University of Tennessee at Chattanooga
College of Engineering and Computer Science
ENCE 3610 – Soil Mechanics
ENCE 3610L – Soil Mechanics Laboratory
ENCE 4610 – Foundation Analysis and Design

Guidelines and Requirements for Reports and Presentations
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This document contains guidelines for reports and presentations for both undergraduate geotechnical courses. It includes guidelines for both laboratory reports and design projects.

The first section is applicable to both laboratory reports and design reports. After that there are sections specific to each. Pay special attention to the requirements of these sections. Oral presentation guidelines are applicable mostly to the design project.

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Some of this material has been around for a long time, so if it's too dated just have a good laugh. However, the basic requirements for a good technical report have not substantially changed with the advent of computers, word processors and presentation graphics; it's just easier to make your work look good. As time permits, I will update the information here with references to new word processing and graphics technology.

If you have any questions, feel free to email me at cbv526@mocs.utc.edu.

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1Revision history:
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- Revision 1: February 2005
- Revision 2: October 2009
- Revision 3: December 2009
- Revision 4: September 2010
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Guide For Writing An Engineering Report[2]

Whether to sell a pet proposal, justify a capital expenditure, or present a study or research project, technical reports are a vital part of engineering. Needed repairs go unfunded, cost reduction opportunities are lost—all because the report on which approval depended simply did not convey its message effectively. And many an otherwise well qualified engineer misses out on promotions because he has never mastered the art of presenting his thoughts in writing.

Not every engineer can be a great writer, nor is it expected of him, but he should be able to write a report that is clear and readable, particularly if he aspires to management. Report writing is work. This article presents a few suggestions to make this chore easier and to improve the results, including a format for organizing the report, a step-by-step procedure for the actual writing, and some common problems and how to deal with them.

Format

One of the most useful devices for turning out a workmanlike report is a well-organized arrangement or format, and many companies have their own standards. Following—with no claim to originality—is a scheme that can serve for reports of varying degrees of formality from a simple memorandum to a full-blown report, complete with cover and binding! Included in the format are: letter of transmittal, title page, table of contents[3], summary of conclusions and recommendations, purpose and scope, background of introduction, discussion, conclusions, recommendations, and appendix**.

- *Letter of transmittal:* This is actually a letter when the report goes to a client, customer, or government agency. Within the company, it is usually a memorandum. In either case, think of it as a friendly introduction that presents the report to the person or group for whom it is intended. It may refer to a request or a contract that initiated the study but should not attempt to summarize the contents of the report.
- *Title page:* Like the letter of transmittal, a title page is required only in a formal report. Companies and departments have standard formats, but in general, the following information should be included: report title; date prepared or submitted; project number, contract number, or other identification; customer or client identification; author's name and title; company and department identification. Choose a title to convey the purpose or nature of the document. For example: "Progress Report," “Report of Investigation," "Recommended . . ."
- *Table of contents:* As a rule of thumb, use a table of contents if there are four or more main parts or sections to the report. Opinion differs on how detailed it should be; the writer feels that only major sections should be listed--comparable to chapters in a book. In any event, be sure that the titles used match those in the text exactly.
- *Summary of conclusions and recommendations:* A good report must reveal its ending in the first paragraph. A technical report exists solely to give information, and people with different needs will read it; some will have time only for a glance. An engineer must summarize his report for quick scanning by a busy executive.

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2 Reproduced in part from an article by JOSEPH HOROWITZ, P.E., Director, Facilities, Engineering, CBS, Inc., N.Y.,N.Y., as printed in Heating/Piping/Air Conditioning, June 1975.

