

CE 3336 – 24324, 24325, 26696 Civil Engineering Materials
MW 13:30-16:20 E212/E209/M105
Spring 2023

Instructor: Vivek Tandon (vivek@utep.edu)

Office: Engineering Annex-220

Office Hours: MS Teams

OBJECTIVES

The purpose of the laboratory is to acquaint you with various tests that are fundamental to the practice of Civil Engineering. In addition, you will learn how to measure the properties of several popular civil engineering materials. You will also learn about the limitations of the laboratory tests and gain insight into issues with property measurement. An additional objective of this lab is to teach you how to plot and present experimental data professionally, prepare reports, and present results to others. Finally, we will also use the laboratory period for review and problem-solving in areas that are traditionally difficult to understand for students.

SCHEDULE

A schedule for the laboratory is presented on a separate sheet. As much as possible, the labs have been scheduled to coincide with the discussion in your lecture sections.

ATTENDANCE

Laboratory attendance is mandatory. If you leave the lab before finishing your experiment or cleaning up your work area, your attendance will not be counted. We know that you have constraints on your time, but we feel strongly that those students who make an effort to attend and complete the lab should be rewarded, and those who do not should be penalized.

If you cannot attend a specific laboratory and have a valid excuse, it may be possible for you to make up the lab. We generally discourage attending make-up labs because it leads to overcrowding and disorganization in the laboratory. However, we do try to accommodate students with valid excuses. You must obtain permission to make up a laboratory.

LABORATORY REPORTS

You will be expected to present the results of your laboratory measurements in laboratory reports. Typically, one report is required for each laboratory period. Late reports will be penalized. A guideline is attached for your convenience.

LAB REPORT DUE DATE

Please make sure that you follow the due dates on the laboratory reports. Laboratory reports are typically due two weeks after the lab period you conducted your experiments (see table 8). However, the reduced data from your group is due by Friday 5:00 p.m. of the week laboratory tests were performed. Any group that does not hand in their reduced data on time will not be able to obtain a grade above 80% for that lab.

You can improve your laboratory reports for a better grade once the due dates are met. Then, address the reports' deficiencies, add the revised version to your portfolio, and hand them to TA at the end of the semester.

GRADE

Your laboratory grade will be determined from the scores on the laboratory reports (Report Check List and Check List for Editing on pages 6 and 7, respectively). You will receive a grade of zero for any late lab report or a report corresponding to any lab that you did not attend fully.

The laboratory reports will be worth as follows:

- Lab Report 0, 1, 2, 3, and 4 40 Points (each)
- Lab Report 5 and 8 (one-page summary) 10 Points
- Lab Report 6 and 7 40 Points (each)
- Field Visit Report (one-page summary): 10 Points

The total laboratory grade is 310 out of 1,600 points of your total grade. Therefore, you must attend and submit each laboratory report. In addition, the lab reports worth 10 points will be used to improve the lab grades.

We do not want to harass you on the lab reports, but we also strongly believe that it is in your best interest to learn to do work like expected of college graduates, i.e., neat, concise, and accurate work. Previous graduates have told us that they were very appreciative of the efforts made to make them better writers after they left college. We certainly hope that all of you will be better writers when you leave this course than when you entered.

COMMENTS BY STUDENTS

We are constantly trying to improve the laboratory to enhance the student's understanding of the course material and make the best possible use of your limited time. We would appreciate any comments or suggestions for improvement that you might have.

POLICY ON CHEATING

Students are expected to be above reproach in all scholastic activities. Students who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the University. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give an unfair advantage to a student, or the attempt to commit such acts (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22). Scholastic dishonesty harms the individual, all students, and the integrity of the University. Therefore, policies on scholastic dishonesty will be strictly enforced.

Laboratory Report Guidelines

The lab reports should be less than five pages long, excluding the appendices. To save paper and space, submit all reports single-spaced.

The laboratory report has to consist of the following sections organized in the order listed below:

- A) COVER PAGE with:
 - Test Title
 - Author's Name and Group Number
 - Course Number and Semester
 - Date of the Report
 - Name of all group members with percentage effort in data collection and reduction
- B) REPORT CHECKLIST and CHECKLIST FOR EDITING
- C) ABSTRACT (less than 150 words) with
 - What you did (one or two sentences)
 - Why you did it (one sentence)
 - On what material (one sentence)
 - What you found (one or two sentences)

The primary objectives and scope of the report should be stated; the techniques or approaches should be described only to the extent necessary for comprehension; the findings and conclusions should be presented concisely. The abstract should not contain unfamiliar terms that are not defined, reference citations, or display equations or lists. The abstract should contain the answer to the lab parameter you measure.

