You will be doing a preliminary design of a three-story office building to be constructed in Madison, Wisconsin. The exterior of the building will be unreinforced masonry. The masonry will not be supported by the steel structural system, but you will need to consider drift limitations for masonry (See ASCE 7-10, section 12.12). The building footprint will be 150 ft by 85 ft. The lateral force system resisting North-South forces will be braced frames at the exterior of the building. The lateral force system resisting East-West forces will be moment frames at the exterior of the building (see below). You will design the following:

1. The steel bracing members for the braced frames.
2. The roof trusses ("K-Joists").
3. The steel sections to be used for the floor beams and girders and columns.
4. A typical moment connections to be used for the moment frames.
5. A typical shear connection to be used when connecting girders to column.
6. A typical shear connection to be used when connecting beams to the girders.

Loads will be calculated using ASCE 7 for wind, snow, dead, live, and live roof. For this project, you will only need to design for lateral wind loads—you can neglect uplift forces on the roof. Use a superimposed dead load of 18 psf for the roof and 80 psf for the interior of the building. As you design your building, consider that material cost is approximately 30% of the cost of the overall structure (the remainder being fabrication and erection costs).\(^1\)

For your final submittal, turn in the items in the order indicated:

1. A one-page (front and back) executive summary of the project. The executive summary should include a brief summary of your design process, any particular problems you had to resolve, and a total cost estimate. Also, explain how your design decisions were influenced by the fact that only 30% of the cost of a steel structure are material costs. Turn in the executive summary as a separate sheet (printed front and back) from your design report.

2. Design details of the frames showing steel sections used, code checks for all members in tabular form, and identification and location of designed connections.

3. A project narrative including:

   (a) Design assumptions and methodology used.
   (b) A narrative explaining how you designed your building for economy and constructability. (See the course website under “Constructability and Economy of Design” for some articles that cover these issues).
   (c) Details of your designed connections with discussion on how they would be constructed in the field. In addition, pick three suggestions from the article “57 Tips for Reducing Connection Costs” (available on the course website) to apply to your connection. Explain how your connection meets the suggestion. You may not use suggestion #12 (A36 steel) or #31 (same strength bolts).
   (d) Material takeoffs including sections used, lengths, and total weight.

4. An appendix with:

   (a) Printouts from your structural analysis program showing all necessary information but not too much. These printouts must be marked up to show the important information used in your design considerations. You must also include hand verification of critical members.
   (b) All hand calculations, which should be neat and easy to follow.

Please note that all pages in the report with structural design calculations (e.g., software printouts, spreadsheets, hand calculations, etc.) must include the initials of the group member responsible for the calculations and the initials of another group member who checked the work. A cover letter is not required.

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2These are too easy!
3The ACI design code stipulates that submitted computer calculations “should consist of sufficient input and output data and other information to allow the [reviewer] to perform a detailed review and make comparisons using another program or manual calculations.” (ACI318-02, R1.2.2) The same standard is expected for this project.