BLAMO Requirements Document

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v1.1

Abstract

The Borehole Logging Application Made for Oregon (BLAMO) project, developed for use by Dr. Matthew Evans and associated parties, serves to modernize the data collection process of borehole logging operations. The application aims to provide mobile front-end interfaces for data collection and automated back-end functionality for data storage and conversion for use in the field by researchers in outdoor environments.

The project will be considered complete once a product has been delivered that meets all milestones and fills the clients needs of remote borehole data collection and storage. This will be ensured by constant communication between all parties, vigorous peer-review practices and preemptive milestone and timeline planning.

Contents

I. Introduction

A. Purpose

The purpose of this software is to modernize the current borehole logging process. Instead of writing down the data in the field and returning to an office to manually enter the data into a software application that then produces a drill log document, a mobile application could be developed with all necessary functionality. This application should take user input and output a professional drill log document that can be shared and transposed onto an aggregated map of borehole data.

B. Scope

The app, titled Borehole Logging Application Made for Oregon (BLAMO), will be utilized in the field to log boreholes and then create drill logs. These drill logs will be stored using a cloud service provider, which will be linked to geographic borehole locations using GIS software. This application will be developed with the intent of replacing handwritten forms, so its user interface for logging boreholes will mirror the process that users are already familiar with. This log will have entries for project, purpose, location, hole ID, workers, equipment, depth and a test description for every depth at which one was performed.

Once all the information for one borehole has been entered into the application, it will create a drill log document in the selected format. This document will be shared using a cloud service provider for the purpose of creating remote backup to improve accessibility to potential third parties. Due to the current logging process, there is a delay between the logging of the borehole and the creation of a drill log document due to the nature of manual recording. This application will reduce the delay as a drill log can be shared almost instantly after the necessary borehole information has been recorded.

Finally, these drill logs should be linked with the drill site using ArcGIS, which will provide a visual, interactive representation of drill sites.. This would allow users to discover sites using a map interface and view associated information, which will be useful for projects with a large number of logged boreholes. Additionally, it can also be used to view previous work done in an area the user is interested in.

C. Product Overview

1) Product Functions: The major functions of this software are:

- Get user input for general borehole information.
- Get user input for each test that was performed.
- Generate drill log document.
- Share drill log document.
- Link drill log to drill site.

2) User Characteristics: The users of this software should generally be well-educated and well-versed in soil and rock analysis. As such, field specific terminology and abbreviations can and should be used throughout the user interface. The users will be accustomed to a different process for logging boreholes and creating drill logs, but they should have experience with mobile interfaces and thus learnability should not be a problem.

3) Limitations: One limiting factor is the availability of a stable internet connection when the user is in the field. In many cases this should not be a problem and as coverage continues to increase this should be less and less of a problem. Another possible limitation is a potential lack of local and/or remote storage space. While these documents are small (on the order of hundreds of KB), there will be an ever-increasing number of them, which means that storage space must be considered a limitation despite its abundance. A final limitation is mobile device interface real estate. A lot of information must be recorded by the user, therefore an efficient method of logging must be designed to prevent user frustration and promote accessibility. If technology such as speech-to-text is used to address this concern, then there may be limitations with that as well.

D. Definitions

- ArcGIS : A geographic information system (GIS).
- gINT : Geotechnical and geoenvironmental software, distributed by Bentley
- Kotlin : A general-purpose programming language, supported by Google, primarily used for developing mobile applications for Android.

II. Specific Requirements

A. External Interfaces

Interfaces in the context of software development as a whole can be partitioned into two categories: internal and external. Internal interfaces are those that we as developers have full access to and control over. We control all portions of the application that are internal, and can diagnose problems accordingly. External interfaces are those that we don't have direct control over, or are managed by a third party.

In the context of the BLAMO project, potential external interfaces include the commissioned cloud service(s), gINT and Esri ArcGIS. Cloud services will be required to remotely update the database with data collected in the field through the application. We likely do not have the capabilities to provide this service ourselves, so we will likely need to outsource.