The abstract should contain all facts!! Do not say how humanity will benefit from these tests!! Do not get poetic!! Evaluate every sentence!! Decide whether a given sentence is positively necessary or it is fluff!! Remove fluff!! If the lab's goal is to measure the strength of concrete, you should positively indicate the strength appropriate for that concrete!!

- D) INTRODUCTION with:
 - The general purpose of the test
 - Anticipated results
 - Intended use of the test results
- E) RESULTS and DISCUSSION:

The results and discussion section of your report are significant because it indicates your understanding of the laboratory exercise's purpose/meaning and procedure. Therefore, I have included a table (see pages 7 and 8) at the end of this syllabus to guide you about the results and discussions that should be included in each report.

Write complete, clear, understandable, and self-contained responses to each discussion question. Don't assume the reader knows the question asked in your laboratory exercise; in other words, make sure that the question you are answering is clear in your response

- **Tables:** Data essential to the report (such as uncertainty estimates, results of key calculations-not lists of raw data) may best be presented for clarity in the form of tables. Tables should be numbered consecutively and appear in the report's body or immediately following the references. Abbreviations and symbols may be used if defined in the text or a list of symbols. The tables should be complete in themselves; i.e., explanatory notes should be placed in footnotes rather than requiring the reader to refer back to the report text for explanatory material.
- **Figures:** Your lab report will undoubtedly contain some figures. Figures should be numbered consecutively, and all figures must be referenced from the written report. It is strongly recommended that you prepare all your figures electronically. Each figure must include an explanatory title positioned beneath the figure. Figures must be self-explanatory so, as far as possible, the reader can understand the figure without referring to the text where you describe it (you still need it, though). Graphs can be drawn in Excel and copied into PowerPoint. However, note that the default form of graphs produced by Excel, while acceptable for the preliminary analysis of a logbook, is unsuitable for reports. The file 'HowToPlot.xls' gives a specific example of turning a basic Excel plot into a report quality graph. The following requirements are illustrated in this example:
 - Measured data should generally be plotted as distinct points, with no lines, since the points were measured. Lines should only be added if they represent something else, e.g., a regression fit or the result of a theoretical prediction.
 - Color should be avoided unless necessary, as reports are always printed or copied in black and white. Colored background, in particular, detracts from the clear presentation of the data.
 - Gridlines should only be used if needed, in which case they should be included for both axes and shown in gray or as dashed lines so as not to be confused with axis lines or annotations on the plot.
 - Axes should have accurate scales and show major and minor divisions. A proper linear scale in which major and minor divisions are in units of 1, 2, or 5×10^n , where n is an integer. Tick marks should point outwards, and at least five major divisions should appear on each axis. In general, the axes should cross at zero. If not reasonable, a note should be made in the figure or axis title (e.g., "note false origin on displacement axis").
 - Axes titles should include the name and/or symbol of the plotted quantity and its unit in a font consistent with the rest of the report.
 - If possible, the legend should appear within the axes without obscuring data. There should be no box drawn around graphs.
 - If estimates of the accuracy of the data are available and comparable in scale to the size of the quantity, the error magnitudes can be shown using error bars.

F) APPENDIX A: DATASHEETS AS RECORDED IN THE LAB:

- All data sheets should contain the names of all members of each group and the group number.

- The datasheet should be kept clean; no example calculations should be written. Instead, write only comments about the experiment, where applicable (e.g., higher loading rate), or note any values you disregard.
- Before posting results, all members of each group should check their calculations.
- If any group does not post results in time, the rest of the groups should do their analysis by using already posted results.

G) APPENDIX B: SAMPLE CALCULATIONS:

An example of each type of calculation performed with the raw laboratory data to obtain the test results and a reference to any formula that has been employed. This can be handwritten, but it has to be neatly done.

All these sections should be organized in the same order as shown above. The pages should be numbered in the bottom right-hand corner, and the set has to be adequately bound. All graphs must be drawn with suitable drafting instruments. Curves and lines cannot be drawn freehand. A symbol template should plot the data points, and data points of different sets should be shown with different symbols.

