Simplified Structural Plan Review

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Course Objectives
- The intent of this course is to...
  1. To learn how to perform a structural plan review of simple commercial or residential projects.
  2. To know how to interpret the EOR/SER design assumptions.
  3. To confirm that a complete lateral and gravity load path are provided.

Course Intent
- This course is for simple projects such as residential and small-to-moderately sized commercial only. Larger projects may require a more detailed review that should be performed by a licensed professional.

Introduction
- What items need to be reviewed?
  - Use & Occupancy
  - Type of Construction
  - Fire-rated Construction
  - Fire protection Systems
  - Means of Egress
  - Accessibility
  - Energy Efficiency
  - Structural Design
  - Mechanical
  - Plumbing
  - Electrical
  - ...

Introduction

- The mission of all building departments is to...
- What areas of the code are primary to “life safety”?
- What areas are secondary?
- Are we focusing our attention on the primary items?

Introduction

- This class is focused on the 2021 IBC and not the structural requirements outlined in the IRC.
- IRC R301.1.3:
  “When a building of otherwise conventional construction contains structural elements exceeding the limits of... (the IRC), these elements shall be designed in accordance with accepted engineering practice.”

Introduction

- CRC structural limitations include...
  - Wind speed ≤ 140mph
  - Weights of materials
  - Ground snow loads ≤ 70psf
  - Structural irregularities
    - Out-of-plane offsets
    - Floors/roofs w/out lateral support
    - Large diaphragm openings
    - Vertical offsets
    - Irregular wall lines

Seminar Format

- Plan Review Process
- Load Paths
- Design Criteria
- Hazard Review
- Construction Plans
- Structural Calculations
- Specifications

Actual Structural Review
**Certifications**

- When you get certified as a building plans examiner, how many questions do you have from Chapters 16-23?
- What types of questions are they?
- Is that what we should be looking at during a structural plan review?
Resources

- **2020 NEHRP Design Examples**
  - Free from FEMA’s website

- **LADBS Standard Plan Check Correction Lists**
  - [https://www.ladbs.org/forms-publications/forms/standard-correction-list](https://www.ladbs.org/forms-publications/forms/standard-correction-list)

Resources

- **ICC Performing Structural Plan Reviews**
  - “The purpose of a structural plan review is to determine that building structures...”
  - Comply with applicable standards of construction.
  - Use appropriate materials and methods.
  - Are safe for people and property.
  - Comply with code requirements.

Study Guides

1. Hazard Review
2. Construction Document Review
3. Calculations & Specifications Review
4. Components & Materials Review
Structural Review

- **Suggested Breakdown:**
  1. Hazard Review (30%)
  2. Construction Plans (60%)
  3. Structural Calculations (8%)
  4. Specifications (2%)

- This break-down only applies to simple projects. More complicated projects may require an extensive review of the calculations and reports by a licensed professional.

Questioning an Engineer

- **How many of you are comfortable questioning an engineer?**

Plan Review Philosophy

- **WABO/SEAW: Structural Plan Review Philosophy**

  [Click to access the WABO/SEAW website]

  http://www.wabo.org/waboseaw-white-papers
Plan Review Philosophy

**Scope of Review:**
- “… it should not necessarily be the reviewer’s primary focus to check the mathematical accuracy of the submitted calculations.”

**Engineering Judgment:**
- “…if the design engineer is able to give a reasonable explanation, the reviewer should defer to the engineer’s judgment, particularly if the issue under discussion is not directly addressed in the code.”
- “Design engineers’ responses… should address the concerns expressed and promote a collaborative effort.”

**Plan Reviewer Judgment:**
- “It is appropriate for a reviewer to ask an engineer to justify a design that directly contradicts a code requirement. For example, a reinforced concrete column that does not have ties or spirals at the code-required spacing should be questioned.”

**Plan Reviewer Judgment:**
- “He or she should avoid delving into the minutiae of details and losing sight of the primary life-safety issues.”
- “In exercising his/her judgment the plan reviewer should refrain from imposing his/her own idea of what constitutes ‘best practices’ on the design engineer.”
Submittal Guidelines

WABO/SEAW: Structural Permit Submittal Guidelines

http://www.wabo.org/waboseaw-white-papers

Construction Documents:
- “…complete as necessary to verify code compliance and inspection in the field.”

