MATERIALS TESTING DATABASE AND WEB APP DEVELOPMENT PROJECT
Project ID: CEEn_2017CPST_010

by

MOR:
Jenny Blonquist
Micklane Farmer
Olivia Sorenson
Riley Vane

A Capstone Project Final Report

Submitted to

Jones & DeMille Engineering

Department of Civil and Environmental Engineering
Brigham Young University

3 March 2018

Executive Summary

PROJECT TITLE: Materials Testing Database and Web App Development Project
PROJECT ID: CEEn-2016CPST-010
PROJECT SPONSOR: Jones & DeMille Engineering
TEAM NAME: MOR (Micklane, Olivia, Riley)

Jones & DeMille Engineering (JDE) is one of Utah's top engineering companies. They offer a full-range of services including water resources, transportation, structures, environmental, and funding procurement. As part of its wide range of services, JDE has a materials testing lab that tests materials from across the state. They run hundreds of soil, asphalt, and concrete tests that provide crucial information to the engineers and contractors on civil engineering projects. They test results are then saved in project folders.

The client, JDE, tasked a team of three of its summer interns, MOR, to develop a web-based material testing geodatabase. This geodatabase will allow the Lab Manager and also Construction Managers in the field to look up material testing results. Instead of searching through project folders, they will be able to search for test results in the geodatabase by the name of the test, the location of the material, the project number, the project name, the date they were tested, and even more. This compilation of tests into a geodatabase will make finding old test results much more efficient and save a tremendous amount of time for JDE.

The project has required the team to design a database in Excel, collect all test results saved by Jones & DeMille to compile in the database (around 1000 tests results), and gather coordinates for the location of the materials that were tested. The integration of the database with GIS is still pending. The project was carried out in accordance with Brigham Young University's (BYU) Civil Engineering capstone program. The project began January 8, 2018, and will close on April 18, 2018.

Table of Contents

Introduction

The client, JDE, tasked a team of three of its summer interns, MOR, to develop a web-based material testing geodatabase. This geodatabase will allow the Lab Manager, and also Construction Managers in the field, to look up material testing results. Instead of searching through project folders, they will be able to search for test results in the geodatabase by the name of the test, the source of the material, the project location, the project number, the project name, the date they were tested, and other similar criteria. This compilation of tests into a geodatabase will make finding old test results much more efficient for JDE.

The project has three main parts: design a database in Excel, collect and enter all test results, and integrate the database in GIS.

For the first task, to design the database, team members met with Mark Rappleye (Lab Manager for JDE) to determine the types of materials tests that would be useful to include in the database. The main tests that the Lab Manager felt more important were Proctors and Gradations. If time were to permit, MOR could also include other less important tests, such as the California Bearing Ratio, Atterburg Limits, Sodium Soundness, Los Angeles Abrasion, Unit Weight, and others. It was also determined that the database needed to include: exact coordinates of the project location; the project number; the project name; the project client the material sample number (the number assigned to a material when it arrives at the testing lab); a description of the material; the AASHTO classification of the material; which pit the material came from, or if the material is native; the data tested; and the file name of the test results.

Once the database had been designed, the team collected all test results saved by Jones & DeMille and added them in the database. This was the bulk of the project, since there were around 1000 tests results to gather and find the necessary information about.