3 The first three are not required for very short or informal reports.

- Although the summary appears first in a report, it is written last. An effective summary must be brief, rarely more than a page, and preferably one paragraph. As the name implies, it presents the most important conclusions but without any supporting discussion.
- *Purpose and scope:* Every report has a purpose: to present findings of a research project, to recommend purchase of new equipment, to present a solution to an engineering problem. A clear statement of the purpose is important to the reader, but it also helps the writer to organize his thoughts. Many a report has wandered off because the writer never bothered to state his purpose.
    - Scope tells the reader what to expect in the report, but it is not, however, a summary of its findings. For example: "Causes of repeated compressor failure are analysed, and corrective action recommended"; or, "Five common pumping techniques for campus chilling systems are examined and compared in terms of economy and simplicity of operation, as well as initial cost."
- *Background or introduction:* A common weakness of engineering reports is to leap directly into a discussion of the problem without explaining just what the problem is. This is rarely a deliberate error; it is just that the writer is so enthused about his subject that he forgets that the reader may not be equally well versed. Even if a report is intended for your immediate superior who knows the subject well, he may want to send it on to others in the organization. The safest approach is to assume that the reader is unfamiliar with the conditions or problem.
    - This section will take various forms: depending on the report's purpose. The background may be historical or it may describe the existing conditions, or the symptoms of a problem. It may present technical information that is essential to understand what follows. Basically, it gives the reader what he needs to understand the discussion that follows.
- *Discussion:* The term "discussion" would rarely be used; more likely, the discussion would be presented under descriptive subheadings such as observations, analysis of data, recommended solutions, or potential savings. Regardless of title, it is the heart of a report. Here is where the writer presents his facts and figures and marshals his arguments. Alternate solutions are presented and evaluated. This section should develop ideas in such a way that the conclusions and recommendations follow naturally.
- *Conclusions:* Conclusions should follow directly from the preceding discussion. If, after stating the conclusions, you feel that some are unsupported, go back and revise the discussion section but do not weaken the impact of your conclusion with further justification or elaboration in this section.
- *Recommendations:* Most reports contain some kind of recommendations. They should be stated briefly, clearly, and without quibbling. In the less formal reports, they may be included with the conclusions.
- *Appendix:* Anything that must be in a report but which would break its continuity belongs in an appendix. Here is the place for lengthy or bulky materials such as calculations, detailed descriptions of test methods, tables, or photographs.

The format just presented is, of course, only a guide to be varied as needed. But even in the briefest memoranda, following this general system will help make the report complete and useful.

Procedure

The format helps to organize the report, but some suggestions on the actual writing process may also be helpful.

- Use an outline. Starting with the format classifications as main headings, list the main topics you want to cover. Leave spaces between each item, since you will think of things later that must be added. When you are finished, go back and fill in the gaps.
- Following the outline, write the first draft as rapidly as possible. Don't stop to correct mistakes. If a word, phrase, or even a whole section proves difficult, skip it and go on. Another trick is to start, not at the beginning, but with the part that comes most easily.
- With a comprehensive outline, it should be no problem to fill in the missing sections later. This may sound like 1aziness, but it is sound psychology. First, it helps overcome the problem of getting started—that numbness that we feel when faced with a blank sheet. Second, many writers find that once started and immersed in a subject, the words come easier. Thoughts organize themselves, and even those portions that seemed so forbidding can be tackled with ease. This is also the reason for speed in writing the first draft; if you stop to correct or polish, you risk losing that all important momentum.
- Only when the first draft is complete, should you begin the process of editing and revising. Continuity is the first consideration in editing. Does each paragraph present a complete thought, with no "gaps" that the reader must fill in. Secondly, correct errors in sentence structure, grammar, and spelling. The final editing should also weed out duplication and superfluous wording.
- Many writers find it helpful, if time permits, to put aside the draft for a few days before making a final review. During this time, the unconscious mind can provide that elusive word or phrase, and a fresh look will often Yield surprising benefits in completeness and readability.
- Do not stop after the final editing, A careful proofreading of the finished typescript is a tedious but essential chore. While a good secretary can spot and correct obvious typos, she cannot be expected to pick up missed words or errors that change the meaning.

Common Pitfalls

A common mistake in technical reports is writing for the author rather than the reader. A line manager is usually more interested in the costs and benefits of a proposed installation than in its design calculations. But an engineer who has spent many hours on these calculations may feel that he must explain them in great detail.

Avoiding "engineereze" is another writing goal. The U.S. Peace Corps once ran an ad for "an engineer who can speak two languages: English and engineering." And, indeed, many engineers seem to lapse into a foreign tongue when writing about their specialties. Yet, most are quite capable of making their point in face-to-face conversation. Possibly, their enthusiasm is more contagious in direct discussion, or they can more readily sense the blank stare that signals incomprehension.

One way of avoiding this temptation is to write as if you were explaining your subject to a friend in an unrelated profession; that is, someone perfectly capable of

grasping your message, but who lacks both your familiarity with the subject and your specific technical background.

Another weakness in technical reports is the leap to a thought or conclusion for which the reader has not been prepared. This might be termed a "readability gap." Often these gaps result from the omission of background information such as existing conditions or history or a clear statement of the problem. The suggested report format will help, as will a good outline and careful review. Review by a colleague will also help in avoiding this problem.