Drawing List:
- “A list of drawings should be included on the plans to ensure the reviewer has a complete package when reviewing the application.”

Design Criteria & Construction Materials:
- “Specific items should be noted on the plans as specified in various code sections including Chapters 1, 16, 17, and 18. At a minimum this should include material specifications, loading criteria, and special inspection requirements.”

Accessory Documents:
- “Additional documents such as a design narrative, calculations, studies and reports should be provided to the extent necessary to clarify code compliance.”

Deferred Submittals:
- “Items not included but intended for later submittal to the building department should be clearly noted on the Drawings.”
Submittal Guidelines

Structural Calculations:
- Provide table of contents
- Include narrative
- Include design criteria summary
- Provide linkage between drawings & calculations
- And more…

Load Paths

Newton’s 3rd Law:
- “To every action there is an equal and opposite reaction.”

Load Path:
- How the loads are transferred from the point of origin to where they are resisted.

Load Paths

What causes vertical loads?
- Gravity

What causes lateral loads?
- Wind
- Seismic

What resists these loads?
- Ground
Parts of a Structure

- Beams, Headers, Columns, Bearing Walls
- Diaphragms (i.e. Floor or Roof)
- Vertical Lateral-Force-Resisting Elements
- Footings & Foundations
- Anything else?

Gravity Load Path

**What loads need to be considered?**

- Dead loads
- Live loads
- Snow loads
- Soil loads
- Hydrostatic loads
- Rain loads
- Flood loads

Gravity Load Path

Concentrated vs. Uniform Loads

- 2×6 REQUIRED: 12 FEET
- 2×10 REQUIRED: 12 FEET

Gravity Load Path

*The gravity load path is pretty easy to follow.*

- What are some common problems?
Lateral Load Path

**Not as easily understood**

- What loads need to be considered?
  - Wind
  - Seismic

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**Lateral Load Path**

**Wind:**

- Wind acts against the sides of a building like the sail on a boat.
- The majority of forces are transferred up into the roof/floor while the rest into the foundation.

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**Lateral Load Path**

**Seismic:**

- Ground shaking causes the structure's mass to be accelerated back and forth.
- Forces are developed where the structure's mass is the largest.

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**Lateral Load Path**

**Lateral-Resisting Elements:**

- Vertical (LFRS):
  - Shear Walls
  - Braced Frames
  - Moment Frames
  - Cantilevered Columns
  - Numerous versions of each
Lateral Load Path

Lateral-Resisting Elements:
- **Horizontal:**
  - Floor/Roof Diaphragm
  - §202: **DIAPHRAGM** – A horizontal or sloped system acting to transmit lateral forces to vertical elements of the lateral force-resisting system.

Lateral-Resisting Elements:
- **Diaphragm Components** (ASCE 7):
  - *Boundary* – A location where shear is transferred into or out of the diaphragm element. Transfer is either to a boundary element or to another force-resisting element.
  - *Collector* (drag strut, tie, subdiaphragm strut) – A diaphragm or shear wall boundary element parallel to the applied load that collects and transfers diaphragm shear forces to the vertical elements of the LFRS or distributes forces within the diaphragm or shear wall.
  - *Subdiaphragm* – A portion of a diaphragm used to transfer wall anchorage forces to diaphragm crossties.

Structures must be designed to resist...
Lateral Load Path

Horizontal Load Path:

- Need to pay attention at interior shear walls!