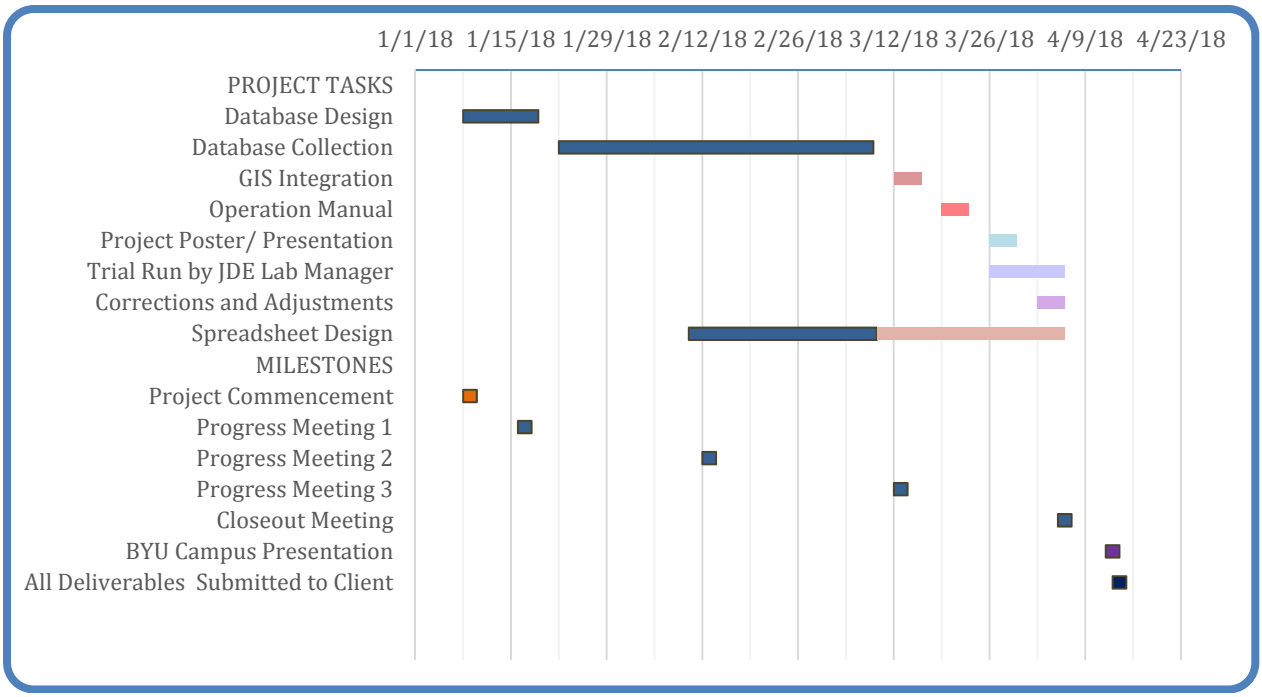
Finally, after all the information was gathered for every test done by JDE, the team will integrate the database with GIS. GIS Manager Adam Perschon (JDE) will assist in this. After the test results are imported into GIS, the team will begin to optimize the interface so that the Lab Manager can easily input future test results. This involved creating a user form in Excel.

In addition to the original scope of work, MOR, in working with Mark Rappleye, has decided to design materials lab spreadsheets that will be used to compute proctor densities, gradations, and several of the more common tests that have been mentioned above. These are being built with the intention that the portable materials labs in Roosevelt and Monticello will not be required to send test results to Richfield for entry for every test. These will be updated and improved forms that JDE has archived, but are outdated and less accurate.

The project is being carried out in accordance with Brigham Young University's (BYU) Civil Engineering capstone program. The project began January 8, 2018, and will close on April 18, 2018.

Schedule

Progress on the proposed work plan has accelerated faster than anticipated. As one can see from the time line, database collection was expected to last through the middle of March. MOR added spreadsheet design to finish off the project time. The team will continue to work on spreadsheet design, along with finishing off the last parts of the schedule. Important milestones to pay attention to are GIS integration, scheduled for mid-March, trial run by JDE lab manager, and the closeout meeting with the client, held mid-April.



Assumptions & Limitations

In the database collection phase of the project, there was a difficulty in finding locations for different pits that contractors provided samples from. In most cases, the pit was located and the correct coordinates were put in the database for the most accurate results. There were a few cases where team members used the location of the contractors headquarters to as the latitude and longitude for the tests that were performed. This will not limit the lab manager from searching in the pit where the sample was obtained.

Design, Analysis & Results

The design of the spreadsheet for database collection was very straight forward. MOR met with Jones and DeMille to determine what criteria the database should categorize tests in. Each of these criteria were given a label at the top of the excel spreadsheet, and respective fields were filled out for each lab test that occurred between the years 2016 and 2017. To allow for easy entry of data in the future, a series of excel forms were created to make sure each test is filled in properly.

MOR team members have started developing new spreadsheets for lab tests in remote offices to enable them to enter data in at their locations. Currently tests are sent to Richfield to be entered in the lab software Geosystems, but with the development of new spreadsheets, those tests can be filled out in the remote offices too. Thus far a specific gravity, proctor, gradation spreadsheets have been developed, and the team will continue to redevelop as many as they can, time permitting. See Appendix A for spreadsheet examples.