REPORT CHECKLIST

Item	Implication		Remark
Do You have all these items in your report?			
COVER PAGE	-10%		
CHECKLIST OF EDITING	-65%		
ABSTRACT	-35%		
INTRODUCTION	-25%		
RESULTS and DISCUSSION	-60%		
APPENDIX A	-15%		
APPENDIX B	-15%		
Is Abstract Appropriate?			
What you did (one or two sentences)	-5%		
Why you did it (one sentence)	-5%		
On what material (one sentence)	-5%		
What you found (one or two sentences)	-5%		
Contain answers to parameters measured	-10%		
Removed sentences that are not relevant	-5%		
Is the Introduction Concise and Complete?			
General purpose of the test (one paragraph)	-10%		
Intended use of test results (one paragraph)	-10%		
Removed sentences that are not relevant	-5%		
Are Results and discussion complete as suggested at the end of each lab instruction?			

CHECKLIST FOR EDITING

Do tables contain correct information and are in the proper format? (-5% for each item and each figure)									
Item	Table							Remark	
	1	2	3	4	5	6	7		
Table has a descriptive title									
Table title is above the table									
Table fits within the margin									
Referred to the table in the text before including it									
Table is not split between two pages									
Tables are numbered consecutively, as referred to in the text									
Have a few sentences in the text describing the information from the table									
All columns and Rows have descriptions									

All columns and rows have appropriate units									
The number of decimals is the same as the precision of measurements									
Font type is the same as the report font type									
Abbreviated symbols are defined under the table									

Do figures contain correct information and are in the proper format? (-5% for each item and each figure)

Item	Figure							Remark
	1	2	3	4	5	6	7	
Figure has a descriptive title								
Figure title is below the figure								
Figure fits within the margin								
Referred to the figure in the text before including it								
Figures are numbered consecutively, as referred to in the text								
Figure is not split between two pages								
Have a few sentences in the text describing the information from the figure								
X and Y axes are labeled								
X and Y axes have appropriate units								
The number of decimals is the same as the precision of measurements for the X and Y axes								
Font type is the same as the report font type								
Measured data points are shown as symbols only (not connected by lines)								
Best fit curves and theoretical curves are shown as lines only								
If several data sets, are they distinguishable								
If several data points, a legend is included								
The legend is descriptive (no linear series 1)								

Item	Implication	Remark
Final Editing		
Everything except Appendices is typed	-10%	
Included page numbers	-5%	
Made sure tables were not split b/w two pages	-5%	
Made sure figures were not split b/w two pages	-5%	
Equations are on a separate line and numbered	-5%	
All symbols and abbreviations are defined	-5%	
Spell-checked report/ read final time for completeness	-20%	
Report is single-spaced	-5%	
Font is 12 points. Times New Roman	-5%	

Tentative Lecture and Laboratory Schedule
All Datasheets and reports are due by 5:00 p.m. Friday

Week	Monday	Wednesday	Laboratory	What is Due?
01/18	No Class	Intro & Topic 1	No Laboratory	Nothing Due: This Week
01/23	Topic 1	Topic 1	No Laboratory	Nothing Due: This Week
01/30	Topic 1	Topic 1	Virtual Plant Visit	Nothing Due: This Week
02/06	Topic 2	Topic 2	Lab 0: How to Prepare Lab Report	<i>Virtual Plant Visit Report Due</i> Data Sheet for Lab 0
02/13	Topic 2	Topic 3	Lab 1: Introduction to Measuring Devices	Lab Report 0 Data Sheet for Lab 1
02/20	Exam I	Topic 3	Lab 2: Specific Gravity, Absorption, and Gradation	Lab Report 1 Data Sheet for Lab 2
02/27	Topic 3	Topic 4	Lab 3a: Mortar Specimen Preparation	Lab Report 2 Data Sheet for Lab 3a
03/06	Topic 4	Topics 4	Lab 3b: Mortar Test (7 days)	Data Sheet for Lab 3b
03/13	Spring Break No Class and Laboratory			
03/20	Topic 4	Topics 4	Lab 4a: Concrete Mix Design	Lab Report 3 Data Sheet for Lab 4a
03/27	Exam II	Topic 5	Lab 4b: Preparation of Concrete Specimens	Data Sheet for Lab 4b
04/03	Topic 5	Topic 5	Lab 5 Binder Test Demonstration	Nothing Due: This Week
04/10	Topic 5	Topic 6	Lab 6a: Marshall Method of Asphalt Concrete Mix Design Problem	Lab Summary Report 5 Lab Calculation Sheet 6a
04/17	Topic 6	Topic 6&7	Lab 6b: Testing of Asphalt Concrete Specimens Lab 4c: Strength Testing of Concrete	Data Sheet for Lab 6b Data Sheet for Lab 4c
04/24	Topic 7	Topic 8	Lab 7: Properties of Wood	Lab Reports 4 and 6 Data Sheet for Lab 7
05/01	Topic 8	Exam III	Lab 8: Masonry Demo Testing	Lab Reports 7 & 8
Final Exam May 8th, 7:00 a.m. – 9:45 a.m.				