The opposite twin to the readability gap is excessive detail. Many engineers simply overwhelm readers with masses of information, and the basic thrust of the report becomes a casualty along the way. The rule is: when in doubt, leave it out. A review by a colleague will help here also.

Some reports are burdened by wordiness. Never use several words when one will do, and as you edit, try striking out any words not essential to the thought or sentence structure. Sentences will be leaner, clearer and carry more punch.

When editing, watch for long words. A good vocabulary may mark an educated person, but it is often the death of a good report. Mercilessly strike out any word that is three syllables or more, provided there is an equally good one of one or two syllables. In addition, watch out for long, run-on sentences and endless paragraphs that tire the reader.

Illustrations And Spreadsheet Plots

Most technical reports require diagrams or graphs, and good illustrations can do much to clarify a point. Avoid stuffing a report with drawings and be as ruthless in cutting out illustrations as you are with words. If you do not refer to a drawing somewhere in the text, it is a safe bet that it can be left out.

Now look at the illustrations themselves and remove as much extraneous detail as possible. Your reader will quickly grasp your point if all but the essentials are pared away.

With word processing, most illustrations can be incorporated into the text with a minimum of difficulty. Illustrations should be sized to be legible. If you're struggling with wrapping the text, simply make the figures the full column width and put them in line.[4]

Probably the most common type of illustration used is the spreadsheet (Excel or LibreOffice.org Calc) spreadsheet plots. These were primarily developed for business and general use purposes. They can be used effectively in engineering reports but it is essential to include the following in any spreadsheet plot:

- Complete tick mark labelling for both or all axes.
- Major gridlines at least for both axes, minor if necessary.
- Title. Make sure your title and axis labelling doesn't take up so much space that the graph that's left is too small to read.
- Labels for both axes.
- Axis scaling and limiting such that the curves on the plot extend at least from one x-axis to another.
- Proper differentiation between different curves, including different data point shapes, different line types (especially important if you're not printing in

4 In the past it was common to put all figures on the full 8 ½" x 11" paper, or a 11" x 17" foldout. Although this is certainly an option it is generally unnecessary; 11" x 17" foldouts in particular should be avoided unless there is no other way of showing the detail.

colour) and appropriate line thicknesses and types. (It's possible to have bar and other types of graphs, but these are not as common.)
- Legend, at the bottom of the graph.
- If least squares curve fitting is used, you must include the equation and the R^2 values on the graph.

These requirements apply to both homework and reports.

Most spreadsheets have various methods (interpolation, least squares) to assign an equation of some kind to a plot. These should be used with great care and never used blindly. These techniques are very powerful but if misused will result in "GIGO" (garbage in/garbage out) with potentially disastrous results.

Editing And Proofreading

In either text and illustrations, like it or not, neatness counts. Reports should be double spaced (one and a half spaces is acceptable,) with generous, uniform margins. The system of headings, paragraphing, and indenting should be consistent throughout. Labelling on illustrations should be clear and abbreviations uniform and generally understood.

The best—indeed the only—method of improving your report writing is careful review of your own work. You are your own best critic. However, a knowledgeable colleague can be very helpful in reviewing both the initial outline and the report itself. Not only can he assure that it "reads right," but he can also often spot gaps in the thinking or raise points that should be covered. If your "sounding board" is not familiar with the details of the report, so much the better because he will be unable to subconsciously fill in missing information.

Many of your reports—and certainly your design project—are team efforts. A team creates an automatic editing group. Use it wisely. No report should be turned in without the entire team having read and "signed off" on the work. Team editing is also essential as most team projects are, in the early stages at least, "cut and paste" projects as each team member's contribution is initially placed into the report. Team editing will prevent repetitions from one part of the report to another, uneven style and formatting, and outright contradictions from each team member.

Summary

The engineer who can present technical thinking in clear English, readily understood by any intelligent reader (especially non-engineers) has a valuable skill. You can cultivate good report writing and enhance your chances for promotion by practice and by following some of these good habits:

- Use a format for every report, even the short, informal memo types.
- Work from an outline.
- Edit, put aside, and then edit again.
- Watch for the readability gap; give your reader enough introductory information to understand the discussion.
- Be ruthless in weeding out all unnecessary items: subjects, words, and illustrations. Use small words.
- Edit the illustrations as carefully as the text.

Design Project Report Requirements

In addition to the general guidelines given earlier, these are specific to the design project report for ENCE 4610. Follow these carefully; failure to do so will have an adverse affect on your grade.

The following must appear in your report.