Lessons Learned

There were several challenges encountered throughout the course of the project thus far. The most challenging parts of the project have been learning how to use file share, coming up with consistent database development, determining pit locations, creating a user friendly database interface, and coming up with more things to do to add to the project. Most of the concerns and challenges MOR has had have been resolved through communication with the client. Team MOR created a user friendly form for data entry when the database is handed over to the client. Pit locations were determined for pit materials testing projects, except in a few cases where company headquarters locations where used.

With the addition of spreadsheet design, some MOR has developed a greater understand in excel spreadsheet design and coding. Many challenges have been encountered during spreadsheet design, but were resolved through countless hours of research and development. The spreadsheets have stretched the team, and helped the team learn a valuable skillset.

Conclusions

In conclusion, the client, JDE, tasked a team of three of its summer interns, MOR, to develop a web-based material testing geodatabase. Thus far, the database development is on schedule. There have been some small challenges with developing the database, but all of the challenges have been resolved. The database collection phase of the project is complete, and the team has moved on to develop new spreadsheets for the lab manager. The schedule outlines tasks still to be performed. Overall, the progress of the project should continue as planned, and no major changes have been made. The team will be contacting Adam to integrate the database within the next couple of weeks.

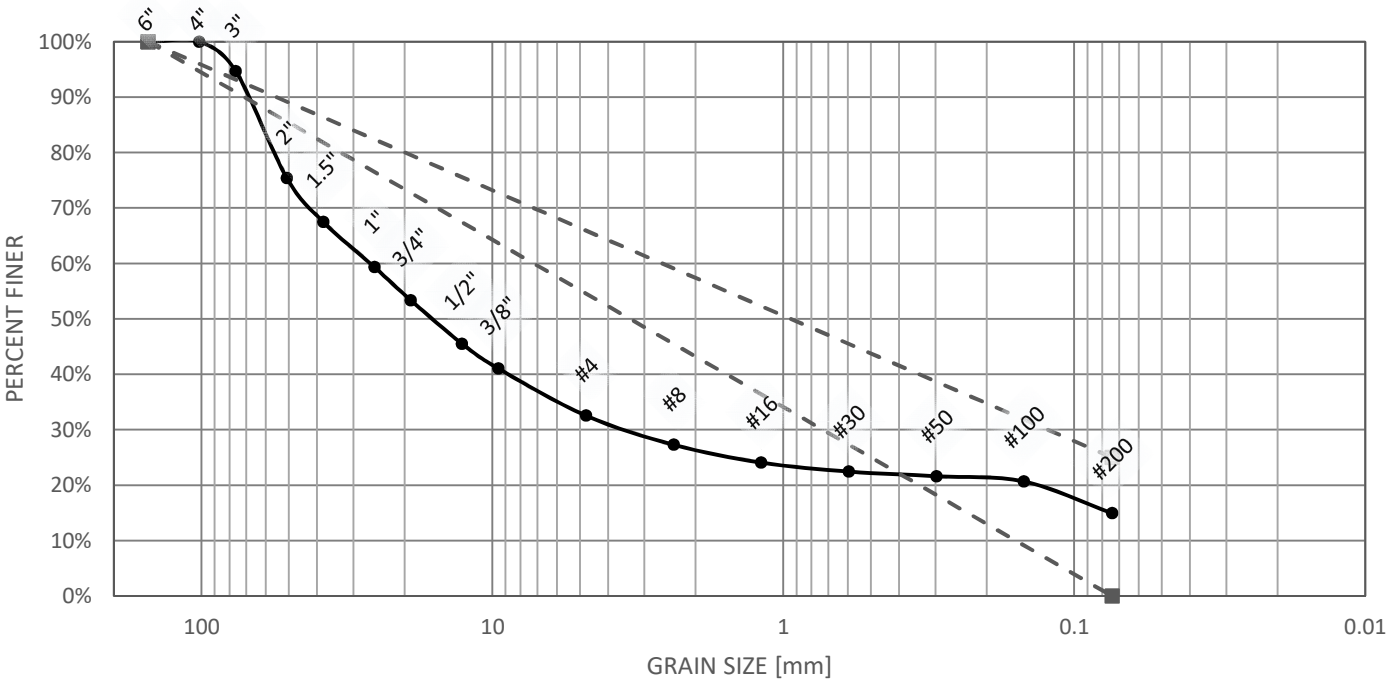
Appendix A

OVERSIZE PARTICLE DISTRIBUTION REPORT

AASHTO T27 and T11, ASTM C117 and C136

CURVE NUMBER: 0

Jones & DeMille Engineering
1535 South 100 West
Richfield, Utah 84701
(435) 896-8266



