. Since the mudstone is nearly 3 times stronger than the stiffest clay used to develop the clay method, an additional SHAFT program method was selected. The SHAFT method for weak rock resulted in a 62 ft. rock socket with an RQD (rock quality designation) of 54%, the average RQD of the rock core within the depth of concern. It was found that this method was very sensitive to variations in RQD such that an RQD = 75% resulted in a rock socket length of 17 ft. and an RQD = 100% resulted in a rock socket length of 6 ft., while an RQD = 65% matched the 26 ft. rock socket length suggested by the SHAFT method for clay. As a result of the SHAFT weak rock method's sensitively to RDQ, little regard was placed on the results of those analyses. The weak rock method from the 1988 FHWA Manual resulted in an estimated rock socket length of 51 ft.

The conclusion of the drilled shaft analyses is that the required factored resistance of 3527 kips can be adequately provided by a rock socket length of 45 ft., a factored resistance of approximately 78.4 kips per lineal foot of 8 ft. diameter shaft. There is approximately 5 ft. of soil overlaying the rock contract such that the total drilled shaft length will be 50 ft. long. Table 6 provides detailed information for the drilled shaft recommended for Bent 2.

Bent	Drilled Shaft Diameter (ft)	Ultimate Capacity/ Nominal Resistance (kips)	LRFD Resistance Factor	Factored Resistance (kips)	Factored Resistance per lineal ft. (kips/ft.)	Estimated Ground Line Elevation (ft)	Required Rock Socket Length (ft)	Minimum Required Tip Elevation (ft)

2	8.00	9797	0.36	3527	78.4	372.9, Rock Contact at 367.9	45.0	322.9

Table 6 – Calapooya Bridge 20861, Axial Drilled Shaft Capacity Information

The drilled shaft data provided in Table 6 is based on axial loading of the drilled shaft. If controlling loads other than axial loads, such as lateral loads from earth pressures or seismic loading conditions, are anticipated, then the drilled shaft should be evaluated for those loads and sized accordingly.

It is recommended that cross-hole sonic logging (CSL) tubes be placed in the drilled shaft on the inside of the rebar cage. CSL tubes allow for the integrity of the drilled shaft concrete to be evaluated shortly after placement of the concrete. The CLS tubes are to be placed at the rate of one per foot of drilled shaft diameter, 8 in this case. The CLS tubes are to be placed evenly along the inside circumference of the drilled shaft rebar cage.
As more fully discussed in subsection 8.4, careful study of the Drill Logs for Test Holes 14813-04 and 14813-07 in Appendix A should be made to more fully understand the nature of the mudstone and potential ramification that may have on the means and methods of advancing the hole and stabilizing the hole wall. Both Test Hole 14813-07 and 14813-04 indicate approximately 7 to 4 ft. zones of mudstone which is weathered, fractured and sheared including seams of soft clay and silt.

For drilled shaft foundations designed in accordance with the above recommendations, settlement is estimated to be less than approximately 1 inch and to be elastic in nature, occurring as the load is applied.

6.1.3 Lateral Pile Capacity

An Excel spreadsheet in Appendix D contains the recommended P-y data for developing curves for use with the computer programs "COMP624P", "Lpile" and "Group", which are used for determining the lateral deflection characteristics of the pile and drilled shaft supported bents. For seismic analyses, this data should be used with the realization that these computer programs do not truly represent seismic lateral loading when used in the cyclic load mode. The P-y curve data is provided as a function of elevation to eliminate any

confusion that may occur while the design pile cap elevations and finish ground lines are finalized. This file is available for electronic transmittal upon request.

The P-y soil profiles extend below the rock contact. As such the foundation elements should be terminated in the computer model at the minimum required tip elevation provided in Tables 5 and 6 of subsections 6.3.1 and 6.3.2. If additional penetration of the pile or drilled shaft is determined to be desired to provide additional lateral restraint, the minimum required tip elevation should be discussed with the Geotechnical Engineer.

The lateral loading soil profiles are based on COMP624P and Lpile internally generated P-y curves for the appropriate soil types encountered. The friction angles, undrained shear strengths and unit weights are the same as those used for the static pile and drilled shaft capacity analyses. The shear strengths, stiffness modulus values (k values), and unit weights are based on correlations to the density of the soil which is estimated from the standard penetration tests. For seismic design purposes, since liquefaction is not anticipated, only standard adjustments of the internally generated P-y curves have been made. The mudstone was modeled as a stiff clay with free water with an undrained shear strength of 32,400 psf.

6.2 Wing Walls

Wing walls with lengths of up to approximately 12 ft. (Bridge 21162) 18 ft. (Bridge 21163) and 16 ft. (Bridge 20861) are indicated in the Final Plans at each corner of the proposed structures. It is understood that these wing walls will be cantilevered from the bridge abutments beneath the bridge deck. This will impose additional loads on the piling supporting the bridge, although lateral loads due to earth pressures will be partially offset due to the wing wall on the opposite end of the pile cap. The magnitude of the earth pressures may be estimated using a soil friction angle of 34 degrees and a unit weight of 125 pcf. It is recommended that at-rest earth pressures be considered at the end of the wing wall/pile cap connection. If the wing wall is sufficiently long and/or flexible, active earth pressures may be used at the tips of the wing walls. The active and at-rest earth pressure coefficients are 0.28 and 0.44, respectively. The earth pressure loads can be linearly interpolated along the length of the wing wall between these values. If it is determined that bridge foundations designed without specific consideration for wing wall

loading can not adequately support the wing walls, specific foundation design recommendations will be provided upon request.

7.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

Fill heights will be up to 10 ft. in height along the new roadway alignment. Embankments shall be constructed in accordance to ODOT Standard Specification 00330 and special provisions and as recommended herein. General embankment fill slope rates are recommended to be no steeper than 1.0 vertical to 2.0 horizontal (1.0V:2.0H). Stone embankment fill slopes can be constructed with a slope rate up to 1.0V:1.5H or flatter. Cut heights in soil are anticipated to be less than 5 ft. in height along the new roadway alignment. Cuts shall be constructed in accordance to ODOT Standard Specification 00330 and special provisions and as recommended herein. Cuts in soil slope rates are recommended to be no steeper than 1.0V:1.5H). If rock cuts are anticipated, slope rates of no steeper than 1.0V:1.25 or paralleling existing rock cuts, whichever is flatter, is recommended.

ODOT Roadway Engineering Section standard sliver fill and benching details should be incorporated into the final contract plans. Settlement of up to approximately 3 in. is anticipated in the foundation soils below the proposed embankments.

Earthwork should be done during the drier portion of the year to avoid wet soils and inclement conditions. To help control moisture contents of the materials used to construct the embankments, this work would ideally be done between the months of June and September when a trace amount of the average annual historical precipitation occurs. If the project schedule requires embankment work to be done during wet weather or soil conditions, granular materials such as stone embankment material or other approved granular materials may be required to provide for satisfactory behavior.

8.0 CONSTRUCTION RECOMMENDATIONS

Construction submittals with geotechnical elements such as pile driving, cofferdams, falsework, detour and work bridges and shoring should be submitted to the Geotechnical

Engineer for review. Construction submittals containing both geotechnical and structural elements should be submitted to the Bridge Engineer for review as well.

For supplemental construction related information, the reader is directed to the sections of this report titled:

- "2.0 Office Study"
- "3.0 Subsurface Field Explorations and Conditions"
- "6.0 Foundation Design Recommendations"
- "7.0 Geotechnical Design Recommendations"

Additionally, it is suggested that the report be read in its entirety for a fuller comprehension of construction related issues and concerns.

8.1 Pile Driving

The driving criterion for the lower ultimate capacity (375 kip) H-piles are to be determined based on the FHWA Gates Equation (Section 00520.42 (b) in the Standard Specifications and related Special Provisions). Piling associated with Option A for Bridge 20861, discussed in subsection 6.3.1, shall be driven based on criteria developed from the FHWA Gates Equation in Standard Specification 00520.42(b). All other piling in subsections 6.1, 6.2 and 6.3.1 shall be driven based on criteria developed from a Wave Equation Analysis (Section 00520.42(c) in the Standard Specifications and related Special Provisions). The material specification for the piling and the usage of reinforced pile tips are intended to help prevent damage to the pile during pile driving operations.

8.2 Drilled Shafts

The drilled shaft foundation at Bridge 20861, Bent 2 will require permanent casing to accommodate the non-contact lap splice between the drilled shaft rebar cage and the column rebar cage. A construction joint in the drilled shaft concrete approximately 6 ft. below the ground surface will be required to accommodate the non-contact lap splice in the rebar cages. The permanent casing will act as stay in place form and shoring for the upper portion of the drilled shaft.

Depending on the means and methods employed by Contractor to advance the drilled shaft excavation, temporary casing below this depth may be desired to stabilize the very soft mudstone. If temporary casing is used, it shall not be allowed to stay in place as the

skin friction of the shaft would be compromised below acceptable limits. As mentioned in subsection 6.3.2, the mudstone is very fissile and subject to degradation (and hence hole instability) if it is allowed to experience a decrease in moisture content, additionally, as discussed below, there may be soft clay seams encountered in the advancement of the hole. As such, it is anticipated that the shaft excavation will be more likely to be successful it a wet method employing slurry to both increase hydrostatic pressures against the hole wall (a stabilizing effect on the stability of the hole) and to lift cuttings. Attempts to pump the hole dry should not be made, least the hole wall stability be compromised.

Careful study of the Drill Logs for Test Holes 14813-04 and 14813-07 in Appendix A should be made to more fully understand the nature of the mudstone and potential ramification that may have on the means and methods of advancing the hole and stabilizing the hole wall. Of note in Test Hole 14813-07 is a weathered, fractured and sheared zone between depths of 26.4 ft. and 33.3 ft. (Elevations 346.4 ft. and 339.5 ft.). A clay seam between depths of 26.5 ft. and 28.5 ft. (Elevations 346.3 ft. and 344.3 ft.) with an undrained shear strength, as measured by a torvane, of between 720 and 1420 psf was noted. A similar seam is noted as soft silt lenses in TH 14813-04 between a depth of 20.0 ft. to 23.5 ft (Elevations 352.9 ft. and 349.4 ft.).

8.3 Embankments

The construction of the embankment widening and sliver fills are expected to require diligent inspection to ensure that recommended standards are followed and that adequate compaction is obtained. The inspector should not allow the sliver fills to be constructed by end-dumping material at the top of the slope and walking it in with equipment. Earthwork equipment is to be operated on horizontal lifts parallel to the centerline of the roadway, constructing the sliver fills from the bottom up. As with all earthwork, this work should be done during the drier portion of the year to avoid wet soils and inclement conditions. To control moisture contents during construction of the embankments, this work would ideally be done between the months of June and September when a trace amount of the average annual historical precipitation occurs. If the project schedule requires embankment work to be done during wet weather or soil conditions, granular materials such as stone embankment material or other approved granular materials may be required to provide for satisfactory behavior.

8.4 Temporary Works; Shoring, Cofferdams, Work and Detour Bridges

A cofferdam may be desired at Bent 2 of Bridge 20861. If a cofferdam is used, unless the sheet pile can be driven the desired embedment in the mudstone bedrock, it may require internal bracing due to the shallow depth to bedrock. Continual pumping of cofferdam excavation is likely to be required.

Shoring may be required between the ends of Bridge 20861 and the proposed adjacent detour bridge to the west (downstream) side. Likewise shoring may be required between the ends of Bridges 21162 and 21163 and the adjacent existing bridges and/or roadway to the west. Conventional solider pile shoring may be appropriate for these locations, depending on the depth of the required excavations, rock contact depths and required pile penetrations, otherwise preboring of the solider pile or other methods of shoring may be required.

At Bridge 20861 temporary support for splicing steel beams may be required as the beams may not be delivered to the site full length, although use of an offset splice and cantilevering of the beams may allow for the interior bent to provide the required support. Conventional driven false bents or mudsills supported on rock may be applicable at this location.