Part of the BLAMO project requirement is to create a visual printout summarizing select data sets. Currently, gINT's output is the standard for borehole logging. As such, it may be prudent for the application to pipe collected data through gINT and collect the output programatically, which would introduce an additional external interface. However, there are a number of potential roadblocks that come with this option regarding gINT's proprietary development practices, and it may be necessary to circumvent gINT entirely. Similarly, the project has a stretch goal of automatically updating a GIS database and display with collected data. We would face similar compatibility hurdles with ArcGIS as we will with gINT, and as such a workaround may be required.

B. Functions

The BLAMO application serves to fill the borehole logging needs of Dr. Evans and associates. Currently, the client is recording data manually by hand in the field which provides a number of issues for data collection, such as data loss due to illegibility of handwriting, inclement weather, debris-stained paper, etc. Creating an application for remote data collection resolves these issues while increasing the speed of collection by uploading data directly to a database from the field. This data should then be formatted into a visual summary similar to the output of gINT.

Additionally if development allows, the collected data should be imported into another existing database with GIS compatibility, creating a visual aggregate of all collected data on a geographic representation. The BLAMO app will serve to expedite the process from data collection to GIS importing.

C. *Usability Requirements*

The BLAMO application will primarily be used in the field by those collecting data. There are a number of needs that the application will need to meet in this situation relating to accessibility and ease of use.

Primarily, the app should be equally usable in both phone and tablet aspect ratios, as these are the two devices that the data collection will take place on the majority of the time. As an extension of this, the application should be easily usable and designed for use with both one hand, two hands, and a stylus available, as users will potentially be recording in inclement weather conditions with gloves on.

Due to the large amount of data fields required and limited screen real estate, data should be grouped into categories and displayed in groups over a number of pages. Pages are easily accessible from one another, and can be returned to once data has been entered. Data categories should be based off of the visual output provided by the gINT summary, as that is what most users will be familiar with.

Data should be uploaded to the cloud automatically, and ideally the user should have minimal interaction with the process, save a confirmation toast or notification upon transmission completion. If connection cannot be made, the application will, at the user's discretion, either upload when a connection can be made, postpone upload until manual confirmation, or upload over USB at a later time.

Beyond this, the back-end processes, such as SQL queries, data conversion, summary creation, etc, should be hidden from the user by default to further emphasize the data collection aspect of the product. Users can enable notifications for completion or for varying stages of the process, such as initialization and termination.

D. *Performance Requirements*

The performance requirements for this product are heavily weighted towards the user interface. The mobile application must be responsive, intuitive, and reliable without data loss even if the device crashes. Specifically, the pages that the user will be filling out must support all fields outlined by the data sheet provided by the client and the capacity to add as much detailed comments as possible. This allows for a complete recording of the user's work and flexibility to add extra detail when necessary.

There will only be a need for one user per mobile application. This device is required to work without any internet connection. Once an internet connection is available it needs to interface with the server to allow a user to upload their completed data sheet. From connection to storage, the server should process all received data in less than a minute.

Considering that this is a low user base application, the server will only be required to handle small quantities of data. This data will be need to be appropriately inserted into the database for storage. The database itself will only require a small amount of pooled connections readily available. Maximum of 50 connections in a pool should suffice for any server interactions and direct connections from administrators.

E. Logical Database Requirements

1) Type of information: All of the information being saved into the database will be borehole drilling log data. This data will be received as chars and floats into the appropriate table, converted to other formats as needed.

2) Frequency of use: The frequency of use for this database will be very low. This will only be accessed after an engineer has completely filled out his log and wants to submit it for saving or by an administrator. As such, there will be relatively minor scaling issues for connections or access by users.

3) Accessing capabilities: The database will only be accessed directly from the server that processes the logging reports and administrators that can directly query. There will be no other forms of access to this database.