SIEVE	PERCENT FINER	SPEC [%]	PASS?
6"	100.0%	100-100	
4"	100.0%		
3"	94.7%		
2"	75.4%		
1.5"	67.5%		
1"	59.3%		
3/4"	53.3%		
1/2"	45.5%		
3/8"	41.0%		
#4	32.5%		
#8	27.3%		
#16	24.1%		
#30	22.4%		
#50	21.6%		
#100	20.7%		
#200	14.9%	0-25	

SPEC: NONE

GRAIN DIST. [%]	
PLUS 3"	5.3%
GRAVEL	67.4%
SAND, COARSE	4.8%
SAND, FINE	7.5%
FINES [SILT,CLAY]	14.9%

COEFFICIENTS [mm]		[in]
D_{90}	69.03	2.718
D_{85}	62.15	2.447
D_{60}	26.26	1.034
D_{50}	16.02	0.631
D_{30}	3.41	0.134
D_{15}	0.07	0.003
D_{10}	0.05	0.002
C_U	530.29	
C_C	8.92	

ATTERBERG LIMITS:
LL: _____ *(ASTM D*
PI: _____ *4318)*

SOIL CLASSIFICATION:
USCS: _____ *(D 2487)*
AASHTO: _____ *(M 145)*

PREP. METHOD:	
SAMPLED:	1/0/1900
RECEIVED:	1/0/1900
TESTED:	1/0/1900
TESTED BY:	0
TECH. NO:	0

MATERIAL DESCRIPTION:
0

REMARKS:

PROJECT #: 0
PROJECT: 0
LOCATION: 0
CLIENT: 0
SAMPLE NUMBER: 0

JONES AND DEMILLE ENGINEERING INC.
Richfield, Utah

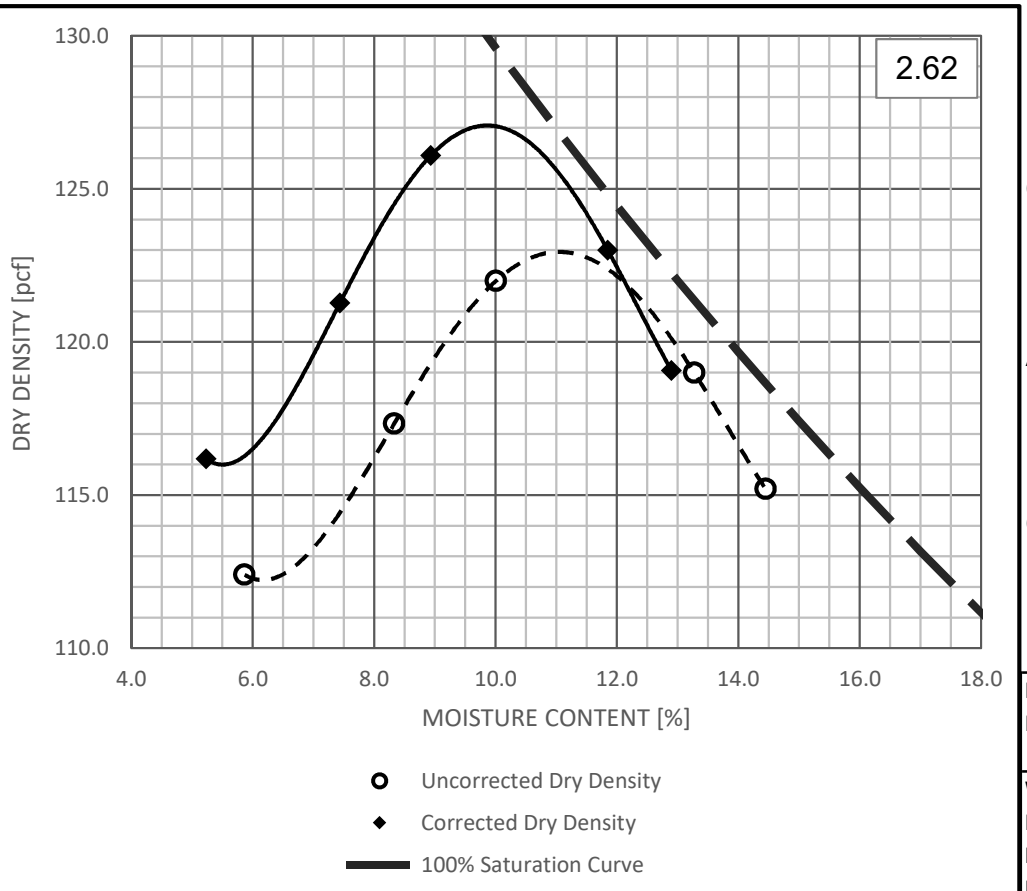
CHECKED BY: Mark Rappleye
POSITION: Lab Manager