Example Report

Laboratory Guideline

How to Prepare a Laboratory Report

Vivek Tandon

Group 4

CE 3336
Fall 2018

August 27, 2019

Group Participation

Member	Group Effort		Lab Report Preparation	
	Data Collection	Data Analysis	Graphs & Tables	Report
1234	5%	0%	100%	100%
4567	60%	95%		
9876	35%	5%		

REPORT CHECKLIST

Item	Implication		Remark
Do You have all these items in your report?			
COVER PAGE	-10%		
CHECKLIST OF EDITING	-65%		
ABSTRACT	-35%		
INTRODUCTION	-25%		
RESULTS and DISCUSSION	-60%		
APPENDIX A	-15%		
APPENDIX B	-15%		
Is Abstract Appropriate?			
What you did (one or two sentences)	-5%		
Why you did it (one sentence)	-5%		
On what material (one sentence)	-5%		
What you found (one or two sentences)	-5%		
Contain answers to parameters measured	-10%		
Removed sentences that are not relevant	-5%		
Is Introduction Concise and Complete?			
General-purpose of the test (one paragraph)	-10%		
Intended use of test results (one paragraph)	-10%		
Removed sentences that are not relevant	-5%		
Are Results and discussion complete as per pages 9 and 10?			
Cut and paste the bullets from tables on pages 9 and 10 for the relevant lab report.			
Complete all graphs			
Complete all tables			
Complete Introduction Section			
Complete Results and Discussion Sections			

CHECKLIST FOR EDITING

Do tables contain correct information and are in the proper format? (-5% for each item and each figure)									
Item	Table							Remark	
	1	2	3	4	5	6	7		
Table has a descriptive title									
Table title is above the table									
Table fits within margin									
Referred to the table in the text before including it									
Table is not split between two pages									
Tables are numbered consecutively as referred to in the text									
Have a few sentences in the text describing the information from the table									
All columns and Rows have descriptions									
All columns and rows have appropriate units									
The number of decimals same as the precision of measurements									
Font type is the same as report font type									
Abbreviated symbols are defined under the table									

Do figures contain correct information and are in the proper format? (-5% for each item and each figure)									
Item	Figure							Remark	
	1	2	3	4	5	6	7		
Figure has a descriptive title									
Figure title is below the figure									
Figure fits within margin									
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Figure is not split between two pages									
Have a few sentences in the text describing the information from the figure									
X and Y axes are labeled									
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Item	Implication	Remark
Final Editing		
Everything except Appendices is typed	-10%	
Included page numbers	-5%	
Made sure tables are not split b/w two pages	-5%	
Made sure figures are not split b/w two pages	-5%	
Equations are on a separate line and numbered	-5%	
All symbols and abbreviations are defined	-5%	
Spell checked report/ read final time for completeness	-20%	
Report is single-spaced	-5%	
Font is 12 points Times New Roman	-5%	

How to Prepare a Laboratory Report

Abstract

Through several case studies, we reviewed the process of presenting and analyzing laboratory results. The focus was on the use of computer software such as Excel and Word.

Introduction

One of the major complaints of the potential employers of UTEP students is that their communication skills are not well-developed. Therefore, we attended a laboratory session to prepare tables and figures and incorporate them into our reports to address this problem.

Four case studies were presented and analyzed in the laboratory session. The significant points and lessons learned from each case are summarized below. The first case study was related to incorporating statistical analysis in interpreting results. The goal of the second case study was to extract results from experimental data using a curve-fitting algorithm.

(Complete this section.)

Results and Discussions

Data from a test carried out to determine the water content of a soil sample was used in the first case study. The raw data provided are included in Table 1. The experiment was repeated ten times. The basic statistical information from the ten experiments is also included in the table. The average water content is about 7.1%, with a standard deviation of about 1.5%. Judging from the coefficient of variation of about 22%, the test results do not seem to be precise. Inspecting Table 1, an outlier is observed under experiment 5. Ignoring this point, the average water content increased to 7.6%. The coefficient of variation decreased to about 6%, indicating a reasonably precise test result.