4) Data Entities and Their Relationships: The data entries will be appropriately set up in database tables that correctly relate each field to a given chunk that is designated from the logging sheet. These will relate back to the main table that holds the time of logging creation and location. Breaking up the data sheet into smaller associated chunks will help us create a clean database structure while allowing us not to have tables with a high amount of columns.

5) Integrity Constraints: There will be one submitted forum with a unique identifying key value pair that consists of the date and location for logged data. This unique constraint will allow each data sheet to be pulled with all of its pertinent information. This also allows for no cross contamination and maintains valid data throughout the database. Each relational table that is populated for each field entry will have a foreign key restraint that relates back to the original unique restraint for that particular entry.

6) Data Retention Requirements: The data should be indefinitely retained because the database will serve a source of truth and a resource point for all engineers and scientists looking to aggregate the data. This may change in the future once all of the information has been processed properly and the application can directly pipe the logged data into a different platform altogether.

F. Design Constraints

The scope of this project is rooted from an educational and public standpoint. Therefore, the greatest constraint is the overall cost of the project to develop and maintain. This leads to not being able to use any of the expensive proprietary software that would aid us in this implementation. Alongside the implementation, there is the constraint on what platform we use to store the recorded data. Oregon State University will probably be able to provide us with server space for our database but this can be problematic because the servers are not open access and blocked behind strict networking rules. A solution to this will have to be middle ware that the requests go through one authentication that has access to the OSU network. Since this is a mobile application, we are restricted to the processing constraints of a tablet running android or iOS.

G. Software System Attributes

1) Reliability: System reliability is imperative to our project. We plan to implement reliability by establishing an auto-save feature. This auto-save feature will allow the data to backup after every text entry, ensuring that the data is always present. Having a solid foundation for data dependency, guarantees minimum to 0 loss in data. This "data contract" will persist through power cycles, app failures, and device damage (assuming memory is still intact). Additionally, auto-saves will help support our goal of ensuring paperless systems benefit over physical data entries.

Application faults (i.e. bugs and crashes) will be minimized. To reduce the number of crash scenarios and bug encounters, we will write rigorous automated and iterative unit tests. Testing will be implemented with 100 percent line and branch coverage to aid in producing thorough results. Lastly, the tests will primarily be black-box, white-box as needed, to guarantee objects are maintaining their functionality, and that implementation follows a logical execution. Testing will be a safety net to ensure product viability and minimize negative user experiences.

Data integrity is important to our application due to the user reliance on accurate data. Allowing data to be manipulated by unauthorized users would violate the credibility of the data, and thus we will implement security measures for the database to support data integrity. The security measures will take on the form of user login for submissions or modifications going to the server, SQL injection protection, and authorized access for data requests. Additionally, it would be important to log upload date/time and modification time stamps for both data logging and security purposes.