COMPACTION TEST REPORT

CURVE NUMBER: *lab

Jones & DeMille Engineering

1535 South 100 West
Richfield, Utah 84701
(435) 896-8266



UNCORRECTED	1	2	3	4	5	6
WM+WS	9792.3	10068.4	10309.7	10329.9	10229.6	
WM	5744.1	5744.1	5744.1	5744.1	5744.1	
WW+T#1	676.5	661	725.4	685.8	735.9	
WD+T#1	652.9	629.3	681	635	674.1	
TARE #1	250.5	248.8	237.4	252.3	246.4	
MOIST.	5.9	8.3	10.0	13.3	14.4	
DD	112.4	117.3	122.0	119.0	115.2	

ROCK CORRECTED RESULTS (AASHTO 224-4)			UNCORRECTED	
Maximum Dry Density =	127.1	pcf	122.9	pcf
Optimum Moisture =	9.9	%	11.1	%

PROJECT #: *num
CLIENT: *customer
PROJECT: *proj name
LOCATION: *source
SAMPLE NUMBER: *lab

JONES AND DEMILLE ENGINEERING INC.

Richfield, Utah

COMPACTION TEST:
AASHTO: T-99
ASTM: D 698

ATTERBERG:
LL: *ll *(ASTM D*
PI: *pi *4318)*

CLASSIFICATION:
USCS: *uscs *(D 2487)*
AASHTO: *aashto *(M 145)*

PREP. METHOD:	Oven Dry
RAMMER TYPE:	Mech. Pie Shaped
WEIGHT [lb]:	5.5
DROP [in]:	12
LAYERS NO:	3
BLOWS:	56
MOLD SIZE: [cf]	0.075
MATERIAL PASS: [in]	3/4
% > 3/4 in:	13.1%
SPECIFIC GRAVITY:	2.62
SAMPLED:	1/1/2011
RECEIVED:	1/2/2011
TESTED:	1/3/2011
SAMPLED BY	*me
TESTED BY:	RV

MATERIAL DESCRIPTION:
*mat

REMARKS:
*remarks

CHECKED BY: Mark Rappleye

POSITION: Lab Manager

Mark Rappleye
Jones and DeMille Engineering
Lab Manager
1535 S 100 W
Richfield, UT 84701
(435) 896-8266

Specific Gravity of Coarse Aggregate

(AASHTO T85) (ASTM C-127)

Date:	3/1/2018
Client:	Jones and DeMille
Project:	Test Run
Project Number:	1707-258
Location:	17+33
Sample Number:	33
Material Description:	Concrete rock

Sample	Dry Weight	SSD Weight	Weight in Water	Specific Gravity Oven Dry	Specific Gravity (SSD)	Specific Gravity (Apparent)	Absorption
				#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Mark Rappleye
Jones and DeMille Engineering
Lab Manager
1535 S 100 W
Richfield, UT 84701
(435) 896-8266

Specific Gravity of Fine Aggregate

(AASHTO T85) (ASTM C-127)

Date:	
Client:	
Project:	
Project Number:	
Location:	
Sample Number:	
Material Description:	

Sample	Dry Weight	SSD Weight	Pyc + Water	Pyc + Water + Sample	Bulk Specific Gravity (OD)	Bulk Specific Gravity (SSD)	Specific Gravity (Apparent)	Absorption
					#VALUE!	#VALUE!	#VALUE!	#VALUE!