Table 2-3: Load Path Connections for Horizontal Mids:

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum Fixing per (2%) of Table B.4.2.2 and Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>B5</td>
<td>Bolting: 60 mm (1\frac{1}{4})&quot; or three M10 (5\frac{3}{4})&quot; bolts each (180^\circ) each side of space scantling</td>
</tr>
<tr>
<td>B6</td>
<td>Bolting: 60 mm (1\frac{1}{4})&quot; or three M10 (5\frac{3}{4})&quot; bolts each (180^\circ) each side of space scantling</td>
</tr>
<tr>
<td>B7</td>
<td>Bolting: 60 mm (1\frac{1}{4})&quot; or three M10 (5\frac{3}{4})&quot; bolts each (180^\circ) each side of space scantling</td>
</tr>
</tbody>
</table>

Illustration:

- Roof sheathing nails \(1\frac{1}{4}\) or \(1\frac{3}{4}\)" head cap | 45 |
- Interior shear walls | 46 |
- Interior shear walls | 47 |
- Interior shear walls | 48 |
Lateral Load Path

Overturning Load Path:

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### Table 3-3: Load Path Connections for Overturning

<table>
<thead>
<tr>
<th>Item</th>
<th>Overturning Load Path Description and Discussion</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>OV1</td>
<td>When Wall 1 is loaded from left to right, the building resists overturning the lower left corner to uplift. The building moves upward causing the lower left corner to uplift. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV2</td>
<td>When Wall 1 is loaded from left to right and an uplift load occurs on OV1, an approximately equal downward force is transferred to OV1. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV3</td>
<td>When Wall 1 is loaded from left to right, the wall resists overturning the lower left corner to uplift. The building moves upward causing the lower left corner to uplift. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV4</td>
<td>When Wall 1 is loaded from left to right and an uplift load occurs on OV1, an approximately equal downward force is transferred to OV1. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV5</td>
<td>The load on Wall 1 is transferred to OV1 and OV2. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV6</td>
<td>The load on Wall 1 is transferred to OV1 and OV2. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV7</td>
<td>The load on Wall 1 is transferred to OV1 and OV2. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
<tr>
<td>OV8</td>
<td>The load on Wall 1 is transferred to OV1 and OV2. The building moves upward and the first story wall is subject to overturning. (Ref. IBC 1604.4)</td>
<td>![Illustration]</td>
</tr>
</tbody>
</table>

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### Lateral Load Path

#### Load Transfer Between Components

- **IBC 1604.4**
- **Section 12.1.3**

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Lateral Load Path

Connections – Applies to all construction types

Example Review Comment:
The project calls for tilt-up panels to be directly connected to the floor slab, with no physical connection to the footing. Please provide calculations showing that the portion of the floor slab that is used is capable of transferring the required forces to the supporting soils. In addition, please provide a check of the panel-to-slab connection for side-edge concrete breakout.
Load Path Summary

Design must consider three load cases:

- Gravity design
- Lateral in one direction
- Lateral in opposite direction

- Load capacity of each building element and their connections must be calculated to resist all three loads and adequately transfer them to...

Design Criteria

Key items to keep in mind...

1) Floor/Roof Live Loads
2) Risk Category
3) Snow Loads
4) Design Wind Speed
5) Wind Exposure
6) Soil Site Class
7) Ground Motions
8) Flood Design Data

1) Floor/Roof Live Loads

IBC 1603.1.1 & 1603.1.2: Floor/Roof Live Loads

- Verify live loads based on use → IBC Table 1607.1
1) Floor/Roof Live Loads

Compare to architectural plans...

2) Risk Category

**Risk Category:** What is the risk category for a...?
- Elementary school
- Retail greenhouse
- Restaurant
- Warehouse
- Single-family home
- Apartment complex

What would this apply to?

Risk Category = 1.5

3) Snow Loads

**IBC 1603.1.3: Snow Loads**
- The following should be provided:
  - Ground Snow Load ($P_g$)
  - Flat-roof Snow Load ($P_f$)
  - Snow Exposure Factor ($C_e$)
  - Thermal factor ($C_t$)
  - Snow Importance Factor ($I_s$)
  - Drift Surcharge Loads ($P_d$) and width ($w$)
4) Design Wind Speed

- Risk Category II: IBC Figure 1609.3(1)

4) Design Wind Speed

- Risk Category III: IBC Figure 1609.3(2)

4) Design Wind Speed

- Risk Category IV: IBC Figure 1609.3(3)

4) Design Wind Speed

- Risk Category I: IBC Figure 1609.3(4)
4) Design Wind Speed

- **Basic Design Wind Speed (V)**
  - $I_W$ is incorporated into the design wind speed.
  - If $V$ is “…determined by the local jurisdiction shall be in accordance with Section 26.5.1 of ASCE 7.”
  - Adjustment must be based upon:
    - Meteorological data, and…
    - An estimated basic wind speed per Section 26.5.3.

