Mechanical Engineering 360
Mechanics of Sports
Spring, 2016-17

Information on Final Project Report Preparation

General Format

The general format is flexible but should be neat and clearly legible. All reports should be word processed and submitted in electronic format (pdf or WORD). I suggest 10 or 12 point font and 1.5 line spacing. All pages should be numbered and assembled in the correct order.

Headings

Style of the headings is again flexible but should be uniform throughout the report. Allow adequate breaks between sections and sub-sections, but do not start a new page for each section. Do not put a section heading at the bottom of a page unless it is followed by at least two lines of text.

Spelling and Grammar

Correct grammar and spelling is expected. Proof-read your report carefully.

Referencing

Anything that is not your own work and is taken or paraphrased from a book or the internet must be referenced. References should be cited within the text at the appropriate place by author and year, e.g. (Smith, 1978) or (Jones and Smith, 1968) or url in either parentheses ( ) or brackets [...]. For three or more authors, use (first author et al., year). References can be either parenthetical (as in the preceding) or as part of the text, e.g., “Smith (1978) shows that...” If you are referring to a particular formula, figure or give a direct quote, the page number should be given.

Style

Try to use active voice. Occasional use of the passive voice is fine, but overuse makes for weak writing. Although some people object to using the first person (“I” or “we”) in technical or scientific reports, I think it is more forceful and direct and often makes it easier to avoid certain awkward or grammatically incorrect constructions.

Generic Report Outline

Title

Authors, Year, Dept or Major (e.g., John Doe, Junior, Industrial Engn.)

Introduction

Give the context of the problem and some background. Why is it interesting (first of all, to you)? How is what you are doing related to the work of others? E.g., Are you summarizing and synthesizing some studies, collecting data of your own, etc. What aspect of the problem are you looking at? Why? How are you addressing the problem?

If you are including a lot of background, e.g., on historical aspects or a description of the game or sport, then this should be put in a separate section, e.g., **Background**, rather than making the **Introduction** too long.

Methodology

Description of your experiment, data collection or formulation.

Analysis

If analysis (derivation, evaluation of equations, etc.) is a significant part of your report, you should do it in a separate section. If it is minor part, or you are using standard (e.g., projectile motion) equations, you can include this in the methodology. If you use specific, non-standard equations (i.e., not Newton's laws, not projectile motion equations, etc.), not only cite the reference where you obtained them, but also give some explanation (Although a full derivation of them is not necessary, if I cannot understand them, then others are unlikely to). Why are they appropriate? What are they based on? Just because you found them in a book or on the internet somewhere (or even more than one place) does not make them suitable. If you really cannot understand an equation or what it is based on, say so and explain why you used it anyway (e.g., only thing you could find, seemed reasonable because...., gave results that were in accord with observation, etc.).

Results

Describe your results using Figures, Table, etc. if appropriate.

Discussion

How do you interpret the results? What are the limitations, weaknesses of your approach? What agrees with your expectations? What does not? Based on your results, what other things could be done? How could the analysis be improved? What are remaining questions? What would you do differently if you had it to do all over again?

Conclusions

Summarize main conclusions of your study.

References

References should be listed in alphabetical order according to author or editor. The following is a list of references taken from the Dept. of CEE, Lafayette College, DRAFT: Instructions for Preparations of Reports. The format is the ASCE standard. You are not required to use this precise format but it should be similar.

ABAQUS user's manual – version 5.6. (1996). Hibbit, Karlsson & Sorenson, Pawtucket, R.I.

Agarwal, V.C., and Mishra, R. (2000). "Discussion of 'Design of pipelines to transport neutrally buoyant capsules,' by Prabhata K. Swamee." *J. Hydr. Engrg.*, ASCE, 126(1), 91-92.

ASTM. (1997). "Standard test method for electrical indication of concrete's ability to resist chloride ion penetration." *C 1202-97*, West Conshohocken, PA.

Bazant, Z.P., and Novak, D. (2000a). "Probabilistic nonlocal theory for quasibrittle fracture initiation and size effect. I: Theory." *J. Engrg. Mech.*, ASCE, 126(2), 166-174.

Bazant, Z.P., and Novak, D. (2000b). "Probabilistic nonlocal theory for quasibrittle fracture initiation and size effect. II Application." *J. Engrg. Mech.*, ASCE 126(2), 175-185.

Duvant, G., and Lions, J.L. (1972). *Les inequations en mechanique et en physique.* Dunod, Paris (in French).

Eshenaur, S.R., Kulicki, J.M., and Mertz, D.R. (1991). "Retrofitting distortion-induced fatigue cracking of non-composite steel girder-floorbeam-stringer bridges." *Proc., 8th Annu. Int. Bridge Conf.*. Engineers' Society of Western Pennsylvania, Pittsburgh, 380-388.

"Factory liability limits backed." (2000). *Washington Post*, Feb. 3, A7.

Federal Highway Administration (FHWA). (1995). "Fly ash facts for highway engineers." *Rep. No. FHWA-SA-94-081*. Washington, D.C.

Federal Register. (1968). 33(No. 146; July 27), 10756.

