

Instructions for Design Project 01

**EGMN 420 Spring 2018 CAE Design
Computer-Aided Engineering Design**

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Contents

1 Objective of Design Project	1
2 Target Audience for Report	1
3 Input Design Requirements	1
4 Desired Output	1
5 General Guidelines for Project and Report	2
6 Typical Report Table of Contents	3

List of Tables

1 Useful checklist for design reports.	5
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List of Figures

1 Objective of Design Project

Develop and describe the design of the main supporting beam of a beam bridge for the specified input data and performance requirements.

2 Target Audience for Report

The target audience for this report is engineering management in your organization to help them decide whether to continue with the project design. If so, they will seek additional funding and authorization to develop more detailed engineering work on this topic.

3 Input Design Requirements

Bridge span length of 10 [m] supporting a total load of 450,000 [N] uniformly distributed over the beam length. This total load includes the bridge operating load and the other bridge-related equipment and structure, but does not include the self-weight of the supporting beam itself. A solid rectangular beam cross-section with dimensions of base b and height h are specified for this beam design.

4 Desired Output

Please determine optimum values of the beam, b , and h , and compare your designs for the following two kinds of beam configurations.

(i). A simply-supported beam, i.e., pinned support at one end and roller support at the other end.

(ii). A beam fixed at both ends.

Please discuss (but do not calculate) possible design changes that should be considered in future design efforts. Provide drawings and detailed list of final design details, i.e., dimensions, materials, supports, etc.

Specify all of the design criteria and the sources. Explain your analysis, design methodology, and method of software calculation (calculator, excel, Matlab, etc.). The final design report should also mention any other items of interest to the reader.

5 General Guidelines for Project and Report

1. Microsoft word and LATEX can be used to compose the final report.
Please see Section 6 on page 3 for typical report organization.
In the report, show Title Page, Table of Contents, List of Tables, and List of Figures.
All figures and tables must have captions, legible notations, and must be properly referenced in the report text.
2. You are allowed to be creative in your report presentation and organization as long as it is professional quality.
Please keep the reader in mind. English composition, clear writing, grammar, spelling, and neatness should be considered.
Note, using figures, tables, and drawings to explain your work will help to present your work.
3. The presentation and details of the project report should be sufficient:
 - (a) To instill confidence to an informed reader or manager that your conclusions, design, calculations, explanations, etc., are correct.
 - (b) To justify the commitment of scarce organization financial resources.
 - (c) To avoid potential legal liability problems (e.g. safety factors)

Furthermore, a well-written report will instill confidence in *you* as a professional engineer in your organization.
4. Proper English grammar and spelling are required. Wordiness will not be rewarded. Keep in mind that engineers and managers are very busy — *Time is not our friend* — and reports that are concise, truthful, accurate, and instill confidence often result in increased opportunities for the report writer(s).
5. Use a Times New Roman font size 12 or Arial 11. Single spacing in the main body of your report; and double spacing between paragraphs.
6. The units of all calculations and presented data must be consistent with the input parameters, as appropriate.
7. The source of all input data, acceptance (allowable) criteria, and assumptions must be specified. The input data include beam length, loading, beam cross-section shape, etc. Criteria includes allowable stress, allowable deflection, Safety Factor,

- etc. Assumption include material selection, material yield strength, other properties, etc.
8. One single PDF of your complete final report must be uploaded to Black- board Assignments.
 9. The VCU Honor Code must be written out, signed, and dated.
 10. Please see Table 1 on page 5 herein for a useful guidance checklist for this design project and final report.

6 Typical Report Table of Contents

1. Title page (name of the project, your name, instructor name and date).
2. Table of Contents, List of Figures, and List of Tables with the corresponding page number.
3. Summary. Put the main information in the brief Summary. Briefly present proposed optimum designs with Factors of Safety. A small table incorporated directly in the text is useful. It is very important to tell the reader what the answer is early on in the report!
4. Introduction. Describe what the project is about, brief overview, objectives, performance requirements, methodology, etc.
5. Design inputs and objectives.
6. Design Methodology. Briefly explains your analysis, design, and optimization methods, including (i) Assumptions employed in the your design; and (ii) Criteria describes allowable values, code requirements, standards, Design Factors, stability, etc. For example, if the beam cross-section (b and h) is too slender, there is a danger that the beam cross-section will be unstable and the beam will buckle laterally. There is a mathematical formula for this laterally instability but we are not considering it directly herein. Therefore, use your judgment and keep a reasonable ratio of b to h .
7. Results and discussion. (i) A simply-supported beam. Show the selected optimum design for b and h using the contour plots. Present all important design characteristics. (ii) A beam fixed at both ends. Show the selected optimum design for b and h using the contour plots. Present all important design characteristics. (iii) Selection of your final

design. Why did you select the particular proposed design?

8. Design Variations. Mention possible variations/improvements in design for future consideration.
9. Conclusions (and recommendations). Present important conclusions and results.
10. References. Bibliography of your cited references.
11. Appendix A, Appendix B, ... for Excel working sheets, or Matlab codes, etc.

Table 1: Useful checklist for design reports.

Overall	
Reader has gained confidence in designer, design, and project results	
Design demonstrates creativity and imagination	
Technical soundness and substance of the design	
Presentation	
Where is the answer?	
Report is informative, easy to read, easy to find information	
Report is clear, concise, and well-written	
Adequate documentation, calculations, and drawings provided	
Clear summary of design particulars	
Follow instructions	
Technical	
Clear written and visual description of the final design	
Knowledge of technical subject matter	
Knowledge and use of available CAE tools, Maple, and MATLAB	
Proper level of technical detail and investigation	
Demonstrated that design meets specifications	
Demonstrated that the design actually functions as intended	
Demonstrated that the design is balanced and stable	
Adequate technical information provided to reproduce design and calculations	
No obvious flaws in the design or design details	