A detour structure is proposed adjacent to Bridge 20861, westerly (downstream) of the existing bridge and a work bridge easterly (upstream) may be required. Adequately designed foundations may be satisfactorily supported on piles or mudsills on suitably dense native materials, including very soft mudstone bedrock. Bedrock maybe encountered near the ground surface at some locations. Mudsill bearing capacity calculations should incorporate an appropriate reduction for saturated soils and account for the proximity of slopes.

9.0 SPECIAL PROVISIONS

Markups to the special provisions for Sections 512 (Drilled Shafts) and 520 (Driven Piles) have been appended in Appendix E for reference.

10.0 LIMITATIONS

The analysis and recommendations presented in this report and its appendices are based on the data obtained from the subsurface explorations performed at the locations indicated on the drill logs and Foundation Data Sheet and from other sources of information discussed in this report. The subsurface explorations have provided detailed information at specific locations in the project area. However, variations in soil and rock conditions may exist between the test holes and groundwater levels may fluctuate periodically. The data shown in the exploration log of each test hole applies only to that particular test hole drilled on the dates indicated and is not intended to be conclusive as to the character of any material or conditions between or around the test holes (see Standard Specification 00120.25). Any interpretation or evaluation of this report by individuals or entities outside of the Oregon Department of Transportation is done so at the sole risk of the individuals or entity.

The nature and extent of any variations in subsurface materials or conditions may not become evident until construction. If subsurface conditions different than those identified in the test holes are observed or are encountered during construction, or appear to be present beneath or beyond excavations, the Geotechnical Engineer should be advised at once so that the Geotechnical Engineer can observe and review these conditions and reconsider the design recommendations where necessary.

It is recommended that construction operations relating to earthwork and foundations be observed by the Geotechnical Engineer or the Project Geologist to determine if the work is proceeding in accordance with the intent of the geotechnical recommendations and to allow for design changes as necessary.

11.0 SIGNATURE PAGE

Reviewed by: Pete Castro, P.E. (Civil, Geotechnical)
Region 3 Senior Geotechnical Engineer
Stamping for Sections* 5.0, 6.3, 6.4, 7.0, 8.0, 9.0, 10.0

Prepared by: Wade Holaday, P.E.
Region 3 Highway Engineer
Stamping for Sections* 1.0, 2.0, 3.0, 4.0, 5.1, 6.0

* Includes all subsections of the specified section or subsection unless a subsection is specifically listed for another registrant.

APPENDIX

Appendix A

Bridge Logs
Laboratory Testing Results Summary
Instrumentation (VWT) Groundwater Level Data Bridge 20861, TH 14813-01

Appendix B

Calapooya Creek Bridge 20861 Foundation Data Sheet

Appendix C

Calapooya Creek Bridge 07338 Plan and Elevation(As-Built) Drawing 10392
Calapooya Creek Bridge 07338 General Bent Details (As-Built) Drawing 10396

Calapooya Creek Bridge 20861 Plan and Elevation, Drawing 84334
Calapooya Bridge 20861 Bent 3 (Bent 1 Similar), Drawing 84348
Calapooya Bridge 20861 Bent 3 Section (Bent 1 Similar), Drawing 84349
Calapooya Creek Bridge 20861 Bent 2, Drawing 84351

Appendix D

500-year and 1000-year Response Spectra

Calapooya Creek Bridge P-y Data for Lateral Pile Loading

Appendix E

Special Provisions, Section 00512 – Drilled Shafts
Special Provisions, Section 00520 – Driven Piles

APPENDIX A GEOTECHNICAL AND FOUNDATION REPORT

OR138W: Dodge Cr/Calapooya Cr Bridge Replacements

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**	Purpose **Embankment Foundation**	Hole No. **14813-01**	
Highway **138W**	County **Douglas**	E.A. No. **PE001304**	
Hole Location Northing: **645,145.16**	Easting: **4,157,861.35**	Key No. **14813**	
Equipment **CME-75**	Driller **Joel & Sam**	Start Card No.	
Project Geologist **Dan Raker**	Recorder **Bryce Rogers**	Bridge No. **20861**	
Start Date **September 28, 2007**	End Date **September 29, 2007**	Total Depth **35.7 ft**	Ground Elev. **385.3 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0.0) Final Log 7/31/10	**0.0 - 1.0 Calapooya Unit-1; (Fill)**		Sta."L"1153+66.0, -49.6	
						1.0 - 7.5 Calapooya Unit-2 CLAY, CH; orange-brown, high plasticity, damp, stiff; (Alluvium)		Drilling method 4" ID HS (0'-20')	
5	N1	53	4-6-6	24	N- 1 (5.0-6.5) CLAY, CH; orange-brown, high plasticity, damp, stiff. (Alluvium) Lab No. 10-001057, LL=66, PI=35.			Note: ground water on 12/29/08 was at -0.2'	
						7.5 - 12.5 Calapooya Unit-3 Sandy SILT with some clay, ML; brown to orange-brown, low plasticity, moist, medium stiff to stiff, fine grained sand; (Alluvium)			
10	N2	80	3-3-5	20	N- 2 (10.0-11.5) Sandy SILT with some clay, ML; brown to orange-brown, low plasticity, moist, medium stiff to stiff, fine grained sand. (Alluvium) Lab No. 10-001058, LL=37, PI=12.			9/29/07 ▽ 13'	
						12.5 - 18.5 Calapooya Unit-4 Silty SAND, SM; orange-brown, nonplastic, wet, very loose, fine to medium grained; (Alluvium)			
15	N3	100	1-1-2	22	N- 3 (15.0-16.5) Silty SAND, SM; orange-brown, nonplastic, wet, very loose, fine to medium grained. (Alluvium) Lab No. 10-001059, LL=ND, PI=NP.			Wet Spoon	
								← Bedrock Contact 18.5'	
20	N4	23	50/3"		N- 4 (20.0-20.4) MUDSTONE; gray, fresh, extremely soft. (Tenmile Formation)	**18.5 - 35.7 Calapooya Unit-6 MUDSTONE, gray, fresh, extremely soft to very soft, very close to moderately close jointing, thin bedded, fissile along bedding planes; (Tenmile Formation)**		Drilling method changed to HQ3 WL (20'-35.7')	
	C1	100	RQD = 0 R0 RQD = 63		C- 1 (20.4-21.7) MUDSTONE, gray, fresh, extremely soft, very close to close jointing, fissile. (Tenmile Formation)				
	C2	100	R0 RQD = 72		C- 2 (21.7-26.7) MUDSTONE, gray, fresh, extremely soft, very close to close jointing, fissile. (Tenmile Formation)				
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Project Name **Calapooya Creek Bridge Replacement** Hole No. **14813-01** Page **2** of **2**

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25									
	C3	100	R0-R1 RQD = 72		C- 3 (26.7-31.7) MUDSTONE, gray, fresh, extremely soft to very soft, close to moderately close jointing, fissile. (Tenmile Formation)				
30									
	C4	75	R0-R1 RQD = 90		C- 4 (31.7-35.7) MUDSTONE, gray, fresh, extremely soft to very soft, close to moderately close jointing, fissile. (Tenmile Formation)			Back filled with bentonite chips (35.7'-21.5') Set transducer at 20.25' sand (21.5'-18.5') bentonite chips (18.5'-0')	
35					(35.7) Bottom of hole.			Bottom of hole 35.7'	
40									
45									
50									
55									
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**		Purpose **Embankment Foundation**	Hole No. **14813-02**
Highway **138W**		County **Douglas**	E.A. No. **PE001304**
Hole Location Northing: **645,116.54**		Easting: **4,157,837.08**	Key No. **14813**
Equipment **CME-75**		Driller **Joel & Sam**	Start Card No.
Project Geologist **Dan Raker**		Recorder **Bryce Rogers**	Bridge No. **20861**
Start Date **September 28, 2007**	End Date **September 28, 2007**	Total Depth **45.7 ft**	Ground Elev. **396.1 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0,0) Final Log 7/31/10	**0.0 - 0.5 AC**		Sta."L"1153+62.5, -12.3	
						0.5 - 2.0 Base Rock		Drilling method 4" ID HS (0'-30')	
						2.0 - 12.0 Calapooya Unit-1 Sandy GRAVEL to Gravelly SAND both with trace to some cobbles and boulders trace silt and/or clay, GW, SP; light brown, brown, gray, nonplastic to low plasticity, damp, loose to medium dense, fine to medium sand, fine to coarse gravel; (Fill)			
5	N1	53	11-10-9		N- 1 (5.0-6.5) Sandy GRAVEL with trace to some cobbles and boulders trace silt, GW, gray, nonplastic, damp, medium dense, fine to coarse. (Fill)				
10	N2	53	2-4-5		N- 2 (10.0-11.5) Gravelly SAND with some cobbles and boulders trace silt and clay, SP; brown, light brown and gray, low plasticity, damp, loose, fine to medium grained. (Fill)				
						12.0 - 22.5 Calapooya Unit-2 CLAY to CLAY with some sand, CH, brown, medium to high plasticity, damp to moist, soft to stiff; (Alluvium)			
15	N3	100	3-5-8	29	N- 3 (15.0-16.5) CLAY, CH, brown, high plasticity, damp, stiff. (Alluvium) Lab No. 10-001060, LL=94, PI=62.				
20	N4	100	1-1-2	27	N- 4 (20.0-21.5) CLAY with some sand, CH, brown, medium plasticity, moist, soft. (Alluvium) Lab No. 10-1061, LL=50, PI=22.				
						22.5 - 27.0 Calapooya Unit-4 Silty SAND with some thin lenses of clayey Silt, SM,		9/28/07 ▽ 23'	
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Project Name **Calapooya Creek Bridge Replacement** Hole No. **14813-02** Page **2** of **2**

