



Senior Thesis Program
Department of Architectural Engineering
Pennsylvania State University
University Park, PA

Structural Technical Report 1

Structural Concepts / Structural Existing Conditions Report

The **Structural Concepts / Structural Existing Conditions Report** consists of a requirement to describe the physical existing conditions of the structure of your building including information relative to design concepts and required loading. It should provide an overview of all the structural components of the building including, but not limited to, the general floor framing, structural slabs, lateral resisting system, foundation system, bracing elements, expansion joints, secondary structural systems for equipment support etc. and support and bracing of the exterior envelope of the building. A section of this report must describe how the primary components work together as a system.

Note: An evaluation form used by the structural faculty to review this report will be distributed in class. This form will serve as a valuable checklist and provide additional insight into the information that should be covered by your report.

The following is a representative list of items that must be included in all reports. Other items should be included as appropriate to providing an understanding of your particular building. You must include all the items required for any Senior Thesis Report Heading. In addition, a Table of Contents is expected for this report. Your appendix should be numbered for reference purposes but does not have to be consecutive with the main body of the report (Hand calculations may be hand numbered or you can use A1, A2, etc.)

***You do not have to type calculations,
but they must be hand printed, neat and organized.***

1. Provide an Introduction/Summary of the overall structural system. Be very specific relative to framing types, material strengths, spans, etc. Provide diagrams, framing plans etc. when ever possible to avoid large amount of descriptive text.
2. Include a list of codes and code requirements for gravity and lateral load conditions. List all the appropriate parts of model codes (IBC etc), design codes (AISC, ACI), and structural standards (ASCE 7). It is not necessary to list all the applicable ASTM standards.
3. Students must include copies of typical framing plans, framing elevations and building or structural sections as necessary to completely describe the framing layout to your consultant. Clearly identify those elements on the framing plan that are parts of the lateral force resisting system. Simplified original sketches prepared by the student showing

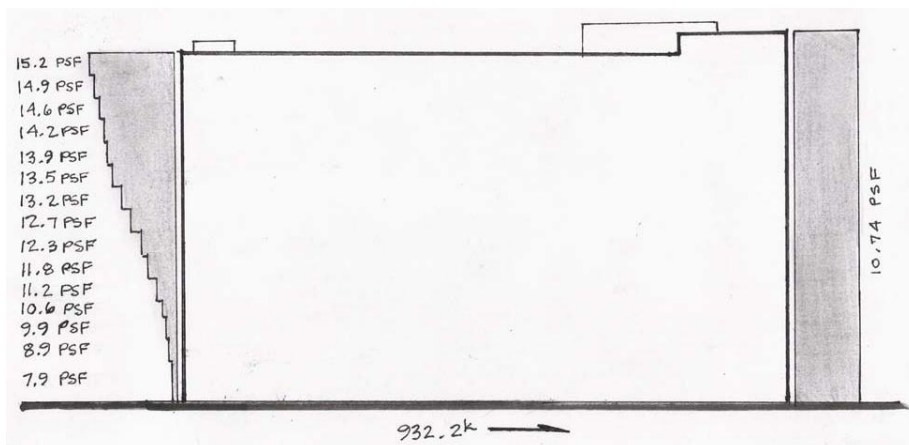
basic framing elements are preferred to reduced size copies of the plans, particularly if reduced original plans are difficult to read at the reduced scale needed to fit in the reports. Copies of plans may be included as a supplement or appendix or in the body of the report if they provide additional information and clarity to the report.

4. Each report must include a detailed description of the structure, including conclusions as to the types of design theory or structural concepts that may have been used (LRFD v ASD, shear walls v braced frame, etc.). Included in the discussion on lateral force resistance should be a description of the lateral load path and how the applied forces travel through the structure and are distributed to the various framing elements. You should discuss the impact that these concepts or issues will have on your work. Include sketches, diagrams etc. to help explain your system. Once again, students must be sure to clearly identify which structural elements are participating in the lateral load resisting (include a discussion of floor diaphragms, collector beams etc.) system providing sketches or framing plans that identify the system parts and components.

5. Compute all required loads including wind and seismic and prepare **loading diagrams** as appropriate for the existing systems (frames, shear walls, braced frames etc.) Students are encouraged to use the latest codes and standards, regardless of what was used when your building was designed or constructed. Keep in mind that this may result in different values and/or member sizes than the original design and the differences should be addressed in your report analysis and summary.

Code research and computation of loads, including calculations should be carefully organized, documented, annotated and placed in an appendix of the report. The more detail you provide relative to the determination of your building loads, the easier it will be for your consultant to provide feedback or help you discover any problem areas.

A partial example of a wind load summary pressure distribution sketch is included below:



Partial sample showing Live Load listing / comparison

Floor Live Loads		
Area	Design Load	ASCE 7-05 Load
Lobby/Open Plan	100 psf	80 psf
Corridors	80 psf	40 psf
Residential Units	40 psf	40 psf
Vehicle Accessible Areas	50 psf	40 psf

6. Provide a spot-check of typical floor framing elements in gravity load areas with explanations for any differences in sizes. Note: Many structural emphasis students will benefit by setting up a preliminary computer model on one of the appropriate analysis/design packages, but this is not required for Tech Report I. In other cases, simple hand and/or handbook type calculations are more appropriate. Check with your consultant or structural coordinator if there are any questions concerning the type or methods of calculations needed. In any event, be sure to describe the design methods and assumptions you used for this part. If you use computer software for member design, the faculty will expect at least some manual spot checks as well.

7. It is not necessary to create a computer model or provide a lateral system analysis for your building in Technical Report I. As previously noted, it is required to provide a description of which structural elements (types and specific locations within the building) which structural elements are a part of the lateral resisting system. In addition the report must demonstrate that you have an understanding of how the lateral system works including the distribution of wind and seismic forces to the various framing elements.

More Comments on Calculations:

Extensive backup design calculations in the form of computer generated output should not be submitted as a part of the report but should be organized, carefully labeled and filed in a notebook for future reference. It should be noted in your report that the calculations are available for review at the request of your structural consultant. **We are more interested in your interpretation and summary of the analysis results than looking at bulk computer results.** Including some limited sample copies of computer output is acceptable, especially if it is for comparison purposes.

Each report must include a summary of the calculations supplemented by charts or graphs representing the calculations. (For example, a sketch of the **wind loads and pressures** on a section / elevation drawing of the framing *is a requirement.*)

Evaluation and Summary

The written report, and in particular your conclusions, should stand on its own without the need for the calculations. All differences between your work and the existing conditions must be justified or explained.

Keep in mind that there are logical reasons for differences so don't blindly modify items to obtain the same answers. The existing work is being reviewed to give you a reference/starting point to understand the building and begin thinking of options for your proposal.

Since the faculty consultants will be looking at your building in detail for the first time, it is required for you to include copies of any photographs, general building elevations, floor plans, and descriptions etc. that you will eventually use as a part of the final existing conditions description or presentation for your project. This is true for all structural technical assignments.

Note that all figures, charts, sketches and photographs must be labeled and numbered and addressed in the body of the report text. It is recommended that you call all of these items "Figures" so that they can be successively numbered for convenience and organization purposes.

Executive Summary

As is standard report practice for senior thesis, an executive summary is required on the first page of your report. Make sure that the executive summary provides a mini snapshot of your findings and conclusions, not just a relisting of the requirements of the assignment.