5) Wind Exposure

- If someone were to call and ask, what wind exposure would you specify for your jurisdiction?

5) Wind Exposure

- **§1609.4.2:** “A ground surface roughness within each 45° sector shall be determined upwind of the site… for the purpose of assigning an exposure…”

- **Surface Roughness B:**
  - “Urban and suburban areas, wooded or other terrain with numerous closely spaced obstructions having the size of a single-family dwelling or greater.”
5) Wind Exposure

- **Surface Roughness C:**
  - "Open terrain with scattered obstructions having heights generally less than 30 feet."

5) Wind Exposure

- **Surface Roughness D:**
  - "Flat, unobstructed areas and water surfaces."

5) Wind Exposure

- **Exposure B:**
  - Buildings ≤ 30 feet: Surface Roughness B for 1,500’
  - Buildings > 30 feet: Surface Roughness B for 2,600’ or 20*building height, whichever is greater.

- **Exposure C:**
  - Shall apply to all cases where Exposure ‘B’ or ‘D’ do not apply.

5) Wind Exposure

- **Exposure D:**
  - Surface Roughness D for 5,000’ or 20*building height, whichever is greater.
  - If Exposure B or C exist upwind and the site is within 600’, or 20*building height, from an Exposure D condition.
5) **Wind Exposure**

- What Wind Exposure applies to this lot?

6) **Soil Site Class**

- Classifications moved to ASCE 7-16.
- Based upon upper 100-feet
  - Site Class A: Hard rock
  - Site Class B: Rock
  - Site Class C: Very dense soil and soft rock
  - Site Class D: Stiff soil
  - Site Class E: Soft clay soil
  - Site Class F: Soils requiring site response analysis

5) **Soil Site Class**

- If not defined, what should we assume?
- IBC 1613.2.2: Site Class Definitions
  - “Where the soil properties are not known in sufficient detail to determine the site class, Site Class D, subjected to the requirements of Section 1613.2.3, shall be used unless the building official or geotechnical data determines that Site Class E or F soils are present at the site.”

6) **Soil Site Class**

- § 20.3.1: Site Class F
  - Soils vulnerable to potential failure or collapse under seismic loading (i.e., liquefiable or collapsible soils)
  - Peats or highly organic clays
  - Very high plasticity clays (Pl > 75)
  - Very thick soft/medium clays (H > 120 ft)
- § 20.3.2: Site Class E
  - Where it does not qualify as Site Class F and…
  - Total thickness of soft clay > 10 ft.
7) Ground Motions

- How many of you verify ground motions?
  - Multiple options, such as ...
    - ATC Hazards by Location (seismic, wind, snow, tornado)
    - SEAOC Seismic Design Map Tool (seismic only)
    - ASCE 7 Hazard Tool (seismic, wind, rain, flood, ice, snow & tsunami)
  - The others are fading out with the introduction of ASCE 7-22.
  - For that reason, we will use the ASCE 7 Hazard Tool as an example.

https://ascehazardtool.org
8) Flood Design Data

- Is there a flooding risk in your jurisdiction?

Flood Hazard Areas (FHA) are established by the local jurisdiction based upon the FEMA Flood Insurance Rate Map (FIRM), Flood Boundary and Floodway Map (FBFM), and other supporting data.

Flood hazard documentation must be prepared and sealed by a registered design professional.