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25	N5	100	1-2-4	28	N- 5 (25.0-26.5) Silty SAND with some thin lenses of clayey Silt, SM, orange-brown, nonplastic to low plasticity in clayey Silt lenses, wet, loose, fine to medium grained. (Alluvium) Lab No. 10-001062, LL-ND, PI=NP.	**orange-brown, nonplastic to low plasticity in clayey Silt lenses, wet, loose, fine to medium grained; (Alluvium)**		← Bedrock Contact 27.0'	
30	N6	20	50/3"		N- 6 (30.0-30.3) MUDSTONE, gray, slightly weathered, extremely soft, fissile, (Tenmile Formation)	**27.0 - 45.7 Calapooya Unit-6 MUDSTONE, gray, slightly weathered to fresh, extremely soft to very soft, close to moderately close jointing, thin bedded, fissile along bedding planes; (Tenmile Formation)**		Drilling method changed to HQ3 WL (30'-45.7')	
	C1	100	RQD = 0 R1 RQD = 93		C- 1 (30.3-31.7) MUDSTONE, gray, fresh, very soft, close jointing. (Tenmile Formation)			WR WC - gray-brown	
	C2	88	R0-R1 RQD = 84		C- 2 (31.7-36.7) MUDSTONE, gray, fresh, extremely soft to very soft, close to moderately close jointing. (Tenmile Formation)				
35									
	C3	100	R0-R1 RQD = 92		C- 3 (36.7-42.2) MUDSTONE, gray, fresh, extremely soft to very soft, close to moderately close jointing, fissile. (Tenmile Formation)				
40									
	C4	100	R1 RQD = 86		C- 4 (42.2-45.7) MUDSTONE, gray, fresh, very soft, close to moderately close jointing. (Tenmile Formation)			Back filled with bentonite chips (45.7'-1') concrete (1'-0')	
45					(45.7) Bottom of hole.			Bottom of hole 45.7'	
50									
55									
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**		Purpose **Bridge Foundation**	Hole No. **14813-03**
Highway **138W**		County **Douglas**	E.A. No. **PE001304**
Hole Location Northing: **645,037.37**		Easting: **4,157,915.23**	Key No. **14813**
Equipment **CME-75**		Driller **Joel & Sam**	Start Card No.
Project Geologist **Dan Raker**		Recorder **Dan Raker**	Bridge No. **20861**
Start Date **September 26, 2007**	End Date **September 27, 2007**	Total Depth **45.0 ft**	Ground Elev. **385.7 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
J - Joint	Pl - Planar	P - Polished
F - Fault	C - Curved	Sl - Slickensided
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Fo - Foliation	St - Stepped	R - Rough
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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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0.0) Final Log 7/31/10 (2.0) Advanced casing through bridge deck approximately 9.9' to ground surface below.	**0.0 - 12.2 Calapooya Unit-2 Clayey SILT with trace to some sand, MH; brown, medium plasticity, moist, soft to stiff; (Alluvium)**		Sta."L"1154+71.9, 7.9 Drilling method 4" CA (0'-19.2')	
5	N1	73	7-6-6	22	N- 1 (4.2-5.7) Clayey SILT with some sand, MH, brown, medium plasticity, moist, stiff. (Alluvium) Lab No. 10-001063, LL=50, PI=21.				
10	N2	73	2-1-2	29	N- 2 (9.2-10.7) Clayey SILT with trace sand, MH, brown, medium plasticity, moist, soft. (Alluvium) Lab No. 10-001064, LL=52, PI=21.			9/27/07 ▽ 12'	
15	N3	100	2-1-1	27	N- 3 (14.2-15.7) Silty SAND with trace clay, SM, mottled brown, gray-brown, low plasticity, wet, very loose, fine to medium grained. (Alluvium) Lab No. 10-001065, LL=34, PI=10.	**12.2 - 18.0 Calapooya Unit-4 Silty SAND with trace clay, SM, mottled brown, gray-brown, low plasticity, wet, very loose, fine to medium grained; (Alluvium)**			
20	N4 C1 C2	100 85 100	50/5" RQD = 0 R0 RQD = 0 R0 RQD = 0		N- 4 (19.2-19.7) From (19.2'-19.4') GRAVEL with some sand, GP, dark gray, nonplastic, wet, medium dense, fine, rounded. (Alluvium) From (19.4'-19.7') MUDSTONE, gray, fresh, extremely soft to very soft. (Tenmile Formation) C- 1 (19.7-20.0) MUDSTONE, gray, fresh, extremely soft. (Tenmile Formation) C- 2 (20.0-25.0) MUDSTONE, gray, fresh, extremely soft, very close to moderately close jointing. Hand friable to coarse sand, fissile along bedding. (Tenmile Formation)	**18.0 - 19.4 Calapooya Unit-5 GRAVEL with some sand, GP, dark gray, nonplastic, wet, medium dense, fine, rounded; (Alluvium)** **19.4 - 45.0 Calapooya Unit-6 MUDSTONE, gray, fresh, extremely soft to very soft, very close to wide jointing, laminated to thin**		Bedrock Contact 19.4' Drilling method changed to HQ3 WL (19.2'-45')	
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Project Name **Calapooya Creek Bridge Replacement** Hole No. **14813-03** Page **2** of **2**

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25	C3	100	R0-R1 RQD = 68		C- 3 (25.0-30.0) MUDSTONE, gray, fresh, extremely soft, close to moderately close jointing. Hand friable to coarse sand, fissile along bedding. (Tenmile Formation)	**bedding dipping 30 to 45 degrees, fissile along bedding planes, some zones hand friable to coarse sand; (Tenmile Formation)**		Blocked	
30	C4	100	R0-R1 RQD = 80		C- 4 (30.0-35.0) MUDSTONE, gray, fresh, extremely to very soft, close to moderately close to wide jointing. Hand friable to coarse sand, fissile along bedding. (Tenmile Formation)				
35	C5	100	R1 RQD = 88		C- 5 (35.0-40.0) MUDSTONE, gray, fresh, very soft, moderately close jointing. Laminated bedding 30 to 45 degrees, fissile along some bedding planes. (Tenmile Formation)				
40	C6	100	R0-R1 RQD = 80		C- 6 (40.0-45.0) MUDSTONE, gray, fresh, very soft, moderately close jointing. Laminated bedding 30 to 45 degrees, fissile along some bedding planes, with extremely soft zones from (41.5'-41.5') and (41.7'-42.0'). (Tenmile Formation)			Blocked Back filled with bentonite chips (45'-0')	
45					(45.0) Bottom of hole.			Bottom of hole 45'	
50									
55									
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**		Purpose **Bridge Foundation**	Hole No. **14813-04**
Highway **138W**		County **Douglas**	E.A. No. **PE001304**
Hole Location Northing: **644,952.12**	Easting: **4,158,065.14**		Key No. **14813**
Equipment **CME-75**		Driller **Joel & Sam**	Start Card No.
Project Geologist **Dan Raker**		Recorder **Kim Wyttenberg**	Bridge No. **20861**
Start Date **September 13, 2007**	End Date **September 14, 2007**	Total Depth **35.0 ft**	Ground Elev. **372.9 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0.0) Final Log 7/23/09	**0.0 - 5.0 Calapooya Unit-5 Gravelly Silty SAND, SW; brown, nonplastic, moist to wet, loose to medium dense, medium to coarse sand, fine rounded gravel; (Alluvium)**		Sta."L"1156+43.6, -8.0	
					(2.0) Advanced casing through bridge deck approximately 23.2' to gravel bar surface below.			Drilling method 4" CA (0'-10')	
5	N1	71	20-50/2"		N- 1 (5.0-5.7) MUDSTONE, gray, fresh, extremely soft, fissile. (Tenmile Formation)	**5.0 - 35.0 Calapooya Unit-6 MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, thin bedded, fissile along bedding; (Tenmile Formation)**		Bedrock Contact 5.0'	
10	N2	100	50/3"		N- 2 (10.0-10.3) MUDSTONE, gray, fresh, extremely soft, fissile. (Tenmile Formation)			Drilling method changed to HQ3 WL (10'-35')	
	C1	100	R0 RQD = 91		C- 1 (10.3-12.5) MUDSTONE, gray, fresh, extremely soft, very close jointing, fissile along bedding. (Tenmile Formation)				
	C2	100	R0 RQD = 0		C- 2 (12.5-15.0) MUDSTONE, gray, fresh, extremely soft, very close jointing, fissile along bedding. (Tenmile Formation)			Lost core out of barrel	
15	C3	100	R1 RQD = 52		C- 3 (15.0-18.0) MUDSTONE, gray, fresh, very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)				
	C4	100	R1 RQD = 0		C- 4 (18.0-20.0) MUDSTONE, gray, fresh, very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			Lost core out of barrel	
20	C5	100	R0-R1 RQD = 68		C- 5 (20.0-23.5) MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			Soft silt lenses within the MUDSTONE EOS, 9-13-2007 BOS, 9-14-2007	
	C6	100	R0-R1 RQD = 47		C- 6 (23.5-25.0) MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			New catcher and ring installed	
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Project Name **Calapooya Creek Bridge Replacement** Hole No. **14813-04** Page **2** of **2**

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25	C7	100	R0-R1 RQD = 52		C- 7 (25.0-30.0) MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			Minor silt lenses mixed within the clay, thin clay zone at 25.4	
30	C8	100	R1 RQD = 40		C- 8 (30.0-35.0) MUDSTONE, gray, fresh, very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			Back filled with bentonite chips (35'-0')	
35					(35.0) Bottom of hole.			Bottom of hole 35'.	
40									
45									
50									
55									
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

			Hole No. **14813-05**
Project **Calapooya Creek Bridge Replacement**		Purpose **Bridge Foundation**	E.A. No. **PE001304**
Highway **138W**		County **Douglas**	Key No. **14813**
Hole Location Northing: **644,864.20**	Easting: **4,158,164.97**		Start Card No.
Equipment **CME-75**		Driller **Joel & Sam**	Bridge No. **20861**
Project Geologist **Dan Raker**		Recorder **Dan Raker**	Ground Elev. **396.6 ft**
Start Date **September 27, 2007**	End Date **September 27, 2007**	Total Depth **56.0 ft**	Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0.0) Final Log 7/31/10	**0.0 - 0.5 AC**		Sta."L"1157+75.8, 7.0	
						0.5 - 2.0 Base Rock		Drilling method 4" ID HS (0'-29.5')	
						2.0 - 14.0 Calapooya Unit-1 Gravelly Clayey SILT with trace to some sand to Gravelly Sandy SILT with trace clay both with trace to some cobbles and boulders to Sandy SILT with trace gravel, ML, brown to gray and gray-brown, non plastic to medium plasticity, damp to moist,medium stiff to stiff; (Fill)		
5	N1	66	2-5-5		N- 1 (4.5-6.0) Gravelly Clayey SILT with trace to some sand, cobbles and boulders, ML, brown to gray, non plastic to medium plasticity, damp to moist, stiff. (Fill)				
10	N2	66	2-3-5		N- 2 (9.5-11.0) From (9.5'-9.8') Gravelly Sandy SILT with some clay cobbles and boulders, ML, brown to gray, nonplastic to medium plasticity, damp to moist, stiff. (Fill) From (9.8'-11') Sandy SILT with trace gravel, ML, gray-brown, low plasticity, moist, medium stiff. (Fill)				
15	N3	66	4-7-6	23	N- 3 (14.5-16.0) SILT with some clay and sand, ML, dark gray, low plasticity, moist, stiff. (Alluvium) Lab No. 10-001066, LL=39, PI=13.	**14.0 - 23.0 Calapooya Unit-2 SILT with some clay and sand, ML, dark gray to gray-brown, low plasticity, moist, medium stiff to stiff, has thin interbedded Sandy SILT lenses that are moist to wet; (Alluvium)**			
20	N4	87	1-2-4	23	N- 4 (19.5-21.0) SILT with some clay and sand, ML, dark gray-brown, low plasticity, moist, medium stiff, has thin interbedded Sandy SILT lenses that are moist to wet. (Alluvium) Lab No. 10-001067, LL=40, PI=14.				
25	N5	87	2-4-10	18	N- 5 (24.5-26.0)	**23.0 - 24.9 Calapooya Unit-3 Silty SAND with trace gravel, SM, brown,**		9/27/07 ▽ 24'	

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Project Name **Calapooya Creek Bridge Replacement** Hole No. **14813-05** Page **2** of **2**