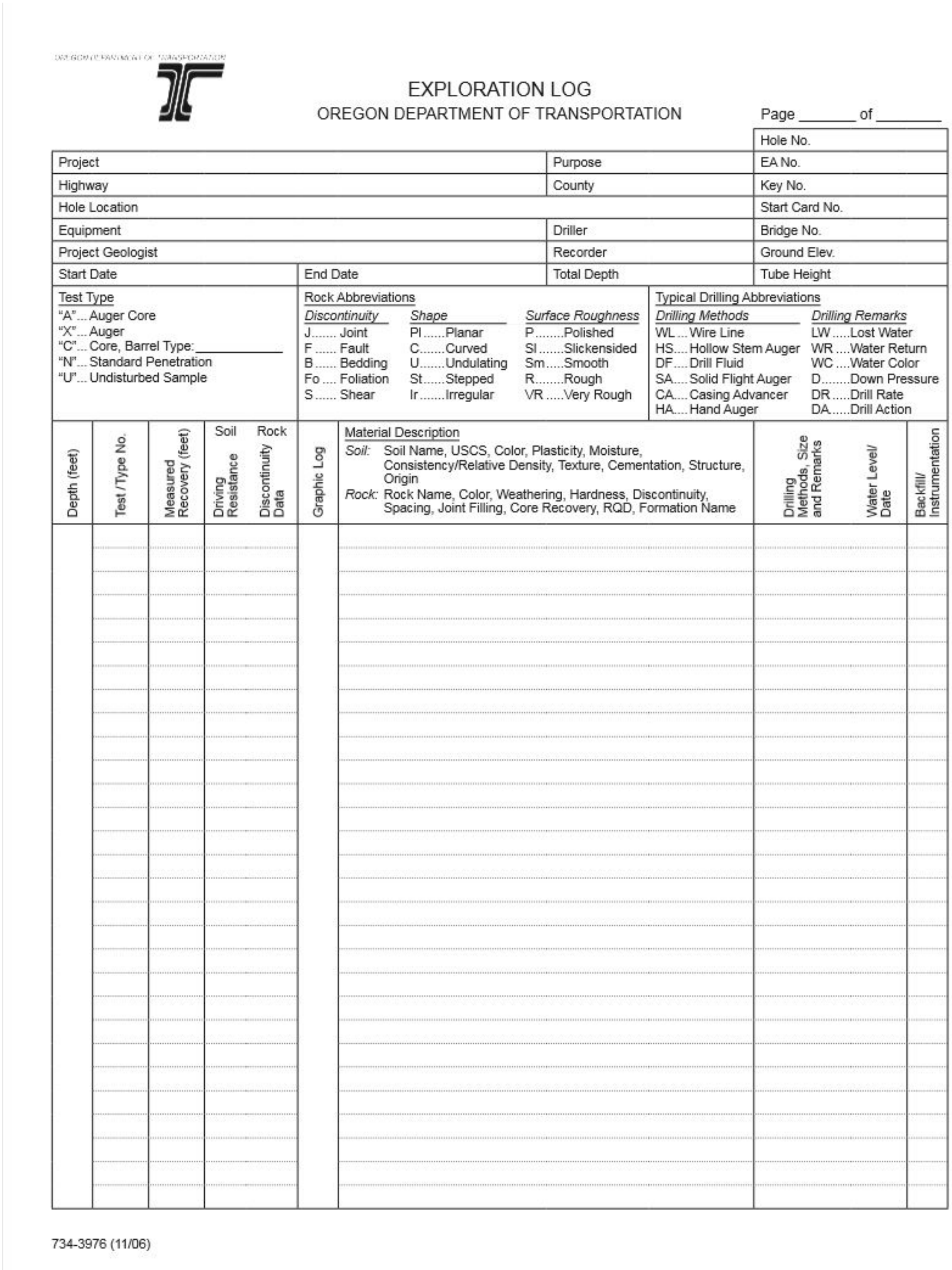
2) Maintainability: Program maintainability will be a strong point of focus for this project, as it may be passed on to other developers and scientists to use and change as their needs develop beyond our outlined scope. Focusing strongly on documentation and modular functionality will be crucial to keeping this project accessible for future Senior groups, and Geologists alike. Limiting concepts might include recursive operations, pointers, and data formatting. To produce a maintainable system, it will be of the utmost importance that we document how future users can modify and update this system in a way that won't compromise its functionality or design.

Modularity will take form in the use of APIs, interfaces, and Logically segmented files. API's will guarantee certain I/O and will need to maintain that contract it has with the application for functionality, thus should not be changed unless absolutely necessary. Interfaces will help enforce rules about objects that the application depends on. Lastly, logically segmenting files will allow future users/developers to easily understand what i/o goes where, and what to change if they have any future needs.

3) Portability: As our application develops, a stretch goal would be to port this android app to iOS. To facilitate this, we will develop using the Kotlin language for its multi-platform support. This will help the contract holder to allow students and scholars to use their own preferred platform outside of school provided devices. Allowing users to choose the platform of their choice will broaden the potential user-base of the application.