Gupta, A., and Krawinkler, H. (1999). “Seismic demands for performance evaluation of steel moment resisting frame structures.” *John A. Blume Earthquake Engrg. Ctr. Rep. No. 132*, Dept. of Civ. and Envir. Engrg., Stanford University, Stanford, CA.

Hordijk, D.A. (1991). “Local approach to fatigue of concrete.” PhD thesis, Div. of Struct. Engrg., Lulea University of Technology, Lulea, Sweden.

International Conference of Building Officials (ICBO). (1997). *Uniform building code*. Whittier, CA.

Melan, J. (1913). *Theory of arches and suspension bridges*, D.B. Steinman, translator, Myron C. Clark, Chicago.

Merifield, R.S., Sloan, S.W., and Yu, H.S. (1999). “Rigorous plasticity solutions for the bearing capacity of two-layered clays.” *Geotechnique*, London, 49(4), 471-490.

“Product overview.” (1999). <http://in-site.bidcom.com.html/overview.html> (Feb. 3, 2000).

Soil survey of Acadia Parish, Louisiana. (1995). Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

Zadeh, L.A. (1981). “Possibility theory and soft data analysis.” *Mathematical frontiers of the social and policy sciences*, L. Cobb and R.M. Thrall, eds., Westview, Boulder, CO, 69-129.

Zhang, H.M. (2000). “Phase transitions in nonequilibrium traffic theory.” *J. Transp. Engrg.*, ASCE, 126(1), 1-12.

Appendix

Appendicies are the proper place for raw data or computer program listings that are not suitable for inclusion in the report body.

Additional Information on Figures and Tables

(again from the Dept. of CEE, Lafayette College, DRAFT: Instructions for Preparations of Reports).

All figures and tables should meet the following guidelines:

1. Every table and figure should have a number, e.g., Figure 1, and a title. Every table and figure also should be referred to in the text (or appendix) of the report. When a specific table or figure is mentioned in the text, the word “table” or “figure” should be capitalized, e.g., “The results of the laboratory tests for grain

size analysis are summarized in Figure 4." Figures and tables should be numbered in the order in which they appear in the text, e.g., Figure 2 should be mentioned in the text before Figure 3 is mentioned and after Figure 1 is mentioned. Figures in the appendices should be numbered A-1, A-2, B-1, etc.

2. Tables and figures should have descriptive titles. These titles should be in the same font and size as the text.

3. Tables and figures should be self-contained, including sufficient information to allow their effective use even if separated from the body of the text. The project name and date of preparation should be included on each figure or table.

4. Tables and figures should be readable from the bottom or the right-hand side of the page. The choice of "portrait" or "landscape" mode of printing should be made on the basis of the best level of comprehension of the information.

5. Tables and figures should be computer software generated and text within a table or figure should be no smaller than 10 point.

6. On graphs, *points* should be used to represent observed data, *lines* should be used to represent theory, equations, or approximations. Data points should be designated with an appropriate symbol (i.e., circles, triangles, etc.). Use a legend to distinguish different sets of data points.

7. Avoid the use of multi-color graphs, since the uniqueness of the color designation is lost in photocopying. [In this case, color is fine, but as a general rule, this is not a bad idea. jwr]

Additional Suggestions (modified from Nathan Tregger, CE 216 TA)

Concerning figures/tables

- USE FIGURES AND TABLES! They explain what's going on so much better than lengthy written explanations.
- Label the axes WITH units (strain is measured in % or in/in depending on how you manipulated the data). [I disagree with this in the case of strain. Per cent is ok, but in/in is meaningless. Light years/light years is the same thing and so is length of my foot/length of my foot. jwr]
- Label each figure as Figure 1, Figure 2, with a short description, and reference each figure in the body of your paper (for example: As Figure 1 shows, the stress-strain values are represented by diamond points...).
- Microsoft Word has a nifty caption feature: right-click on a picture and select Caption…. Make sure it's a figure (if it's a figure) or a table (if it's a table). Figure captions typically go on the bottom while table captions go on the top. Word will automatically number your figures. All figures and tables (including their captions) should be able to be self-explanatory. That is, they should be

understood even if they were the only item on the page. This goes for appendices as well.

- Make your graphs visible! Don't make them so tiny it's hard to read. Also, make sure the axis labels are large enough.
- Only use relevant parts of the graph.