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25					From (24.5'-24.9') Silty SAND with trace gravel, SM, brown, nonplastic, moist to wet, medium dense, medium grained. (Alluvium) Lab No. 10-001068, LL=NP, PI=ND. From (24.9'-26') Gravelly Silty SAND, SW, brown, nonplastic, moist to wet, medium dense, fine rounded gravel, medium to coarse grained sand. (Alluvium)	**nonplastic, moist to wet, medium dense, medium grained.; (Alluvium)** **24.9 - 30.4 Calapooya Unit-5 Gravelly Silty SAND, SW, brown, nonplastic, moist to wet, medium dense, fine rounded gravel, medium to coarse grained sand; (Alluvium)** **30.4 - 56.0 Calapooya Unit-6 MUDSTONE, gray, dark gray moderately weathered to fresh, extremely soft to very soft, very close to close jointing, thin bedded, fissile along bedding planes; (Tenmile Formation)**			
30	N6	100	7-19-50 RQD = 0		N- 6 (29.5-31.0) From (29.5'-30.4') Gravelly Silty SAND, SW, brown, nonplastic, moist to wet, medium dense, fine rounded gravel, medium to coarse grained sand. (Alluvium) From (30.4'-31') MUDSTONE, moderately weathered to fresh, gray, extremely soft. (Tenmile Formation)			Wet spoon ← Bedrock Contact 30.4'	
	C1	100	R0-R1 RQD = 64		C- 1 (31.0-36.0) MUDSTONE, dark gray, fresh, extremely soft to very soft, very close to close jointing, thin bedded, fissile along bedding. (Tenmile Formation)			Drilling method changed to HQ3 WL (29.5'-56')	
35									
	C2	100	R0 RQD = 0		C- 2 (36.0-41.0) MUDSTONE, dark gray, fresh, extremely soft, very close jointing, thin bedded, fissile along bedding, shear pattern with some slickensided structures. (Tenmile Formation)			Shear/Slickenside patterns within mudstone	
40									
	C3	100	R0 RQD = 0		C- 3 (41.0-46.0) MUDSTONE, dark gray, fresh, extremely soft, very close to close jointing, thin bedded, fissile along bedding. (Tenmile Formation)				
45									
	C4	100	R0 RQD = 0		C- 4 (46.0-51.0) MUDSTONE, dark gray, fresh, extremely soft, very close to close jointing, thin bedded, fissile along bedding. (Tenmile Formation)				
50									
	C5	100	R0-R1 RQD = 8		C- 5 (51.0-56.0) MUDSTONE, dark gray, fresh, extremely soft to very soft, soft zone (54.8'-55.1'), very close to close jointing, thin bedded, fissile along bedding. (Tenmile Formation)			Back filled with bentonite chips (56'-1') concrete (1'-0')	
55									
					(56.0) Bottom of hole.			Bottom of hole 56.0'	
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**		Purpose **Wall Foundation**	Hole No. **14813-06**
Highway **138W**		County **Douglas**	E.A. No. **PE001304**
Hole Location Northing: **644,811.74**	Easting: **4,158,278.11**		Key No. **14813**
Equipment **CME-75**		Driller **Joel & Sam**	Start Card No.
Project Geologist **Dan Raker**		Recorder **Bryce Rogers**	Bridge No. **20861**
Start Date **September 28, 2007**	End Date **September 28, 2007**	Total Depth **45.7 ft**	Ground Elev. **395.4 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0					(0.0) Final Log 7/31/10	**0.0 - 0.5 AC; (AC)**		Sta."L"1158+98.6, -14.8	
						0.5 - 2.0 Base Rock; (Base Rock)		Drilling method 4" ID HS (0'-30')	
						2.0 - 13.0 Calapooya Unit-1 Gravelly SAND with some silt to Sandy SILT with some clay , SP, ML; brown, brown-gray and dark gray, low plasticity, damp, medium dense and medium stiff, fine to medium grained sand; (Fill)			
5	N1	53	3-7-6		N- 1 (5.0-6.5) Gravelly SAND with some silt, SP; brown-gray, low plasticity, damp, medium dense, fine to medium grained. (Fill)				
10	N2	47	1-2-5		N- 2 (10.0-11.5) Sandy SILT with some clay, ML; brown to dark gray, low plasticity, damp, medium stiff. (Fill)				
						13.0 - 28.5 Calapooya Unit-2 Sandy CLAY with some silt, CL to SILT with some clay and sand, ML to Silty SAND with some clay and gravel, SM; brown, dark brown, gray, dark gray, orange-brown, mottled, low to medium plasticity, moist to wet, medium stiff to stiff; (Alluvium)			
15	N3	80	1-4-6	23	N- 3 (15.0-16.5) Sandy CLAY with some silt, CL; dark brown to dark gray, low to medium plasticity, moist, stiff. (Alluvium) Lab No 10-001069, LL=40, PI=15.				
20	N4	57	2-3-4	28	N- 4 (20.0-21.5) SILT with some clay and sand, ML; dark brown to dark gray, mottled, low plasticity, moist, medium stiff. (Alluvium) Lab No. 10-001070, LL=41, PI=14.			9/28/07 ▽ 24'	
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25	N5	87	3-6-7	18	N- 5 (25.0-26.5) Silty SAND with some clay and gravel, SM; brown, gray, orange-brown, medium plasticity, wet, stiff. (Alluvium) Lab No. 10-001071, LL=45, PI=17.				
						28.5 - 45.7 Calapooya Unit-6 MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, thin bedded, fissile along bedding; (Tenmile Formation)		← Bedrock Contact 28.5'	
30	N6	23	50/3"		N- 6 (30.0-30.4) MUDSTONE, gray, fresh, extremely soft. (Tenmile Formation)				
	C1	100	R0 RQD = 67		C- 1 (30.4-31.7) MUDSTONE, gray, fresh, extremely soft, very close to close jointing. (Tenmile Formation)			Drilling method changed to HQ3 WL (29.5'-56')	
	C2	100	R0 RQD = 68		C- 2 (31.7-36.7) MUDSTONE, gray, fresh, extremely soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			WR WC gray-brown	
35									
	C3	100	R0-R1 RQD = 32		C- 3 (36.7-41.7) MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)				
40									
	C4	100	R0-R1 RQD = 50		C- 4 (41.7-45.7) MUDSTONE, gray, fresh, extremely soft to very soft, very close to close jointing, fissile along bedding. (Tenmile Formation)			Back filled with bentonite chips (45.7'-1') concrete (1'-0')	
45					(45.7) Bottom of hole.			Bottom of hole 45.7'	
50									
55									
60									
63									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

Project **Calapooya Creek Bridge Replacement**		Purpose **Bridge Foundation**	Hole No. **14813-07**
Highway **138W**		County **Douglas**	E.A. No. **PE001304**
Hole Location Northing: **644,932.98**	Easting: **4,158,065.89**		Key No. **14813**
Equipment **CME-75**		Driller **Ed Duffy**	Start Card No.
Project Geologist **Dan Raker**		Recorder **Dan Raker**	Bridge No. **20861**
Start Date **June 8, 2010**	End Date **June 8, 2010**	Total Depth **81.4 ft**	Ground Elev. **372.8 ft**
			Tube Height

Test Type
"A" - Advancer
"X" - Auger
"C" - Core
"N" - Standard Penetration Test
"U" - Undisturbed Sample
"D" - Oversize Split Spoon Sample

Rock Abbreviations

Discontinuity	Shape	Surface Roughness
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F - Fault	C - Curved	Sl - Slickensided
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Drilling Methods	Drilling Remarks
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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 / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
0	N1	20	3-1-1		(0.0) Final Log 7-31-10 N- 1 (0.0-1.5) SAND with some gravel trace silt, SP, brown, nonplastic, wet, very loose, fine to coarse grained.	**0.0 - 6.2 Calapooya Unit-5 SAND with some gravel trace silt, SP, to Sandy GRAVEL with some silt, trace clay, GP brown to gray-brown, nonplastic to low plasticity, wet, very loose to loose, fine to coarse grained sand, fine rounded gravel.; (Alluvium)**		Sta."L"1156+55.2, +7.3 23.7 feet from Deck to Ground Surface below.	
5	N2	10	1-2-16		N- 2 (4.8-6.2) From (4.8'-6.0') Heaving SAND From (6.0'-6.2') Sandy GRAVEL with some silt, trace clay, GP, gray-brown, nonplastic to low plasticity, wet, loose, fine grained, rounded. Alluvium From (6.2'-6.4') MUDSTONE, gray, fresh, very soft. (Tenmile Formation)			Driller notes harder at 5 feet. Bedrock contact 6.2' 6/8/10 ▽ 7'	
	C1	94	R1 RQD = 50		C- 1 (6.4-11.4) MUDSTONE, gray, fresh, very soft, close jointing, medium to thick bedded. (Tenmile Formation) Lab No. 10-001831 (6.8'-7.4') Unconfined Compressive Strength (UCS)=598 psi. Lab No. 10-001832 (10.8'-11.4') UCS=231 psi.	**6.2 - 81.4 Calapooya Unit-6 MUDSTONE, gray, decomposed to mainly fresh, extremely soft to mainly very soft, very close to wide jointing, some shearing with slickensides along joints, medium to thick bedded; (Tenmile Formation)**			
10	C2	100	R1 RQD = 40		C- 2 (11.4-16.4) MUDSTONE, gray, fresh, very soft, close jointing, medium to thick bedded. (Tenmile Formation) Lab No. 10-001833 (11.4'-12.3') UCS=602 psi.			Shear zone 13.1' to 13.3'	
15	C3	100	R1 RQD = 100		C- 3 (16.4-21.4) MUDSTONE, gray, fresh, very soft, wide jointing, medium to thick bedded, full stick, no fractures. (Tenmile Formation) Lab No. 10-001834 (17.3'-18.0') UCS=619 psi. Lab No. 10-001835 (18.4'-19.1') UCS=358 psi.				
20	C4	100	R1 RQD = 92		C- 4 (21.4-26.4) MUDSTONE, gray, fresh, very soft, close to moderately close jointing, medium to thick bedded. (Tenmile Formation)				
25									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description (SOIL: Soil Name, USCS, Color, Plasticity, Moisture, Consistency/Relative Density, Texture, Cementation, Structure, Origin. ROCK: Rock Name, Color, Weathering, Hardness, Discontinuity Spacing, Joint Filling, Core Recovery, Formation Name.)	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
25	C5	100	R0-R1 RQD = 0	35	C- 5 (26.4-31.4) MUDSTONE, with clay seams, gray, fresh to decomposed at clay seams, extremely soft to very soft, very close jointing, highly fractured, some slickensides. From (26.5'-28.5') CLAY, CH; gray, medium plasticity, moist, medium stiff to stiff. Lab No. 10-001830 (26.8'-27') LL=50, PI=28.			Clay seam 26.5' to 28.5' Torvane = 0.60 and 0.71 TSF at 26.8' Torvane = 0.36 and 0.43 TSF at 27.5'	
30	C6	92	R1 RQD = 48		C- 6 (31.4-36.4) From (31.5'-33.3') MUDSTONE, gray, fresh to moderately weathered, very soft, very close jointing, some shearing with slickedsides, medium to thick bedded. (Tenmile Formation) From (33.3'-36.4') MUDSTONE, gray, fresh, very soft, moderately close jointing, medium to thick bedded. (Tenmile Formation) Lab No. 10-001837 (33.4'-34.1') UCS=337 psi.				
35	C7	100	R1 RQD = 80		C- 7 (36.4-41.4) MUDSTONE, gray, fresh, very soft, close to moderately close jointing with trace shearing on joints, medium to thick bedded, concretions at 37.5' and 40.2'. (Tenmile Formation) Lab No. 10-001838 (38.4'-39.1') UCS=619 psi.				
40	C8	100	R1 RQD = 50		C- 8 (41.4-46.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded, concretion at 42.6. (Tenmile Formation)				
45	C9	98	R1 RQD = 26		C- 9 (46.4-51.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded, concretion at 49.0'. (Tenmile Formation)				
50	C10	96	R1 RQD = 70		C- 10 (51.4-56.4) MUDSTONE, gray, fresh, very soft, very close to moderately close jointing, slickensides along joints, medium to thick bedded. (Tenmile Formation)				
55	C11	100	R1 RQD = 68		C- 11 (56.4-61.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded. (Tenmile Formation)				
60	C12	96	R0-R1 RQD = 50		C- 12 (61.4-66.4) MUDSTONE, gray, fresh, extremely soft to very soft, very close to moderately close jointing,				
63									

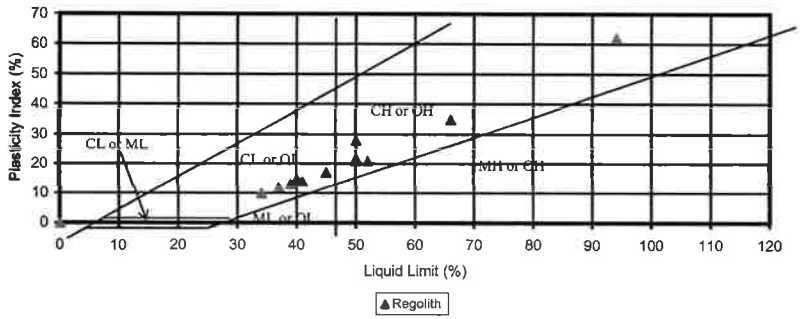
Depth (ft)	Test Type, No.	Percent Recovery	Soil / Rock: Driving Resistance / Discontinuity Data Or RQD%	Percent Natural Moisture	Material Description	Unit Description	Graphic Log	Drilling Methods, Size and Remarks / Water Level/ Date	Backfill/ Instrumentation
63					slickensides along joints, medium to thick bedded. Extremely soft zone 64.8'-65.3', highly fractured zones 61.8'-62.1' and 64.3'-64.5'. (Tenmile Formation) Lab No. 10-001843 (63.0'-63.9') UCS=247 psi.				
65									
	C13	100	R1 RQD = 40		C- 13 (66.4-71.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded. Very close jointing zones 70.2'-71.1' and 69.6'-69.8'. (Tenmile Formation)				
70									
	C14	100	R1 RQD = 90		C- 14 (71.4-76.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded. Highly fractured zone 71.4'-71.7'. (Tenmile Formation) Lab No. 10-001845 (71.6'-72.3') UCS=670 psi. Lab No. 10-001846 (75.5'-76.4') UCS=622 psi.				
75									
	C15	100	R1 RQD = 50		C- 15 (76.4-81.4) MUDSTONE, gray, fresh, very soft, very close to close jointing, slickensides along joints, medium to thick bedded. Highly fractured zone 78.1'-78.4'. (Tenmile Formation) Lab No. 10-001847 (77.3'-77.9') UCS=621 psi. Lab No. 10-001848 (80.5'-81.0') UCS=986 psi.			Backfilled with granular bentonite (81.4'-0')	
80									
					(81.4) Bottom of hole.			Bottom of hole 81.4'	
85									
90									
95									
100									