H. Supporting Information

The BLAMO: Borehole Logging Application project is setting out to build a paperless system for geologists and students to use for recording data. The paper form our application will be replacing is the ODOT (Oregon Department of Transportation) form 739-3976, and looks like:



OREGON DEPARTMENT OF TRANSPORTATION

EXPLORATION LOG

OREGON DEPARTMENT OF TRANSPORTATION

Page _______ of ________

		Hole No.
Project	Purpose	EA No.
Highway	County	Key No.
Hole Location		Start Card No.
Equipment	Driller	Bridge No.
Project Geologist	Recorder	Ground Elev.
Start Date / End Date	Total Depth	Tube Height

Test Type
"A"... Auger Core
"X"... Auger
"C"... Core, Barrel Type: ____________
"N"... Standard Penetration
"U"... Undisturbed 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 Flight Auger	D........Down Pressure
CA.... Casing Advancer	DR .....Drill Rate
HA.... Hand Auger	DA .....Drill Action

Depth (feet)	Test /Type No.	Measured Recovery (feet)	Soil: Driving Resistance	Rock: Discontinuity Data	Graphic Log	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, RQD, Formation Name	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation

734-3976 (11/06)

Fig. 1. ODOT Form 739-3976

This form will be replaced by a digital form with a series of text fields, check lists, and other informational fields for users to fill out and log.

III. Verification

The project will be considered complete once we as developers have delivered a product that meets all milestones and fills the clients needs of remote borehole data collection and storage.

In order to keep the project moving fluidly and ensure project milestones are met on time, we will maintain an open line of contact directly to the client and provide regular updates to all parties involved as to the status of the project. Time estimates will be created ahead of time, prioritizing critical features, and adjusted with prior notice if necessary.

Due to the large scope of the project, it may be the case that development of the ArcGIS capability is not completed during the time frame of this project. The client is aware of this possibility, and time estimates will be revisited and reevaluated often to ensure the project is completed in a satisfactory manner.

IV. Appendices

Included are examples of a handwritten form, and a final drill log document. As well as a tentative timeline for development.

Oregon Department of Transportation

EXPLORATION LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. TB-1
Project IOWA ST. VIADUCT REP'L	Purpose MONITORING	E.A. No. N/A
Highway 001 MP 28F	County MULTNOMAH	Key No. 14949
Hole Location 11'E, 4'S of staked location		Start Card No.
Equipment CME 75 TRACKED	Driller JOEL / CASCADE	Bridge No. N/A
Project Geologist S. HAY	Recorder J. LAUER	Ground Elev. ~253'
Start Date 1-7-08	End Date 1-9-08 / Total Depth 90'	Tube Height

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

Depth (~~meters~~) ft	Test Type, No.	Measured Recovery (inches) (~~meters~~)	Soil: Driving Resistance / Rock: Discontinuity Data	Graphic Log	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, RQD, Formation Name.)	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
				ML		0- 10" HSA		
	N-1	16	3-4-5 (9)		N-1 2.5-4.0 SILT, ML, brown w/ gray-brown mottling, low plasticity, moist, stiff, homogeneous w/ tr. f. sand [Fine-grained Flood Dep.]			
5	N-2	12	3-4-5 (9)		N-2 5.0-6.5 gray and red-brown mottling			
	N-3	14	2-3-5 (8)	ML	N-3 7.5-9.0 intergrading SILT, as above but med. stiff to stiff, and SANDY SILT, f. sand, weak horiz. layers			
10	N-4	12	3-4-6 (10)	ML/SM	N-4 10.0-11.5 intergraded SILT to SANDY SILT, as above but stiff and SILTY fine SAND, SM, NP to low plasticity, moist, loose to med. dense, horiz. layers			
	N-5	12	3-3-4 (7)	SM	N-5 12.5-14.0 SILTY SAND, SM, pale yellow, NP, moist, loose, ~~massive~~ homogeneous, micaceous			
15	N-6	24	PUSH (ST)		N-6 (Shelby) 15.0-17.0			
	N-7	18	2-3-3 (6)		N-7 17.5-19.0 as above with fine orange oxydization banding as horizontal layers, occasional wood fragments			
20	N-8	NR	3-4-6 (10)		N-8 20.0-21.5 as above	no recovery @ 20'		
				ML				
25	N-9	18	2-2-5 (7)		N-9 25.0-26.5 SILT, ML, dark gray, med. plasticity, moist, med. stiff, homogeneous, micaceous			