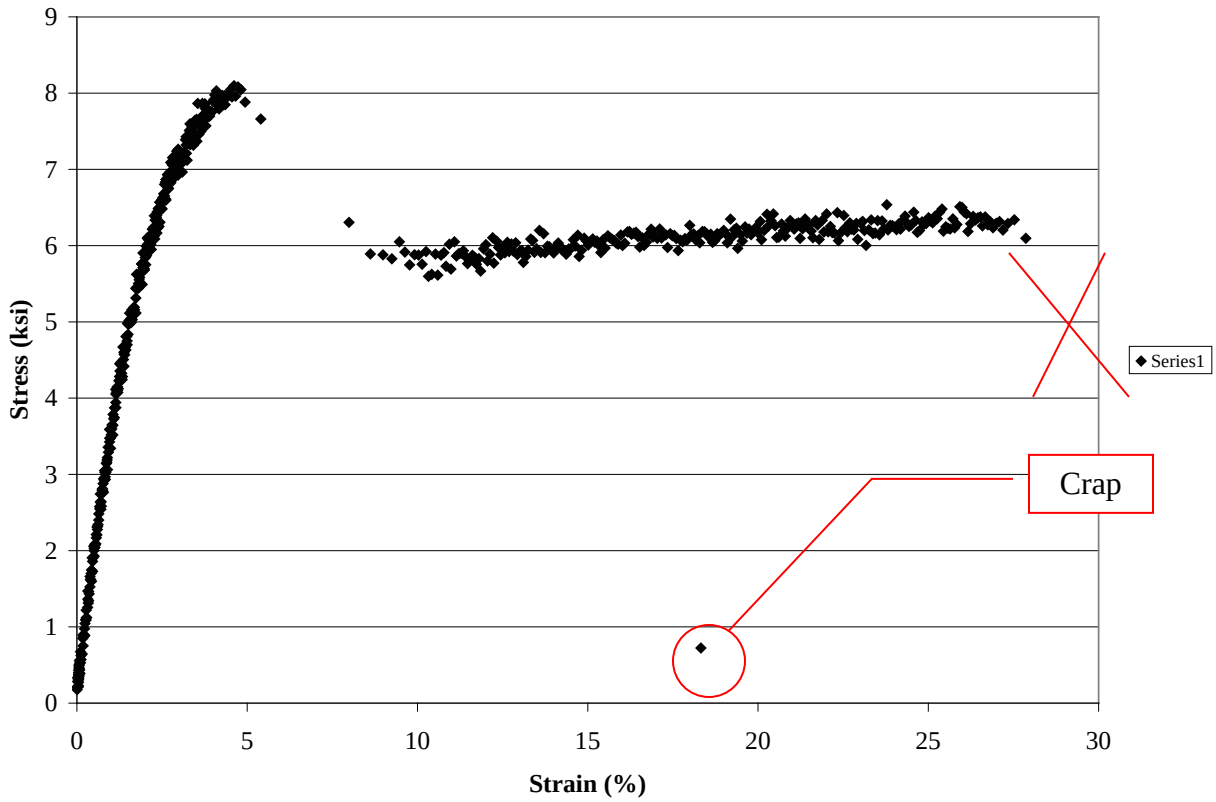

Figure 1: Stress-strain curve for polycarbonate, quite possibly the most wonderful material in the whole world.

- Also, you don't need a legend for a single data graph like the one above. Just make sure you say what it is in the figure description. Do use legends for multi-data plots and make sure they aren't color dependent (use different shape points). In the office, you usually make black and white copies, so the colors get lost. [See above. In this case, color is fine. jwr]
- Usually, when you are plotting experimental data, use points, not lines or points connected by lines. You only use lines for theoretical curves, such as a trend line.
- Format your numbers on the axes as "round" numbers, e.g. 1, 2, 3, 4, not 1.94583, 2.3235, 3.3442.
- You should never refer the reader to figures and tables in the appendices. If this information is necessary for clarity (e.g., summary figures and/or tables), these figures should be in the main body of the report. The reader should be referred to the appendices for descriptions of procedures that were developed by the authors and cannot be cited, detailed results of testing, calculations supporting analyses, etc.

- On the other hand, put necessary graphs in your paper. (In this case, the materials report shows the material properties of the materials, so stress-strain graphs of the materials describe this very well, and thus it's important.)
- When you are trying to compare several stress-strain curves (e.g. for the first few labs), plot them on the same axes. That way you can easily compare them and you are saving space as well.

Other things:

- Calculate percent error when comparing your data to literature, and put this in your tables. It's a way of normalizing the comparison.
- Calculate percent differences when comparing two different entities (where neither is an accepted value).
- Also, cite the source from which you obtained your reference information.
- USE tables when presenting the information. No one wants to read a paragraph where every other word is a number. (don't forget to number your tables)
- In your tables and calculations, use a consistent number of significant figures, and don't use more than about 3. Engineering isn't that accurate in general.
- No writing in the 1st person. It's not an autobiography. [I disagree with this. Writing in the first person is fine. It makes it easier to avoid the debilitating overuse of the passive voice and awkward and sometimes grammatically incorrect constructions. jwr]
- Don't use words like, it was relatively ductile, or it was a lot more ductile or it was it was kinda more ductilish… these words don't mean anything unless you have numbers to back them up. Which you do, so use the numbers… (it was 25% more ductile, blah blah blah.
- If you do calculations, don't put them in the body of the report. They go in the appendix. And make sure you do the calculations. Documentation is 99% of an engineer's job. Five months after a project is done, your [supervisor] WILL ask you how you did something and if you didn't document it clearly, someone isn't going to be able to pay off their college loans.
- When finding literature values, remember that properties may be called something different, depending on the source. Knowing the definitions of the properties will help you figure out which is which.
- Your report needs to look professional, and it needs to be concise. You can get really far by knowing how to communicate through reports, presentations, etc.

March 25, 2009