ODOT DRILL LOG CALAPOOYA CREEK.GPJ ODOT_MAN.GDT 8/19/10

LABORATORY TEST RESULTS

Location			Index Testing											
Boring			Soil/Rock Classification			Natural	Atterburg Limits		P - 200	Dry Unit Wt.		Max. Compressive	Resistivity	pH
Hole #	Sample #	Depth (ft)	Description	Unit	USCS	Moisture (%)	LL (%)	PI (%)	(%)	γ_w(lb/ft³)	$E_{50(\%strain)}$	Strength (psi)	Ω	
14813-01	N-1	5.0-6.5	CLAY	Calapooya Unit 2	CH	24.0	66	35	98.2					
14813-01	N-2	10.0-11.5	Sandy SILT with some clay	Calapooya Unit 3	ML	20.0	37	12	54.2					
14813-01	N-3	15.0-16.5	Silty SAND	Calapooya Unit 4	SM	22.0	0	NP	22.9					
14813-02	N-3	15.0-16.5	CLAY	Calapooya Unit 2	CH	29.0	94	62	95.9					
14813-02	N-4	20.0-21.5	CLAY with some sand	Calapooya Unit 2	CH	27.0	50	22	75.8					
14813-02	N-5	25.0-26.5	Silty SAND	Calapooya Unit 4	SM	28.0	0	NP	34.4					
14813-03	N-1	4.2-5.7	Clayay SILT with some sand	Calapooya Unit 2	MH	22.0	50	21	79.9					
14813-03	N-2	9.2-10.7	Clayey SILT with trace sand	Calapooya Unit 2	MH	29.0	52	21	87.5					
14813-03	N-3	14.2-15.7	Silty SAND with trace clay	Calapooya Unit 4	SM	27.0	34	10	28.9					
14813-05	N-3	14.5-16.0	SILT with some clay and sand	Calapooya Unit 2	ML	23.0	39	13	74.1					
14813-05	N-4	19.5-21.0	SILT with some clay and sand	Calapooya Unit 2	ML	23.0	40	14	73.0					
14813-05	N-5	24.5-26.0	Silty SAND with trace gravel	Calapooya Unit 3	SM	18.0	0	NP	31.4					
14813-06	N-3	15.0-16.5	Sandy CLAY with some silt	Calapooya Unit 2	CL	23.0	40	15	67.2					
14813-06	N-4	20.0-21.5	SILT with some clay and sand	Calapooya Unit 2	ML	28.0	41	14	80.9					
14813-06	N-5	25.0-26.5	Silty SAND with some clay and gravel	Calapooya Unit 2	SM	18.0	45	17	39.2					
14813-07	C-5	26.8-27	CLAY	Calapooya Unit 6	CH	35.0	50	28	96.6					

PLASTICITY CHART



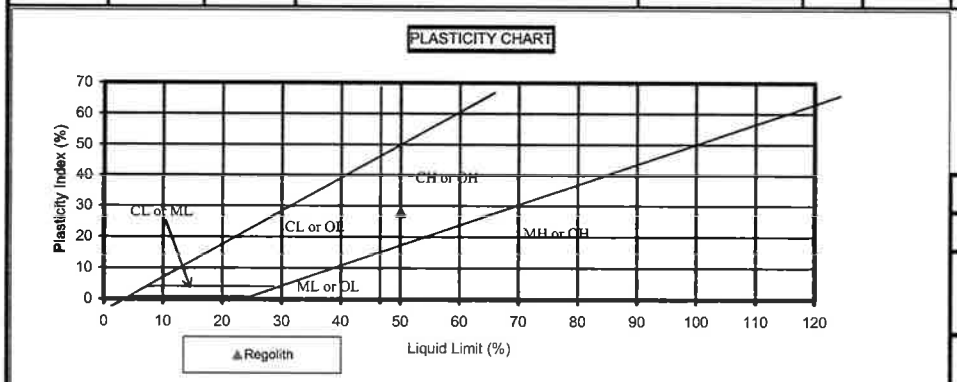
Laboratory Test Results (Soil)

Hwy: 138W: Calapooya Cr. Bridge No. 20861 **M.P. 22.10**
Key # 14813 **Date: 8/2/09**

Oregon Department of Transportation

LABORATORY TEST RESULTS

Location			Index Testing											
Boring			Soil/Rock Classification			Natural	Atterburg Limits		P - 200	Dry Unit Wt.		Max. Compressive	Resistivity	pH
Hole #	Sample #	Depth (ft)	Description	Unit	USCS	Moisture (%)	LL (%)	PI (%)	(%)	γ_w(lb/ft³)	$E_{50(\%strain)}$	Strength (psi)	Ω	
14813-03	C-3	26.1-26.5	Mudstone - No Data, Sample fell apart	Calapooya Unit 6										
14813-03	C-4	31.2-31.9	Mudstone - No Data, Sample fell apart	Calapooya Unit 6										
14813-03	C-5	42.3-42.7	Mudstone - No Data, Sample fell apart	Calapooya Unit 6										
14813-04	C-3	15.3-15.8	Mudstone - No Data, Sample fell apart	Calapooya Unit 6										
14813-04	C-3	16.8-17.5	Mudstone - No Data, Sample fell apart	Calapooya Unit 6										
14813-07	C-1	6.8-7.4	Mudstone	Calapooya Unit 6		7.8				139.8	0.79	598		
14813-07	C-1	10.8-11.4	Mudstone	Calapooya Unit 6		N/R				N/R	0.65	231		
14813-07	C-2	11.4-12.3	Mudstone	Calapooya Unit 6		7.7				140.6	0.41	602		
14813-07	C-3	17.3-18.0	Mudstone	Calapooya Unit 6		N/R				N/R	0.45	619		
14813-07	C-3	18.4-19.1	Mudstone	Calapooya Unit 6		7.6				139.6	0.21	358		
14813-07	C-5	26.8-27.0	Mudstone/Clay Seam	Calapooya Unit 6	CH	35.0	50	28	96.6					
14813-07	C-6	33.4-34.1	Mudstone	Calapooya Unit 6		N/R				N/R	0.19	337		
14813-07	C-7	38.4-39.1	Mudstone	Calapooya Unit 6		8.1				139.7	0.39	619		
14813-07	C-12	63.0-63.9	Mudstone	Calapooya Unit 6		8.0				138.9	0.28	247		
14813-07	C-14	71.6-72.3	Mudstone	Calapooya Unit 6		N/R				N/R	0.58	670		
14813-07	C-14	75.5-76.4	Mudstone	Calapooya Unit 6		8.1				139.8	0.23	622		
14813-07	C-15	77.3-77.9	Mudstone	Calapooya Unit 6		N/R				N/R	0.34	621		
14813-07	C=15	80.5-81.0	Mudstone	Calapooya Unit 6		7.6				140.9	0.83	986		

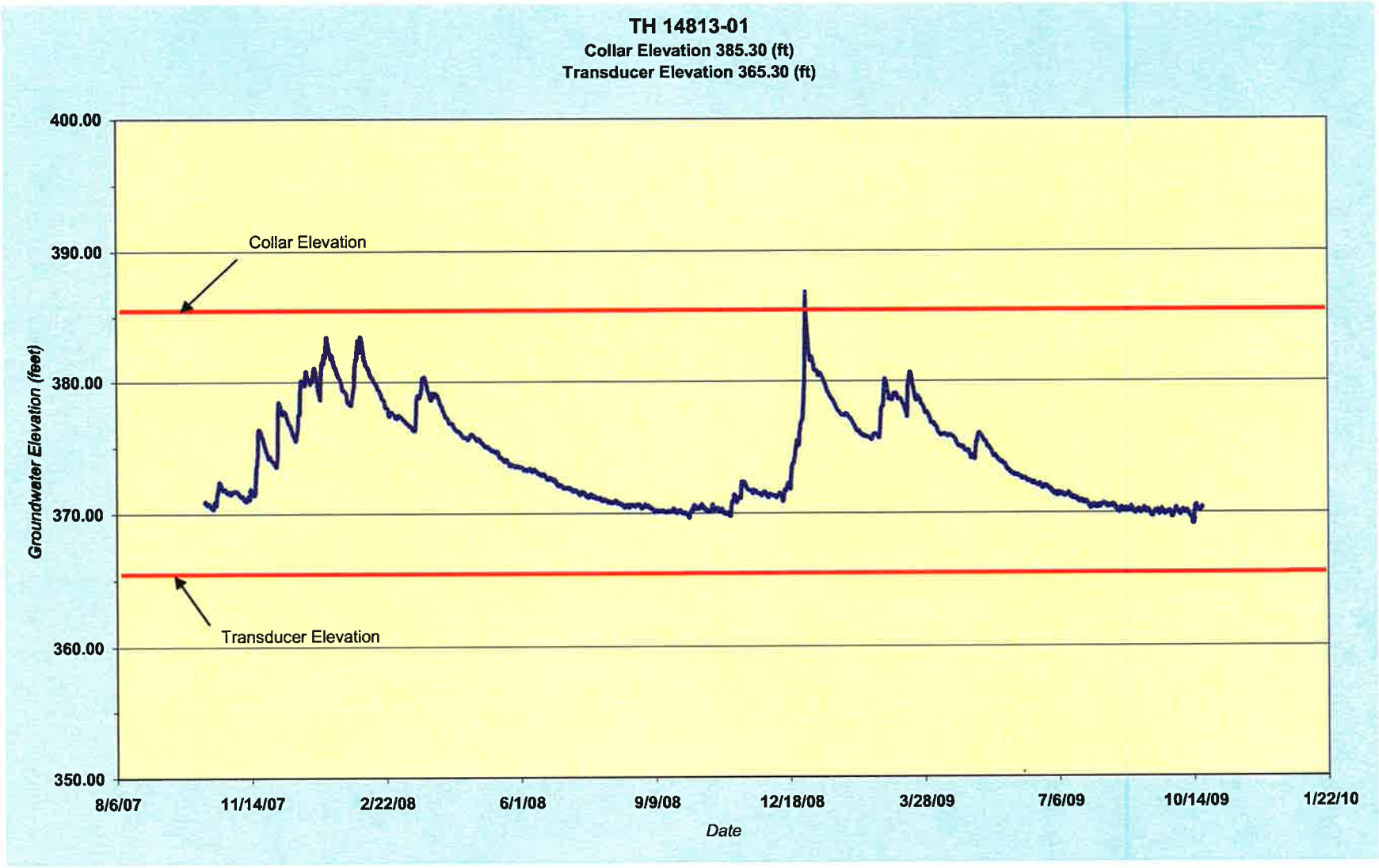


Laboratory Test Results (Core)

Hwy: 138W: Calapooya Cr. Bridge No. 20861 **M.P. 22.10**
Key # 14813 **Date: 8/2/10**

Oregon Department of Transportation

HWY 138 W Calapooya Creek



Transducer S/N 05-14291
Datalogger S/N 550
Programmed 10/10/2007

Recording Timeframe 10/10/07 - 5/16/08
Recording Interval (6 hr)
Data Downloaded 5/16/08
Printed 5/16/08

