

Assignment 5: Final Design Report

At the conclusion of a design project, the actual deliverable is often not the physical object itself, but rather a detailed written account of the process and results. The final design report is usually addressed to a client and thoroughly explains the work that was done. Although your work this semester will also be represented by the crane and its performance, the final design report provides an equally important means by which your achievements in the course will be assessed.

Unlike your previous reports, which were written in memorandum format, this will be what is called a **formal report**. Formal reports are “formal” in two ways. Because the final design report is the final product, it has a very official look; it includes elements that enhance its presentation. Most final design reports are also quite long. Therefore, to make the report easier to read, it has a standard structure.

What makes a formal report “formal”?

- Official look
- Standard structure

This report will be **team-written**. You will need to work closely together to coordinate the various tasks of the report and make sure all the requested information is included. Designation of one or two people to manage production of the “master document” is recommended. Be sure you also arrange procedures for sharing information needed by other team members.

This report, like the rocket design report, will have one reader who reads only the executive summary and conclusions and looks at the figures and tables. Another engineering reader will read the entire report plus any appendices that are referenced in the main body of the report, and your writing instructor will read the body of the report but not the appendices.

Due Dates

This is due **Monday, December 17, at 4 p.m.** if you are in the **Monday** lab sections (1, 3, and 5) and **Wednesday, December 19, at 1 p.m.** if you are in the **Thursday** lab sections (2, 4, and 6). You will receive specific submission instructions from your writing instructor. Reviews of drafts are optional and should be arranged with your writing instructor and the engineering faculty as needed.

Purpose

The objectives of this assignment are for you to:

- Present a technical description of a final product
- Explain the design process that led to the final product
- Present and discuss performance results
- Compare your crane’s actual performance to your predictions
- Offer conclusions about your process and performance
- Learn the conventions and standard components of formal reports
- Use figures and tables to present technical information
- Follow document specifications
- Organize the production of a formal team-written report

Report Sections and Content

Letter of transmittal

The letter of transmittal announces the delivery of the final report. It is a formal business letter, addressed to the recipient(s) of the report, that accompanies the final report and briefly explains what the report is and why it is being submitted. Letters of transmittal sometimes address special circumstances that are not covered in the report, highlight key findings or recommendations, and/or give further contact information. Address the letter to the Sophomore Engineering Clinic Faculty, or list all of the names, including your writing instructor. The letter of transmittal should be **signed by every team member**.

Cover page

Create a cover page showing the title of the project, team number and list of members, the name of the course, your section number and writing instructor, and the date submitted. You may also “customize” or embellish your cover page if you wish.

Executive Summary

Present a concise “stand-alone” explanation of the purpose of the project that includes **all essential facts** about the design problem and the design solution. Remember that, in addition to providing a preview of the report, the executive summary is also written for **readers who are not reading the body of the report**. Refer to relevant figures and tables in the text so they can be found with ease. Executive summaries are usually about 1/10 the length of the complete document. Include a heading for this section.

Acknowledgments

On a new page, identify and express appreciation for contributions made by persons other than your team members—for example, faculty you consulted or technical personnel who assisted you. Include a heading for this section.

Introduction

On a new page, explain what the report pertains to and how it is structured. Refer to particular sections and briefly indicate what is discussed. Include a reference to Appendix A, which will be the list of personnel and summary of team member contributions. Remember that the introduction is a **navigational guide** to readers who want to know what to expect and/or readers who may want to go directly to certain sections.

In formal reports, a heading should be provided for the Introduction. All subsequent sections, up until the Appendices, should also include a heading and continue on the same page as the preceding section. Subheadings should be used as needed to distinguish different content focuses within the major sections.

Design Process

This section reviews the design process with an emphasis on the thought process and the data that inform your final design. Begin with the definition of the design problem. Then describe the process by which you chose and optimized your final design. At the beginning of this discussion, you should refer the reader to the Final Design section and the figure showing your final design. In particular, identify the information you had available to you when you chose the truss family you optimized and explain the basis for your decision.

Include figures showing at least two other truss families that you considered; part of your discussion here should address the criteria and data that led you to **eliminate** these design possibilities. Explain the additional design work you undertook to further optimize your final design. Plots showing the data from your parametric studies should be integrated into this discussion and their impact on your final design should be explained. Additionally, provide the relevant parameters for the plastic that were measured on the MTS machine. One or more sets of data that you used to predict load-deflection relationships and failure load for critical plastic members would be helpful. The raw data that are presented on the wiki might or might not be appropriate for making your prediction. It is possible that you will need to consider the relationships between multiple sets of data to extract the pertinent information. Be sure to summarize and show all relevant data in figures or tables in the body of the report.

Final Design

Present a complete technical description of your final crane design, including structure, function, and materials. Include a table showing materials used and resulting cost of the structure. Be sure to point out design innovations that proved crucial to your crane's performance. This discussion must be accompanied by a SolidWorks side-view of your design with labels and dimensions for all major parts and all truss members. This figure should be a SolidWorks *drawing*, not a screen-shot of an assembly. Include a table of member forces for a defined load and identify which members are in tension and which are in compression. Additional figures, such as "close-up" views of selected parts, may be used where appropriate.

Results and Discussion

Summarize the results of your crane's performance at the final competition. Show all lifts and relevant data for each one. If appropriate, provide a qualitative description of your crane's performance as well. Use figures and tables where appropriate to effectively present results. Show the performance equation with final values included and calculate your final score. Compare your calculated projection of the crane's performance to your actual results and, if applicable, offer your conjectures about any differences. Compare your crane's design and/or performance to others you observed.

Conclusions

The conclusions provide further evaluation of and final reflections on the results, **not only for readers who have read the entire report, but also for those who are reading only the executive summary and the conclusions.** This section should begin with a summary of the results of the crane lifts and a review of the results of the performance equation. Summarize your comparison of the actual results to the expected results and provide your evaluation of the actual results according to a relevant performance criterion. Refer to any relevant figures or tables in the body of the report. Finally, discuss what you would do differently to optimize this design, and/or identify any sources of error that impacted performance.

Appendices

- A.** List of personnel and summary of specific contributions to the project, including how individual tasks related to the overall goal and to tasks being performed by other team members
- B.** Structural and failure analysis calculations for your final design (must show free-body diagrams and sample or hand calculations in addition to Matlab results)
- C., D., etc.** **Any supplemental material** that some readers might want to see in addition to the essential data presented in the body of the report (specs not directly relevant to the design problem, preliminary sketches, raw data). A reader will not typically read your appendices from start to finish. Instead, a reader will read the main body of the report, and look for information in the appendices as needed. Be sure to refer to these appendices in the body of the report.

Document Specifications

A separate Style Sheet will be provided with specific format instructions.

Additional Notes

- Appendices should not include any material that is important for understanding the report. Essential material should be included in the body.
- Think of this report as a **final exam**. You should apply as needed all skills and knowledge you have acquired during the semester. Review lab and class handouts, your own previous reports, and your team notebook.

General Grading Criteria

Your grade will be based on your presentation of the final product and performance results, your insights into the design process, and your adherence to document specifications.

Please turn in 3 copies of this report.

Adapted from

The MIT Guide to Science and Engineering Communication
(J.G. Paradis and M.L. Zimmerman, 2nd ed., MIT Press, 2002);

A Guide to Writing as an Engineer
(D. Beer and D. McMurrey, 2nd ed., John Wiley & Sons, 2005); and

Scientific and Technical Reports—Preparation, Presentation, and Preservation
(National Information Standards Organization, ANSI/NISO Z39.18-2005)