- General
  - A complete statement of the problem
    - Overview of the project
    - General description of the soil borings and soil profile, illustrated with charts
    - Any specific factors that would influence the design not directly related to the structural loads and the resistance of the soil (environmental, neighbouring structures, etc.)
  - Sample Calculations
    - Sample calculations are required for many steps in the design and reporting process
    - These must be clear and easy to follow
    - Use of computer solution is acceptable but spreadsheet/program must be explained and data input and output clearly set forth
- Shallow Foundations
  - Shallow foundations should be considered first in any design project
  - If accepted, detailed calculations for both bearing capacity and settlement must be presented
  - Structural analysis of shallow foundations only necessary for spread footings (not necessary for mats)
  - Don't forget to include weight of the foundation in the calculations
  - A basic geometrical layout of the foundation is required and rationale for the arrangement
  - If rejected, an overview of the reasons for rejection (with sample calculations) must be detailed
  - Any soil improvement (compaction, etc.) must be detailed
- Deep Foundations
  - At least two types of deep foundations must be considered. This could include drilled shafts and one form of driven piles, two types of driven piles, etc.
  - Specialised type of foundations (stone columns, vibrocompacted foundations, etc.) are acceptable if applicable but same reporting requirements for these as anything else.
  - Complete sample calculations are required
  - Weight of the foundation consideration not required for driven piles but required for other types
  - A basic geometrical layout of the foundation is required (number of piles or shafts, arrangement, etc.) and rationale for the arrangement
  - Structural analysis for deep foundations required
  - Bent structural analysis for either piles or drilled shafts not required

- Retaining Walls
    - At least two types of retaining walls should be considered, with reasons for selecting one over others
    - Sample calculations are necessary as with foundation report
    - If foundation analysis (shallow or deep) is required, must be included
    - Structural analysis only necessary for sheet pile walls
    - Any anchorage system, or soil replacement or modification, must be described and analysed in detail

Laboratory Report Writing

The following instructions will apply to the reports prepared for laboratory tests, but the information presented may be used for other reports outside the soil mechanics laboratory. Keep in mind that everything done in writing a report has as its goal the selling of your work to the reader, which in this case is your instructor.

Order of sections for report:

1. Initial Matter (5 points)
   a) Title or Cover Page. This will contain the following from top to bottom:
      - Course Name
      - Your Name
      - Date of Report
      - Name of Test
      - Number of Report (i.e., Laboratory Experiment 1, Laboratory Experiment 2, etc.)
      - Instructor's Name

   b) Objective of Test. This will list briefly the specific goals of the test. Note: the statement, "to familiarize the student with..." will not be considered as a pertinent objective.
   c) Specification(s) under which the experiment is being run. Most soils experiments —laboratory or field—are conducted using standard specifications from the U.S. Army, U.S. Army Corps of Engineers, ASTM, AASHTO, etc. In this laboratory, most experiments will be conducted with procedures from the soils laboratory manual, and these must be referenced properly in your report.
2. Procedure (5 points)
   a) List of equipment used. This can be either a list or complete schematic of the equipment being used.
   b) Overview of test procedure. Since you have properly referenced the procedure earlier, you only need to note the places where your procedure varied from the actual specification.
3. Results and Discussion. (45 points) The results will usually be given in tabular and graphical form and should be referred to by figure or table number. The discussion should analyse and inter-relate the results of the test. Not only should it discuss the implications of the curve shapes, but it should attempt to explain any unusual or unexpected results, source of errors, and suggestions for remedying the test errors. TELL THE READER WHAT THE RESULTS MEAN. The results should not only be stated but also interpreted. Relevant reference material should be used to clarify the results. Relating the results of this test to those of other tests will often result in good discussion material. The reliability and limitations of the results should be commented on. Like all other sections of the report, it should be concise and should proceed from the general to the particular. The use of English should be especially watched, as poor grammar often makes a perfectly logical statement confused and meaningless. If in the analysis some interesting or important point is brought out, not considered in the original objectives, it should be developed in the discussion and covered by additional conclusions. Do not bring up a point in your discussion unless you pursue it in a full discussion (or at least one paragraph). This section of

the report weighs heavily in the final evaluation of the report, therefore, considerable effort should be expended here. Your reader is disinclined to wade through heavy, dull reports. A description of the test procedure does not constitute a discussion.