Depth ft	Test Type, No.	Measured Recovery (inches)	Driving Resistance / Discontinuity Data	Graphic Log	Material Description	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
30	N-10	18	5-10-11 (21)	ML	N-10 30.0-31.5 CLAYEY SILT, ML, dk gray, med. plasticity, moist, very stiff, weak subblocky structure.			
				ML				
35	N-11	18	9-8-11 (19)		N-11 35.0-36.5 SANDY SILT, ML, light tan, low plasticity to NP, moist, v. stiff, homogeneous			
40	N-12	12	5-9-13 (22)	ML/SM	N-12 40.0-41.5 intergraded SANDY SILT, as above, w/ SILTY SAND, SM, lt. tan, NP, moist, med. dense, f. sand.	COB 1-7-08		
				SM				
45	N-13	4	50/1"		N-13 45.0-45' SILTY fine SAND, SM, light tan, NP, moist, very dense, homogeneous			
50	N-14	18	21-17-18 (35)		N-14 50.0-51.5 as above but dense			
55	N-15	18	14-34-27 (61)		N-15 55.0-56.5 intergraded SILTY SAND, as above but very dense, with SANDY SILT, ML, tan w/ dk brown staining, low to v. low plasticity, moist, hard, f. sand, tr. oxidization banding	drill action indicates gravels 57-60'		
				ML				
60	N-16	4	50/3"		N-16 60.0-60.3 SILT w/ SAND & GRAVEL, ML, dk brown to gray-brown, v. low plasticity to NP, moist, very hard, angular, decomp. basalt and quartzite gravels w/ silt + sand matrix-supported conglomerate, weakly cemented [Troutdale Fm?]			
				CL/GC				
65	N-17	18	28-29-32 (61)		N-17 65.0-66.5 LEAN CLAY w/ SAND + GRAVEL to CLAYEY GRAVEL, CL/GC, lt. gray to red-brown, med. plasticity to NP, very hard + very dense, angular decomposed basalt gravels in clay + sand matrix, occ. clast-supported, uncemented [decomp. CRB]			
70	N-18		45-50/6"		N-18 70.0-71.0			
	C-1	27	(9.5/12")		C-1 70.0-73.2			
					70.0-72.5 - as above			

Oregon Department of Transportation

EXPLORATION LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. TB-1
Project IOWA ST. VIADUCT REP'L	Purpose MONITORING	E.A. No.
Highway 001, MP 28F	County MULTNOMAH	Key No. 14949
Hole Location 11'E, 4'S of stake		Start Card No. N/A
Equipment CME 75 TRACK	Driller JOEL / CASCADE	Bridge No.
Project Geologist S. HAY	Recorder J. LAUER	Ground Elev. ~253'
Start Date 1-7-08	End Date 1-9-08 / Total Depth 90'	Tube Height