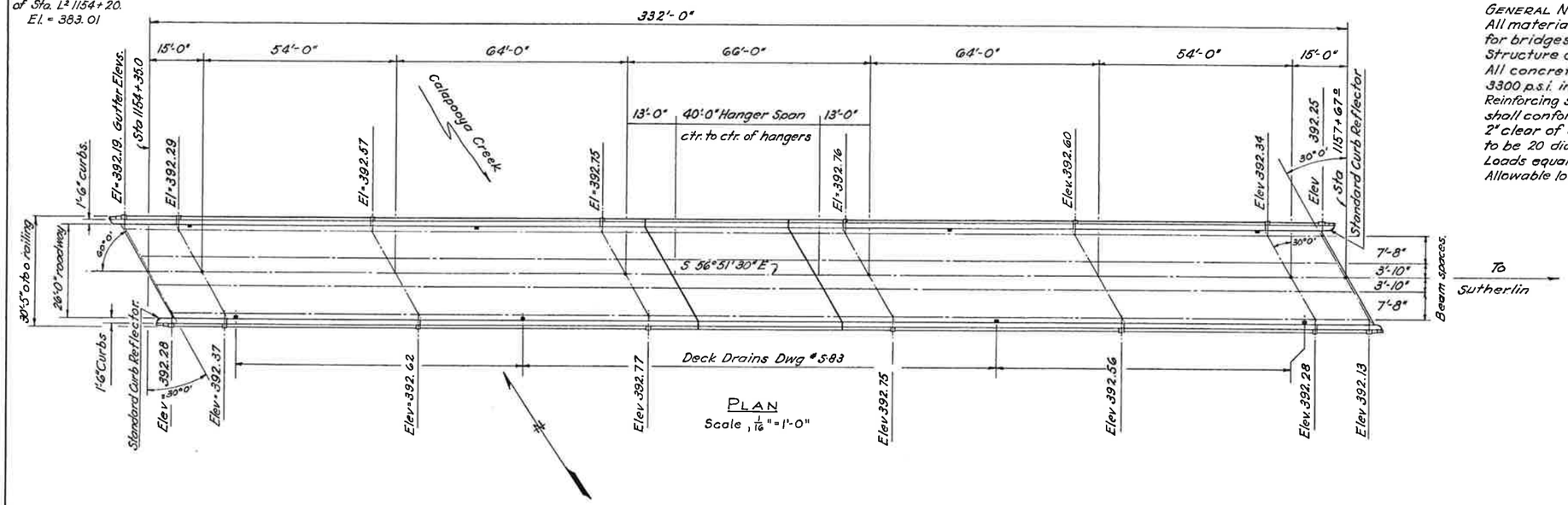
APPENDIX B GEOTECHNICAL AND FOUNDATION REPORT

OR138W: Dodge Cr/Calapooya Cr Bridge Replacements

APPENDIX C GEOTECHNICAL AND FOUNDATION REPORT

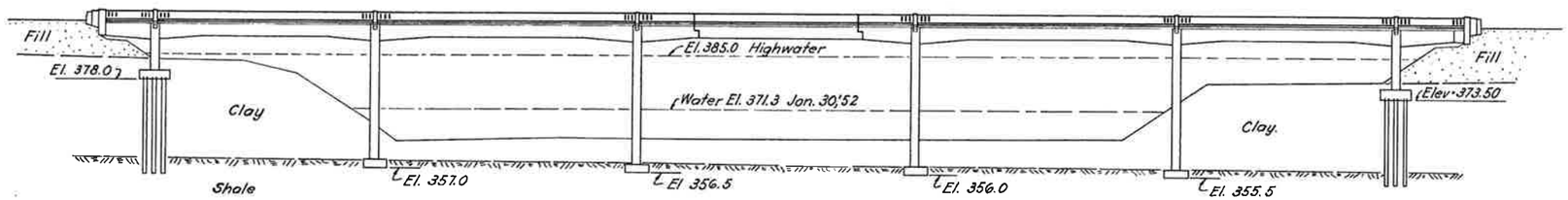
OR138W: Dodge Cr/Calapooya Cr Bridge Replacements

B.M. hub, 93' L of Sta. L² 1154+20. El. = 383.01



PLAN
Scale, 1/16" = 1'-0"

GENERAL NOTES:
All materials & workmanship shall conform to the specifications for bridges, of the Oregon State Highway Department.
Structure designed for H20-S16-44 loading.
All concrete shall be class A mix with a breaking strength of 3300 p.s.i. in 28 days. (fc = 1320 p.s.i.)
Reinforcing steel shall be intermediate grade bars and shall conform to A.S.T.M. specification A 305-49. Place bars 2" clear of concrete face unless otherwise shown. Bar splices to be 20 diams unless otherwise shown. fs = 20,000 p.s.i.
Loads equally distributed to all beams for Moments.
Allowable load on shale = 5 tons/sq ft.



DESIGN DATA

Moments in kips. Note:- all columns fixed. ½ column effective per beam.

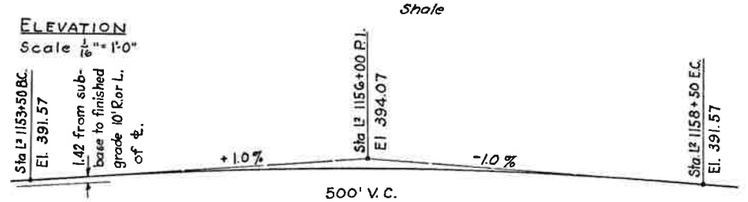
	Cant.	Haunch	54' Span	Haunch	64' Span	Haunch	Cant.	40' Hanger Span.
U.D.L.	0	-183.85	+171.35	-522.65	+179.65	-549.00	0	+280.00
C.D.L.	0	- 5.00	+ 22.00	- 40.50	+ 10.40	- 43.00	0	+ 15.00
C.L.L.	0	-381.26	+518.79	-723.78	+543.49	-566.13	0	+360.52
Total.	0	-570.11	+712.14	-1286.93	+733.54	-1,158.73	0	+655.52

*ULL + 2 concentrated Moment Loads.

Shear in kips

U.D.L	-18.90	+31.60	- 44.00	+ 44.40	- 45.20	+46.20	+28.00	-28.00
C.D.L	- 4.07	2.50	- 3.90	+ 3.30	- 3.26	+ 4.71	+ 2.50	- 2.50
C.L.L.	-27.04	+ 50.28	-50.00	+ 54.12	-52.40	+46.65	+46.65	- 46.65
Totals	-50.01	+ 84.38	- 97.90	+101.82	-100.86	+97.56	+17.15	- 77.15
Reaction	107.85		148.04		151.17		77.15	77.15

ELEVATION
Scale 1/16" = 1'-0"



FINISHED GRADE PROFILE - 10' R. OR L. OF ℄
(Not to scale)

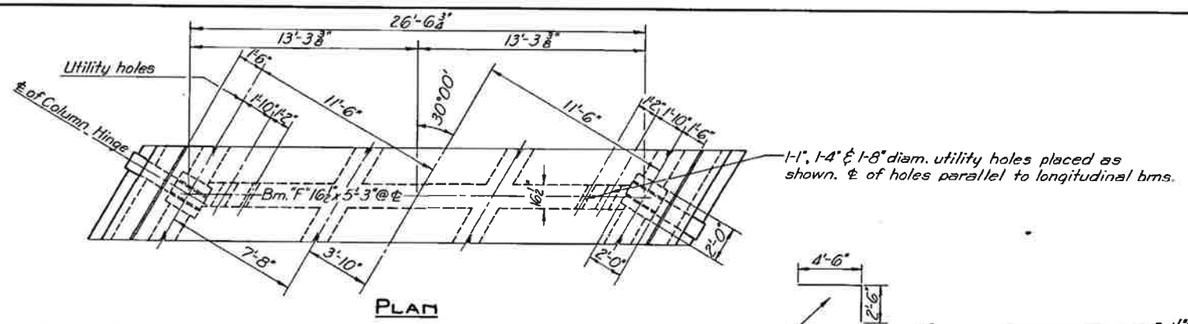
Approved:
Bridge Engineer

FOR INFORMATION ONLY

OREGON
STATE HIGHWAY COMMISSION

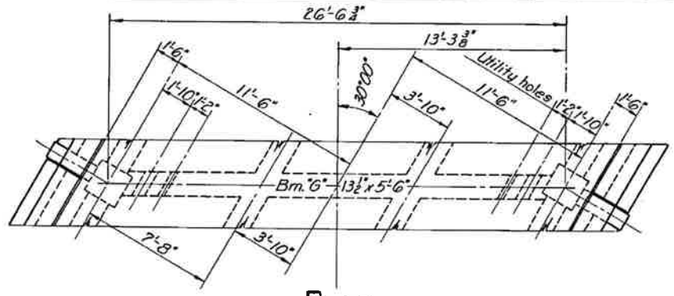
CALAPOOYA CREEK BRIDGE
CALAPOOYA CREEK — SUTHERLIN SECTION
ELKTON-SUTHERLIN HWY — DOUGLAS COUNTY
PLAN AND ELEVATION

SCALE AS NOTED — DRAWN BY C.A.J. — SHEET 1 OF 7
JUNE 24, 1952 — TRACED BY F.H.M. — BRIDGE NO. 7338
CALC BK NO. 303 — CHECKED BY — DRAWING NO 10392
ACCOMPANIED BY DRWGS 10393-94-95-96-97 & S-83

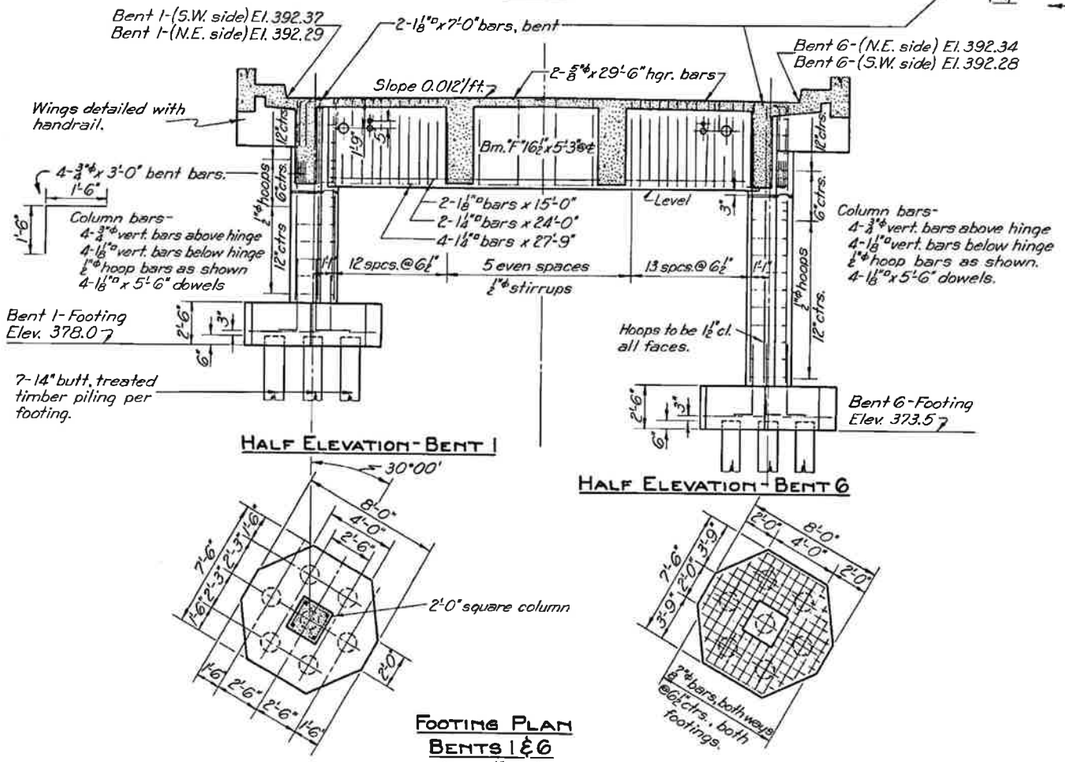


PLAN

1-1", 1-4" ℄ 1-8" diam. utility holes placed as shown. ℄ of holes parallel to longitudinal bms.