8) Flood Design Data

- IBC 1612.4: Flood Documentation
  - Not subject to high-velocity wave action:
    - Elevation of lowest floor, including basement
    - Fully enclosed areas below flood elevation → Statement that design will allow for equalization of flood waters per ASCE 24
    - Dry floodproofing → Statement that complies with ASCE 24

- Subject to high-velocity wave action:
  - Elevation of lowest horizontal structural member
  - Statement that building is designed in accordance with ASCE 24, including:
    - Pile & column foundations
    - Structure anchored to resist flotation, collapse or lateral movement with wind and flood loads acting simultaneously
  - Statement that breakaway walls are designed per ASCE 24
PART D
Hazard Review

30%

Hazard Review (30%)
1. Verify Project Location
2. Verify Ground Motions
3. Verify Snow Loads
4. Review Geotechnical Report
5. Review Geologic Hazards
6. Review Adopted Flood Maps
7. Perhaps most important part of structural review!

I. Project Location

- Use Google Earth or other mapping software to verify project location.
- Make sure location matches what is shown in the geotechnical report and site plan.
- Note the following items:
  - Existing structures
  - Sloping site?
  - Appropriate Wind Exposure
  - Other Items!
2. Ground Motions

<table>
<thead>
<tr>
<th>Site Class ‘D’</th>
</tr>
</thead>
<tbody>
<tr>
<td>$S_{DS} = 0.51g$</td>
</tr>
<tr>
<td>$S_{DI} = N/A$</td>
</tr>
<tr>
<td>SDC = ???</td>
</tr>
</tbody>
</table>

3. Snow Loads

- **Verify Ground (Pg) and Flat Roof (Pf)**
  - What is the ground snow load?
  - What is the importance factor?
  - What is the exposure factor?
  - What is the thermal factor?

4. Geotechnical Report

- **Is a soils report required? (IBC 1803)**
  - Questionable & expansive soils
  - High water table
  - Deep foundations
  - Variable rock
  - Excavations near foundations
  - Structural fill or CLSM
  - S.D.C. ‘C’ or above.

4. Geotechnical Report

- **Basis of Investigation (IBC 1803.3)**
  - “…the number and types…shall be determined by a registered design professional.”
  - Are 2 borings acceptable for the following?
4. Geotechnical Report

**Basis of Investigation (IBC 1803.3)**
- Civil + Structural Engineer Magazine, Dec. 2019
  - “But with no universal standard governing how much data must be collected during the investigation and written into the final report, the geotechnical engineer and owner are left to negotiate what should be included.”
  - “The geotechnical engineer wants the most thorough investigation possible and the owner wants to keep the cost of all geotechnical work as low as possible.”
- **Bottom line…** It is okay for us to question the number of borings performed during the investigation.

**IBC 1803.6: Report should provide…**
- A plot showing locations of borings
- Complete record of soil borings
- Record of soil profile
- Elevation of water table
- Recommendations for…
  - Foundation type
  - Bearing capacity
  - Mitigation measures for expansive soils
- Expected total & differential settlement
- Compacted fill properties

**Allowable Bearing Pressure:**
- The allowable bearing pressure is dependent upon…
  - Types of foundations
  - Applied loads
  - Soil type
  - Expected settlement

**Total & Differential Settlement:**
- **Total** = maximum settlement beneath footings
- **Differential** = the uneven settlement that occurs
- Allowable bearing pressure typically considers…
  - **Total settlement** = 1-inch maximum
  - **Differential settlement** = ½-inch maximum
- Geotech may also specify minimum footing dimensions or additional reinforcing to limit expected settlement.
4. Geotechnical Report

**IBC 1803.5.12: Additional items for SDC ‘D-F’…**
- Seismic lateral earth pressure → 6-feet
- Potential for liquefaction
- Quantify consequences of liquefaction
- Liquefaction mitigation measures

**IBC 1803.5.5: Deep Foundations**
- Recommended deep foundation types
- Recommended center-to-center spacing
- Driving criteria
- Installation procedures
- Field inspection & reporting procedures
- Load test requirements
- Reductions for group action

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**Is it okay to assume Soil Site Class ‘D’?**
- ‘D’ = stiff soil
- ‘E’ = soft clay
- ‘F’ = liquefiable/collapsible

**Site Class E & F soils in high seismic regions require all footings to have “seismic ties” (IBC 1809.13).**
4. Geotechnical Report