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

Depth (~~meters~~) ft	Test Type, No.	Measured Recovery (inches) (~~meters~~)	Soil: Driving Resistance / Rock: Discontinuity Data	Graphic Log	Material Description	Drilling Methods, Size and Remarks	Water Level/ Date	Backfill/ Instrumentation
			scattered gravel-sized basalt frag	GC / BSLT	72.5-73.6 BASALT, dk gray, mod. weathered, med. hard (R-3), individual gravel-sized corestones in clay/silt matrix, tr. secondary mineralization, 67% rec., 0% RQD [decomp. CRB]			
	C-2	12			C-2 73.5-75.5 as above, 50% rec., 0% RQD			
75	C-3	24	occ. cobble-sized basalt frag.		C-3 75.5-80.5 as above, some vesicles, trace yellow clay infilling, 40% rec., 15% RQD			
					grades to v. close to close open fractures w/ trace clay infilling			
80	C-4	6	3 joint sets: vert, horiz and 45°		C-4 80.5-80.6 as above, 100% rec., 0% RQD			
	C-5	22			C-5 80.6-83.6 as above, 71% rec., 20% RQD			
	C-6	12			C-6 83.6-85.0, as above, 67% rec., 0% RQD	COB 1-8-08		
85	C-7	12	much small broken gravels		C-7 85.0-86.2, as above, 100% rec., 0% RQD			
	C-8	6			C-8 86.2-88.0 as above, 25% rec., 0% RQD			
	C-9	12			C-9 88.0-90.0, as above, 50% rec., 0% RQD			
90					Boring completed @ 90 ft. GW not observed during drilling.			
95								
100								

DRILL LOG

OREGON DEPARTMENT OF TRANSPORTATION

		Hole No. 1-2000
Project Klamath Falls Port of Entry	Purpose Retaining Wall Foundation	E.A. No. C0181430/000
Highway The Dalles-California (US 97)	County Klamath	Key No. 08945
Hole Location Northing: 67,032.30 Easting: 1,392,252.99		Start Card No.
Equipment 93-991	Driller Dave Johnson	Bridge No.
Project Geologist Kris Iverson	Recorder Kris Iverson	Ground Elev. 1286.99m
Start Date April 19, 2000 / End Date April 19, 2000	Total Depth 7.32m	Tube Height

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

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, RQD, Formation Name.

Depth (meters)	Test Type, No.	Percent Recovery	Soil: Driving Resistance / Rock: 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 - 0.3 Sandy GRAVEL (Shoulder Aggregate); GP; Variegated Gray; Nonplastic; Moist; (FILL);		Used Bentonite Mud Drill Fluid; Advanced with 0.1 m Tricone Bit and NW Rod (Open Hole).		
1	N1	80.0	2-3-21	102.5	N-1 (0.76 - 1.22) Elastic (Diatomaceous) SILT with Some Sand; MH; Light/Medium Brown (Variegated); High Plasticity; Wet; Medium Stiff/Medium Dense; Lensed; Pushed Gravel/Cobble In Final 0.15 m, LL=105/PI=34; (Fill)	0.3 - 2.13 Elastic (Diatomaceous) SILT with Some Sand and Gravel (Possible Cobble); MH; Variegated: Light Brown/Brown/Black; High Plasticity; Wet; Medium Stiff/Medium Dense; (FILL);				
	N2	7.0	9-9-8		N-2 (1.52 - 1.98) GRAVEL; GP; Black; Nonplastic; Wet; Medium Dense; Gravel Stuck In Shoe of Sampler; (Fill)					
2	N3	69.0	5-10--25/0.10	26.1	N-3 (2.29 - 2.68) Sandy SILT with Some Gravel; MH-GM; Variegated: Medium Brown/Black; Medium Plasticity; Wet; Very Stiff/Very Dense; Homogeneous; Bounced on Rock, LL=58/PI=26; (Colluvium)	2.13 - 2.68 Sandy SILT with Some Gravel; MH-GM; Medium Brown/Black (Variegated); Medium Plasticity; Wet; Very Stiff/Very Dense; (COLLUVIUM);				
3	C1	100.0	RQD = 37		C-1 (3.02 - 4.27) BASALT (and Basalt Flow BRECCIA); Black; Slightly Weathered to Fresh; Hard (R4); RQD = 37; Very Close and Close Jointed; Breccia Zones: Sand/Gravel Size Basalt Fragments with Diatomaceous Silt Matrix; (Pliocene/Pleistocene Lavas)			Triconed to 3.02 m, then advanced with HQ Coring. Used 3.05 m (10 ft) Core Barrel.		
4	C2	100.0	RQD = 35		C-2 (4.27 - 7.32) BASALT (and Basalt Flow BRECCIA); Black; Slightly Weathered; Hard (R4); RQD = 35; Very Close and Close Jointed with Some Healed Jointing; Some Diatomaceous Silt Infilling to 4.66 m, then Silty Sand Infilling and Thin (0.1 m), Silty Sand Interbeds; (Pliocene/Pleistocene Lavas)	2.68 - 7.32 BASALT and Basalt Flow BRECCIA; Black with Brown; Slightly Weathered to Fresh; Hard (R4); Very Close to Close Jointed; Diatomaceous Silt and Silty Sand Infilling and Few Thin Silty Sand Interbeds; (PLIOCENE/ PLEISTOCENE LAVAS);				
5										
6										
7								Backfilled with 3/8 Bentonite Chips		
8										