PLAN



HALF ELEVATION-BENT 1

HALF ELEVATION-BENT 6

FOOTING PLAN
BENTS 1 & 6
Scale-¼"=1'-0"

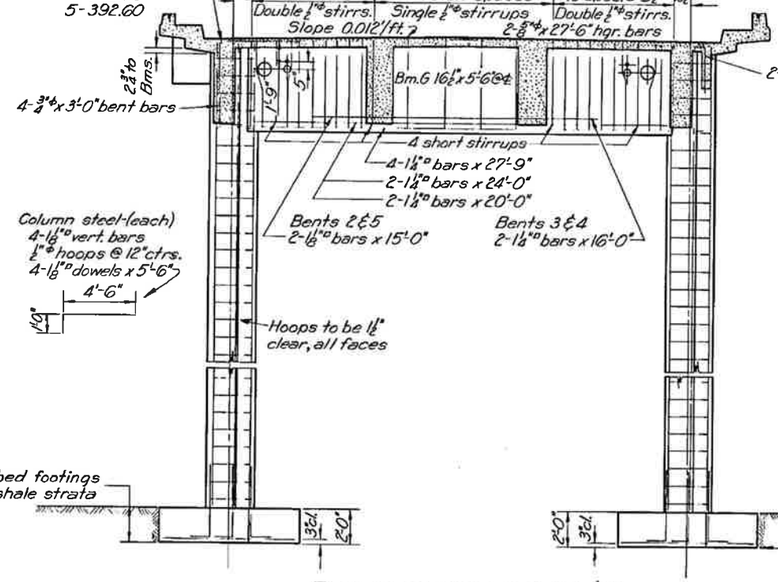
Gutter Elevs.-
N.E. side-Bent 2-392.57
3-392.75
4-392.76
5-392.60

2-1⅛"ø x 7'-0" bent bars

2 added ⅝"ø x 9'-0" hgr. bars

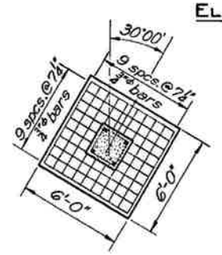
2 added ⅝"ø x 9'-0" hgr. bars.

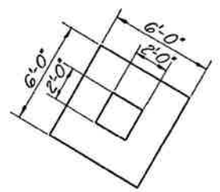
Gutter Elevs.-
S.W. side-Bent 2-392.62
3-392.77
4-392.75
5-392.56



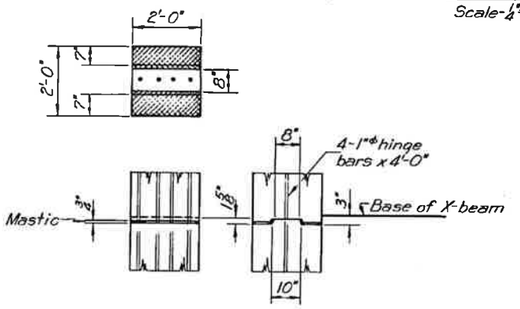
ELEVATION-BENTS 2,3,4 & 5
Scale-¼"=1'-0"

Elevations
Bent 2-357.0
3-356.5
4-356.0
5-355.5

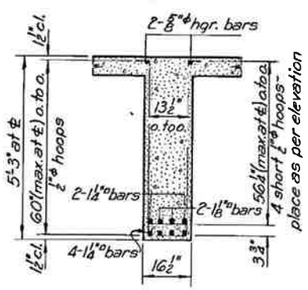




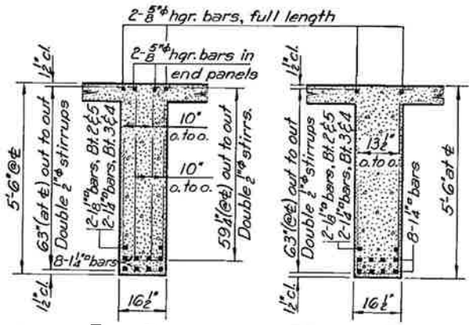
FOOTING PLAN
BENTS 2,3,4 & 5
Scale-¼"=1'-0"



COLUMN HINGE-BENTS 1 & 6
Scale-½"=1'-0"



BM."F"-16½" x 5'-3"
Scale-½"=1'-0"



END PANELS MIDDLE PANEL
BEAM "G"
Scale-½"=1'-0"

FOR INFORMATION ONLY

OREGON
STATE HIGHWAY COMMISSION

CALAPOOYA CREEK BRIDGE
GENERAL BENT DETAILS

Approved:

Bridge Engineer

SCALE AS NOTED
JUNE 25, 1952
CHECKED BY

DRAWN BY C.A.J.
TRACED BY C.O.F.

SHEET 5 OF 7
BRIDGE NO. 7338
DRAWING NO. 10396

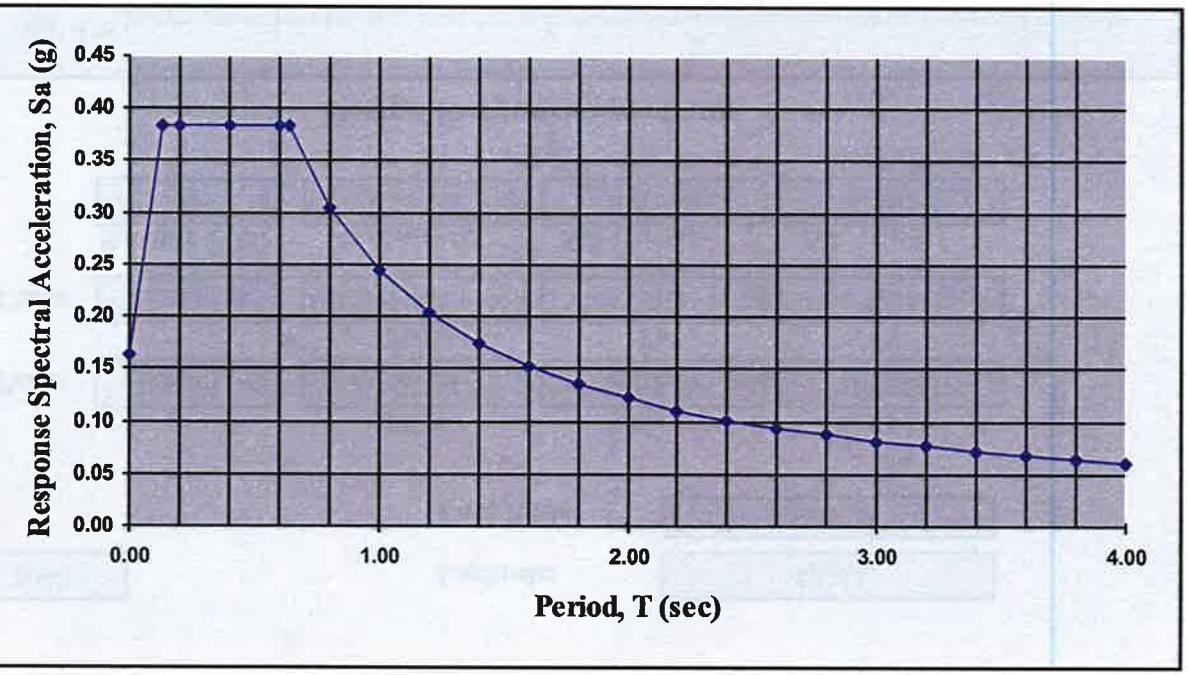
APPENDIX D GEOTECHNICAL AND FOUNDATION REPORT

OR138W: Dodge Cr/Calapooya Cr Bridge Replacements

USGS Data	2002	Latitude:	43.41
		Longitude:	-123.38

		PGA	Ss	S1
Rtn Perio	500	0.1362	0.3193	0.1481
		Fpga	Fa	Fv
Site Class	C	1.2	1.2	1.65
	Seismic Zone	As (FpgaPGA	Sds (Fa*Ss)	Sd (Fv*S1)
	B	0.1634	0.3832	0.2444

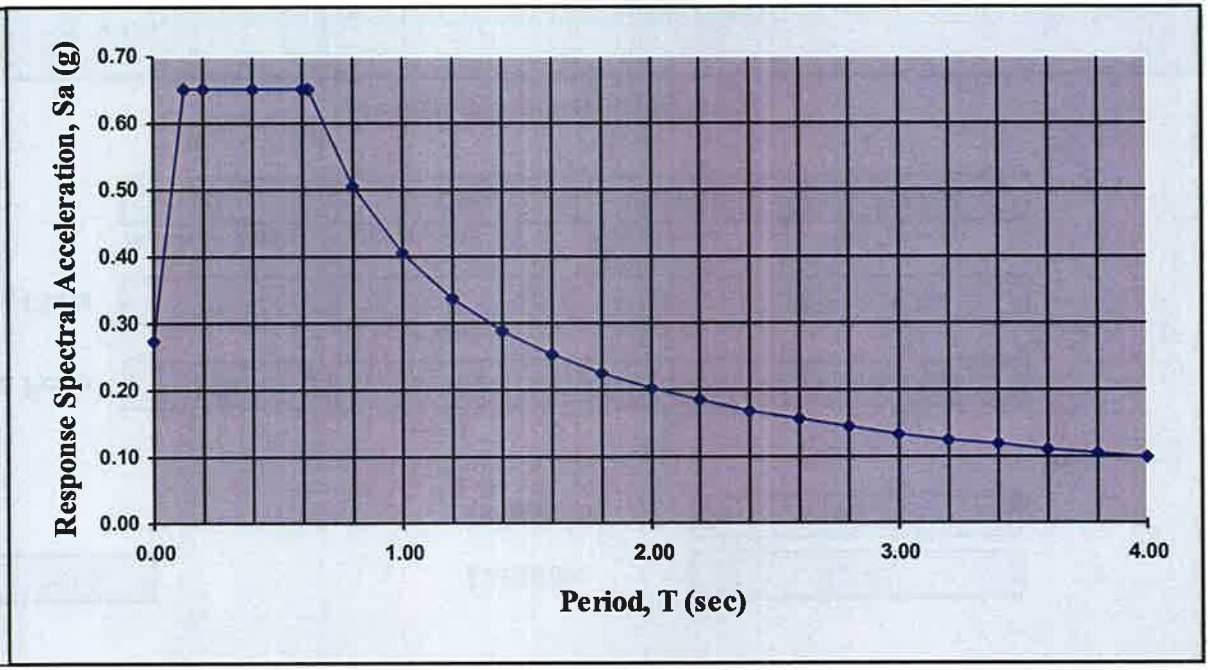
T (sec)	Sa (g)
0.00	0.1634
0.13	0.3832
0.20	0.3832
0.40	0.3832
0.60	0.3832
0.64	0.3832
0.80	0.3055
1.00	0.2444
1.20	0.2037
1.40	0.1746
1.60	0.1527
1.80	0.1358
2.00	0.1222
2.20	0.1111
2.40	0.1018
2.60	0.094
2.80	0.0873
3.00	0.0815
3.20	0.0764
3.40	0.0719
3.60	0.0679
3.80	0.0643
4.00	0.0611



USGS Data	2002	Latitude:	43.41
		Longitude:	-123.38

		PGA	Ss	S1
Rtn Perio	1000	0.2334	0.5525	0.2633
		Fpga	Fa	Fv
Site Class	C	1.17	1.18	1.54
	Seismic Zone	As (FpgaPGA	Sds (Fa*Ss)	Sd (Fv*S1)
	C	0.2731	0.6519	0.4055

T (sec)	Sa (g)
0.00	0.2731
0.12	0.6519
0.20	0.6519
0.40	0.6519
0.60	0.6519
0.62	0.6519
0.80	0.5069
1.00	0.4055
1.20	0.3379
1.40	0.2896
1.60	0.2534
1.80	0.2253
2.00	0.2028
2.20	0.1843
2.40	0.169
2.60	0.156
2.80	0.1448
3.00	0.1352
3.20	0.1267
3.40	0.1193
3.60	0.1126
3.80	0.1067
4.00	0.1014



OR 138: Calapooya Cr. Bridge - Lateral Loading Soil P-y Profiles

Bridge Name: Calapooya Creek
Bridge Number: 20581
Prepared By: J. Lonie on 02Feb10. Reviewed by P. Castro Jan 2010 and updated on 06JUL10 w/ June 2010 Bent 2 drilling and rock testing data

Notes: (Notes for all bents are the same except as noted.)