Table 1 – Results from Water Content Tests on a Soil Sample

Experiment	Water Content
1	7.3
2	7.7
3	7.9
4	8.1
5	2.9
6	7.1
7	7.6
8	6.9
9	7.4
10	8.3
Average, %	7.1
Standard Deviation, %	1.5
Coefficient of Variation, %	22.1

The goal of the second case study was to extract results from experimental data using a curve-

fitting algorithm. As shown in Table 2, the discharge velocity, V , of material was measured as a function of hydraulic gradient, i . According to Darcy's law, these two parameters are related through:

$$V = K i \quad (1)$$

where K is the hydraulic conductivity, the variation in discharge velocity with hydraulic gradient is depicted in Figure 1. To obtain the hydraulic conductivity, a line is fitted to the measured data. The line describes the trend of the data reasonably since the R^2 value is about 0.83. Therefore, the hydraulic conductivity of this material is about 0.036 cm/sec.

Table 2 – Variation in Discharge Velocity with Hydraulic Gradient Measured from a Permeability Test

Hydraulic Gradient, cm/cm	4.7	3.4	2.0
Discharge Velocity, cm/sec	0.16	0.12	0.09

(Complete this section as well)

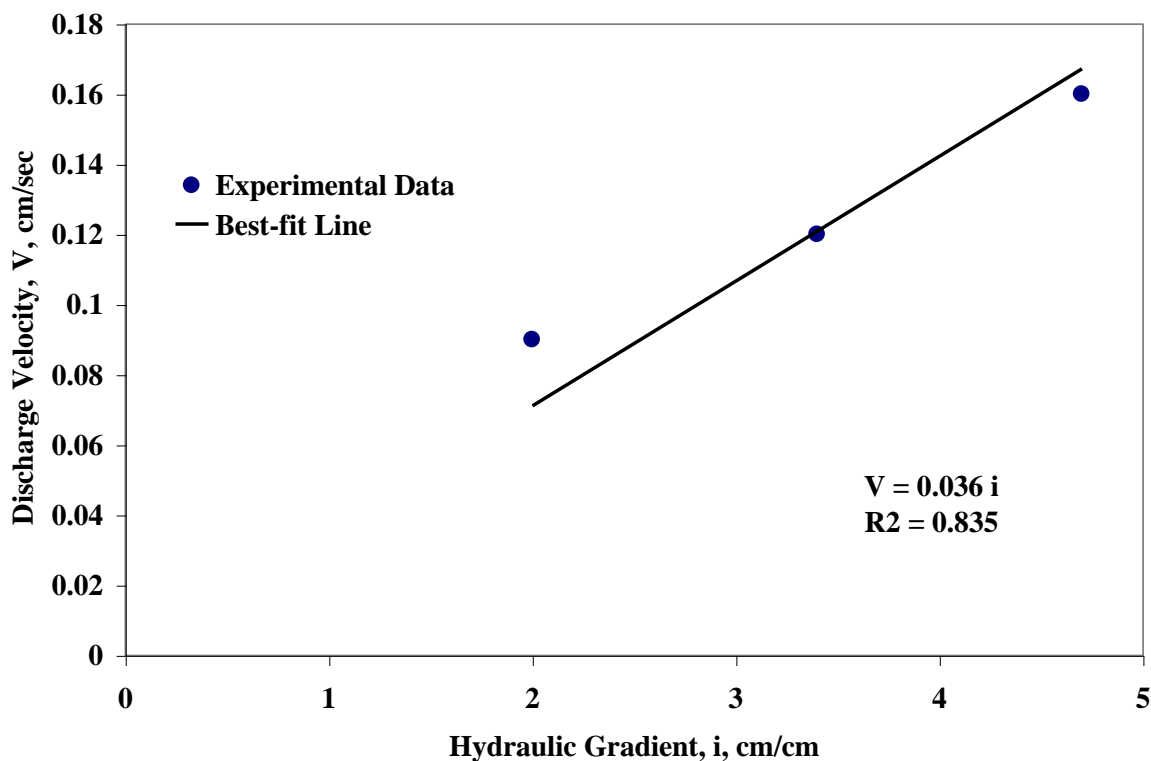


Figure 1 – Variation in Discharge Velocity with Hydraulic Gradient from a Permeability Test

APPENDIX A: DATASHEETS AS RECORDED IN THE LAB

(Include all the forms you used in this lab)

APPENDIX B: SAMPLE CALCULATIONS

(Include sample hand calculation or excel sheet etc. here)