TASK NAME	START DATE	DAY OF MONTH*	END DATE	DURATION* (WORK DAYS)	DAYS COMPLETE*	DAYS REMAINING*	TEAM MEMBER	PERCENT COMPLETE
Phase 1								
Design Android Application (UML, Tasks)	11/1	1	11/12	17.13433723	11	6.134337234	Group	100%
Proto-type UX	11/1	1	11/12	11	8.8	6.134337234	Group	80%
Implement I/O Systems	1/20	20	2/6	17	10.2	86.13433723	TBA	60%
Implement UX	1/20	20	2/7	18	7.2	86.13433723	TBA	40%
Implement Data Formatting	1/20	20	2/8	19	3.8	86.13433723	TBA	20%
Port to iOS	2/6	6	2/13	7	0	103.1343372	TBA	0%
Phase 2								
Design Relational Systems (SQL)	2/1	1	2/8	7	7	98.13433723	Group	100%
Design Network Systems for I/O	2/2	2	2/9	7	5.6	99.13433723	Group	80%
Implement Network Availabilty	2/9	9	2/23	14	8.4	106.1343372	TBA	60%
Implement Server	2/9	9	2/23	14	5.6	106.1343372	TBA	40%
Implement Auto Save features	2/22	22	3/1	8	1.6	119.1343372	TBA	20%
Implement Android App Upload Settings	2/22	22	3/1	8	0	119.1343372	TBA	0%
Alpha Stage								
Plan Agenda for Meeting	2/14	14	2/19	5	5	111.1343372	Group	100%
Prepare presentation	2/15	15	2/20	5	4	112.1343372	Group	80%
Thuroughly test application	2/20	20	2/28	8	4.8	117.1343372	Group	60%
Finalize Presentation	2/28	28	3/1	2	0.8	125.1343372	Group	40%
Post	03/2020	1	3/1	0	0	127.1343372	Group	20%
Beta Stage								
Finalize Phase 1	3/1	1	3/20	19	19	127.1343372	Group	100%
Finalize Phase 2	3/2	2	3/20	18	14.4	128.1343372	TBA	80%
Prepaire for Engineering Expo	5/1	1	5/14	13	7.8	188.1343372	TBA	60%
Present At Expo	5/15	15	5/15	0	0	202.1343372	TBA	0%
Phase 3 (Stretch)								
Design Server/App functionality for GIS	3/20	20	4/1	12	12	146.1343372	Group	100%
Implement GIS conversion	3/20	20	4/1	12	9.6	146.1343372	TBA	80%
Implement GIS File System	3/20	20	4/1	12	7.2	146.1343372	TBA	60%
Test	3/20	20	4/1	12	0	146.1343372	TBA	0%

Phase 1 Phase 2 Alpha Stage Beta Stage