1) * Ground water level of elevation 380.3 ft was used for seismic design soil unit weights below these elevations are buoyant.
Elevation 380.3 provided in the ODOT Hydraulics Report "OR 138: Calapooya Creek Bridge Elkton-Sutherlin Hwy, MP 22.1 Douglas County" by Bruce Carmichael

2) P-y Curve Criteria Soil Types
1 = Soft Clay (Matlock)
2 = Stiff Clay with Free Water (Reese)
3 = Stiff Clay w/o Free Water (Reese)
4 = Sand (Reese)
5 = Liquefiable Sand model as a 4 under static loads and as a 1 under seismic loads with appropriate inputs. C value of a liquefied sand is a residual undrained shear value.
6 = Liquefiable low to medium plasticity silt model as a 1. Use residual undrained shear strengths for seismic loading.

3) All profiles carried to rock contact.

Bent 1 - Lateral Loading, Soil P-y Parameters

Elevation (ft)	Distance below cap (in)	Soil Description	P-y Curve Criteria	Liquefaction Potential Soil 5 & 6 Seismic Event 500 yr	Liquefaction Potential Soil 5 & 6 Seismic Event 1000 yr	c Soils 1,2,3,6 (psf)	c Soils 1,2,3,6 (psi)	Residual c Soils 5,6 (psf)	Residual c Soils 5,6 (psi)	ϕ Soil 4,5 (deg)	ε_{50} Soils 1,2,3,6	Residual ε_{50} Soils 5,6 (pci)	K Soils 2, 4, 5 (pci)	Cyclic K Soil 2 (pci)	Effective Unit Weight (pci)
387.3	0.00	Bottom of Pile Cap													
		Unit 2	1	No	No	1200	8.33				0.008				0.061
380.3	-84.00	GWT													
		Unit 2	1	No	No	400	2.78				0.02				0.022
373.5	-165.60														
		Unit 4	4	No	No					27			16		0.028
367.7	-235.20														
		Unit 5	4	No	No					30			29		0.028
366.3	-252.00														
		Unit 6	2	No	No	32400	225.00				0.003		2500	1000	0.051
340.7	-559.20	Termination of Hole													

Bent 2 - Lateral Loading, Soil P-y Parameters

Elevation (ft)	Distance below ground (in)	Soil Description	P-y Curve Criteria	Liquefaction Potential Soil 5 & 6 Seismic Event 500 yr	Liquefaction Potential Soil 5 & 6 Seismic Event 1000 yr	c Soils 1,2,3,6 (psf)	c Soils 1,2,3,6 (psi)	Residual c Soils 5,6 (psf)	Residual c Soils 5,6 (psi)	ϕ Soil 4,5 (deg)	ε_{50} Soils 1,2,3,6	Residual ε_{50} Soils 5,6 (pci)	K Soils 2, 4, 5 (pci)	Cyclic K Soil 2 (pci)	Effective Unit Weight (pci)
372.9	0.00	Below GWT													
		Unit 5	5	Yes	Yes			20	0.139	29		0.02	24		0.028
367.9	-60.00														
		Unit 6	2	No	No	32400	225.00				0.003		2500	1000	0.051
291.5	-976.80	Termination of Hole													

Bent 3 - Lateral Loading, Soil P-y Parameters

Elevation (ft)	Distance below cap (in)	Soil Description	P-y Curve Criteria	Liquefaction Potential Soil 5 & 6 Seismic Event 500 yr	Liquefaction Potential Soil 5 & 6 Seismic Event 1000 yr	c Soils 1,2,3,6 (psf)	c Soils 1,2,3,6 (psi)	Residual c Soils 5,6 (psf)	Residual c Soils 5,6 (psi)	ϕ Soil 4,5 (deg)	ε_{50} Soils 1,2,3,6	Residual ε_{50} Soils 5,6 (pci)	K Soils 2, 4, 5 (pci)	Cyclic K Soil 2 (pci)	Effective Unit Weight (pci)
387.9	0.00	Bottom of Pile Cap													
		Unit 1	1	No	No	800	5.556				0.01				0.058
382.8	-52.80														
		Unit 2	1	No	No	600	4.167				0.012				0.061
380.3	-80.40	GWT													
		Unit 2	1	No	No	600	4.167				0.012				0.025
373.6	-160.80														
		Unit 3	4	No	No					34			24		0.025
371.7	-183.60														
		Unit 5	4	No	No					34			60		0.028
366.2	-249.60														
		Unit 6	2	No	No	32400	225.00				0.003		2500	1000	0.051
340.6	-556.80	Termination of Hole													

Unit-1 is Sandy GRAVEL trace to some silt, cobbles and boulders, GW; to Gravelly SAND some cobbles and boulders trace silt and clay, SP; to Gravelly Clayey SILT trace to some clay cobbles and boulders, ML; to Gravelly Sandy SILT some clay cobbles and boulders, ML; to Sandy silt trace gravel, ML; to Gravelly SAND some silt, SP; to Sandy SILT, ML; brown, gray-brown gray, dark gray, nonplastic to medium plasticity, dry to moist, loose to medium dense and medium stiff to stiff, fine to medium sand, fine to coarse gravel. (Fill).

Unit-2 Clayey SILT, ML; to SILT some clay, ML; to SILT some clay trace sand, ML; to Sandy SILT some clay, ML; to Clayey SILT some sand, ML; to Sandy Clayey SILT some gravel, ML; orange-brown, brown, dark brown, some mottling, low to medium plasticity, damp to wet, soft to stiff. (Alluvium)

Unit-3 Silty SAND trace gravel and clay, SM; brown to orange-brown, nonplastic to low plasticity, moist to wet, loose to medium dense, fine to medium grained. (Alluvium)

Unit-4 SAND trace silt, SP; to SAND some silt, SP-SM; to SAND some silt trace clay, SP-SM; brown, orange-brown, gray-brown, some mottling, nonplastic to low plasticity, wet, very loose to loose, fine to medium grained has scattered zones of thin interbedded clayey silt lenses. (Alluvium)

Unit-5 Gravelly Silty SAND, SW; to GRAVEL some sand, GP; brown, dark gray, nonplastic, moist to wet, loose to medium dense, fine rounded gravel, medium to coarse sand. (Alluvium)

Unit-6 MUDSTONE, gray, slightly weathered to fresh, extremely soft to very soft, very close to moderately close jointing, laminated to thin bedded, fissile along some bedding planes, some zones hand friable, some sheared zones with slickensides. (Tenmile Formation)

APPENDIX E GEOTECHNICAL AND FOUNDATION REPORT

OR138W: Dodge Cr/Calapooya Cr Bridge Replacements

SECTION 00512 - DRILLED SHAFTS

Comply with Section 00512 of the Standard Specifications modified as follows:

00512.13 Steel Casing - Delete the sentence that begins "Use casing with an outside diameter...".

00512.18 Grout - Replace this subsection with the following subsection:

00512.18 CSL Cement Grout - Furnish non-epoxy grout or tendon grout from the QPL or furnish a pumpable CSL cement grout consisting of neat cement and water that has a water cement ratio between 0.38 and 0.45. The portland cement for the pumpable CSL cement grout shall meet the requirements of Section 02010.

00512.43(c) Temporary Casing - In the paragraph that begins "Where the acceleration coefficient...", replace the words "acceleration coefficient" with the words "peak horizontal ground acceleration coefficient for the 1,000 year return period" and replace the value "0.10" with "0.16 g (acceleration due to gravity)".

Add the following subsection:

00512.44 Permanent Casing - Furnish and install permanent casing as follows:

Bridge Number	Bent Number	Casing Size	Elevation for Top of Casing (Feet)	Elevation for Bottom of Casing (Feet)
20861	2	8'-0"	372.07	364.40

Perform welding of all permanent casing according to AWS D1.1. Test all full penetration welds using nondestructive methods by either radiograph or ultrasonic methods. Base nondestructive testing acceptance criteria on cyclic tension loading.

After concrete placement, fill all void space between the casing and the shaft excavation with a material that approximates the geotechnical properties of the in-situ materials.

00512.45(d) Concrete Cover - Replace this subsection, except for the subsection number and title, with the following:

Maintain the required concrete cover shown by placing concentric spacer bars or other approved devices around the reinforcing cage. Place spacing devices on minimum 10 foot vertical spacings the full length of the shaft. At each 10 foot level, place spacers on a minimum 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.

00512.48(a) Crosshole Sonic Log Testing - Add the following to the end of this subsection:

For drilled shafts constructed using non-contact splice methods, perform CSL testing after the initial pour to the bottom of the splice region and prior to placement of the column reinforcement and pouring of the splice region.

00512.80(d) Drilled Shaft Concrete - Add the following at the end of the paragraph:

The estimated quantity of drilled shaft concrete is:

Structure	Class	Quantity (Cubic Yard)
20861	4000	93

00512.80(e) Drilled Shaft Reinforcement - Add the following at the end of the paragraph:

The estimated quantity of drilled shaft reinforcement is:

Structure	Quantity Uncoated (Pound)
20861	10520

00512.80(f) Crosshole Sonic Log Equipment Mobilization - Delete this subsection.

00512.80(h) Crosshole Sonic Log Tests - Replace the sentence that begins "No separate measurement..." with the following sentence:

No separate measurement will be made for CSL equipment and operating personnel or for CSL tests performed at the Contractor's option.

00512.90 Payment - Delete the paragraph that begins "Item (f) includes...".

Item (h) includes mobilization of all CSL testing equipment and personnel to and from the site, all CSL testing, interpretation, analysis, electronic data, and final report for each tested and accepted shaft.

SECTION 00520 - DRIVEN PILES

Comply with Section 00520 of the Standard Specifications modified as follows:

00520.11 Engineer's Estimated Length List - Add the following to the end of this subsection:

The Engineer's estimated lengths of steel piling are:

Location	No.	Length (Feet)	Kind
Bridge 20861 – Bent 1	8	40	HP12x84
Bridge 20861 – Bent 3	6	40	HP12x84
Bridge 21162 – Bent 1	6	30	HP14x89
Bridge 21162 – Bent 2	6	35	HP14x89
Bridge 21163 – Bent 1	8	30	HP12x84
Bridge 21163 – Bent 2	8	25	HP12x84

00520.20(d-3) Wave Equation Method - Add the following paragraph and table(s) at the end of this subsection:

The input values for the wave equation analyses are:

Bridge-Bent	Pile Type	Pile Length * (Feet)	Quake (Inches)		Damping (sec./ft.)		% skin (ITYS)	R_n (kips)
			Skin	Toe	Skin	Toe		
20861 - Bent 1	HP12x84	40	0.10	0.10	0.05	0.15	98	890
20861 - Bent 3	HP12x84	40	0.10	0.10	0.05	0.15	98	890
21162 – Bent 1	HP14x89	30	0.10	0.10	0.05	0.15	14	940
21162 – Bent 2	HP14x89	35	0.10	0.10	0.05	0.15	12	940
21163 – Bent 1	HP12x84	30	0.10	0.10	0.05	0.15	7	890
21163 – Bent 2	HP12x84	25	0.10	0.10	0.05	0.15	5	890

* For Wave Equation analyses proposes only these pile lengths are based on the top of the pile being approximately 5 above the finished cutoff elevation. All additional pile length above that elevation, that may be required to accommodate the Contractors pile installation method or site conditions, shall be added to the lengths listed above and appropriate changes made to the skin friction distribution input listed below.

For Bridges 21162 and 21163 use a triangular skin friction distribution.

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For Bridge 20861 use the relative skin friction distribution values listed below in the WEAP analysis:

Bent 1		Bent 3	
Depth* (Feet)	Relative Distribution	Depth* (Feet)	Relative Distribution
2.0	0.0	2.0	0.0
11.3	1.2	6.4	1.4
16.3	0.4	7.4	1.4
18.8	0.2	12.4	0.6
24.6	0.2	15.4	0.7
25.8	0.7	17.3	0.7
26.0	32.4	17.4	0.8
36.6	32.4	22.4	0.8
		22.8	32.4
		33.4	32.4

* Depths are depth below finished cutoff elevation; assume approximately 4 to 7 ft. stick up above this level.