4. Conclusions. (25 points) This must include the following:
   a) The numerical results of the experiment, in summary form.
   b) The relevance of the experiment for design, even if that relevance is a general one. All conclusions must be based on and be supported by the contents of report. Conclusions should be developed in the discussion. Conclusions must not be a repetition of the discussion nor can a conclusion be discussed in this section.
5. Appendix (20 points) should consist of supplementary material you may wish to retain. If necessary, scan it into your document. Remember, neatness is a good selling point. Materials in the Appendix can include but are not limited to the following:
   a) Original Data Sheet (this must appear in the appendix.)
   b) References and Reference Material (laboratory notes, etc.)
   c) Sample Calculations. Do not use these to display your results; use the data sheet or tabulation in the text.

Note On Presentation Of Tabular And Graphical Results

Permissible options for data presentation are as follows:

1. Using the "DD" data forms in the lab manual. Many of these are also posted on UTC Learn with the experiment.
2. Using the lab spreadsheet on UTC Learn.

Laboratory Design Proposals

Laboratory design proposals are similar to conventional lab reports except that they describe an experiment you would like to run rather than one you already have performed. Most experiments in Soil Mechanics are simply run according to a specification, but there are situations where either there is more than one way to conduct an experiment or you are performing a sequence of experiments on a soil sample.

The basic outline is similar to that for conventional laboratory reports, but the outline is a little different and thus the rubric is different. The following is an outline for these types of reports:

1. Initial Matter (10 points.) The same as for experiments, except that you may have more than one specification or lab procedure referenced.
2. Procedure (40 points.) This is where you need to be specific and detailed in what you propose to do. If you want to shorten your description, you can directly reference parts of the lab specification(s) you listed earlier without having to copy them. However, it should be clear how you are varying from these procedures, or choosing options available.
3. Discussion (40 points.) You need to back up the rationale for your procedure here. You need to explain why you are doing what you are doing. This is also the place where you explain how you plan to process the data (crunch the numbers.) This must be specific, not vague. Here is also a good place to describe any "trial runs" of the experiments, if you have done them.
4. Appendix (10 points.) Any supporting material must be listed here.

Guidelines For Oral Presentations

Unless otherwise noted, each speaker or team will get twelve (10) minutes each for a presentation. This will be broken down into eight (7) minutes for the actual talk and four (3) minutes for any questions that the audience might have.

Although the presentation is basically to lay out the contents and results of the report, simply reading the report or slavishly reproducing its contents in an oral form will lead to a boring presentation. The oral presentation should, in effect, be an independent rendering of the material in the report, designed to get the audience's attention and to make real the procedures and conclusions contained in the report. In preparing the oral presentation and the graphics that go with it, you should consider how best to achieve this with your listeners, and this might require that the material actually presented by different from that in the report. This may involve either reserving certain material for the report itself and/or adding other related material not suitable for written presentation. We have no problem with the latter as long as the material is in accordance with our other guidelines.

We want your ideas and material to make an impact with the audience -- this makes a successful class for all of us.

Presentation Slides

All slide shows should be "presentation graphic" type of slides, i.e., Microsoft PowerPoint. The podium projector will be available. You may want to “dry run” the experiment on the podium projector to make sure it works there. The podium projectors currently feature Microsoft PowerPoint 2010 and its possible there will be changes if you used an earlier version of PowerPoint to prepare the presentation.

Other requirements are as follows:

1. All lettering or text is to be clear, and hand written text should be avoided. To make your text visible, the height of the text should be at least 24 points. The EMCS classroom environment we are using is more forgiving of small print than others, and sometimes you can get away with small print; however, keep in mind that you will be making presentations in the workplace and the projection may not be as large.
2. Avoid “unusual” fonts; they may not be available on the podium projector and the results may be unpredictable.
3. Slides should be made to avoid the viewers' eyestrain. The most important way to do this is to establish a pleasing colour scheme. A blue background slide with white or yellow lettering is the “classic” type of background, although over the years the students tend to prefer a bright neutral background (white/beige) with black lettering. Most backgrounds that come with PowerPoint have default bulleting and font setups; unless you know what you're doing, stick with them.
4. Graphs should be clear and simple, avoiding such common mistakes as excessive gridlines, too many curves in one graph, and too many numbers on the scales. If possible, colour graphs should be used, but again the colour scheme should be simple and logical. Remember that the viewers can absorb only so much information from one chart, especially when they only have a minute or so to look at it.

5. If photographs are used -- and they can be very effective -- they must be in focus and the colours not washed out.
6. Make sure you have the right number of slides. As mentioned before, slides should be projected for about a minute before moving along.