- **Durability (IBC 1904)**
  - Shall conform to ACI 318-19 (Exception: R-2 & R-3 ≤ 3-stories)
  - Section 19.3.1 of ACI 318-19:
    - Freezing (F0, F1, F2, & F3)
    - Sulfate (S0, S1, S2, & S3)
    - Permeability (P0, P1, P2, & P3)
    - Corrosive (C0, C1, & C2)
      - 0 = Not applicable
      - 1 = Moderate
      - 2 = Severe
      - 3 = Very severe

- **Durability (cont.)**
  - Section 19.3.1.1 of ACI 318-19: “Licensed design professional shall assign exposure classes in accordance with the severity of the anticipated exposures…”

  **Example Review Comment:**
  Section 19.3.1.1 of ACI 318-19 requires the design professional to assign exposure classes to structural concrete members in accordance with Table 19.3.1.1. Please address.

4. Geotechnical Report

- Does the site plan match the project location?
- How old is the report?
- Is the Soil Site Class specified?
- Should “footing seismic ties” be required? (Site Class ‘E’ or ‘F’ only; see IBC 1809.13)
- Are foundations required to span a certain distance per the report recommendations?
- Are their special drainage requirements that should be noted on the plans?

5. Geologic Hazards

- Are their other geologic hazards at your site?
5. Geologic Hazards

- **Footings on Slopes:**
  - IBC Figure 1808.7.1
  - or...
  - Ascending Slopes (IBC 1808.7.1)
  - Descending Slopes (IBC 1808.7.2)
  - or...
  - Alternate setbacks & clearances (IBC 1808.7.5)

- **Ascending Slopes (IBC 1808.7.1)**
  - Clearance = “...sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures.”

- **Descending Slopes (IBC 1808.7.2)**
  - Setback = “...set back from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement.”
6. Flood Maps

- Verify that you are not in an FHA:
  - https://msc.fema.gov/portal/home

6. Flood Maps

- Verify that you are not in an FHA:
  - Flood Zones A or V → Within FHA
  - Flood Zones B or shaded X → moderate flood hazard
  - Flood Zones C or unshaded X → minimal flood hazard

Sample Comments

**Ground Motions:**
When checking the ASCE Hazard Tool the design ground motions per the 2021 IBC appear to be $S_{DS}=1.763g$ and $S_{D1}=0.794g$. The value noted on the plans and in the calculations is $S_{DS}=1.45g$. This is significantly less than noted above. Please address.

**Flood Hazard Area:**
The project is located within a flood hazard area as shown on the City’s current Flood Insurance Rate Map (FIRM). Please provide all necessary flood hazard documentation as outlined in IBC 1612.4.

**Snow Loads:**
The design roof snow load is greater than 30psf. Please confirm that a percentage of the snow was considered in the seismic weight of the structure as required by the load combinations of ASCE 7 or IBC 1605.2.

Sample Comments

**Geotechnical Report #1:**
The City requires that geotechnical reports submitted for review be dated no more than two years from the submittal date. Please provide an update letter from a geotechnical engineer stating that the recommendations in the report are still valid or stating what items may have changed.

**Geotechnical Report #2:**
The geotechnical report states that all concrete which is to come into contact with the site soils are to meet the ACI requirements for “Moderate” sulfate exposure. This requires a minimum f’c = 4,000psi, maximum w/c = 0.3, and Type II cement per IBC 1904.1. Please note these requirements on the plans.

**Geotechnical Report #3:**
The geotechnical report classifies the site soils as Site Class ‘E’. As such all individual spread footings must be interconnected by means of seismic ties in accordance with IBC 1809.13. Please address.
PART E
Construction Plans

Construction Plans (60%)
- Civil, Architectural, MEP Perusal
- General Structural Notes
- Footing & Foundation Plan
- Floor Framing Plan(s)
- Roof Framing Plan(s)
- Sections & Details
- Miscellaneous

1. Civil, Architectural, MEP
   - What items need to be considered by SER/EOR?
     - Retaining walls
     - Dimensions
     - Canopies
     - Mechanical unit weights
     - Suspended elements
     - Check uses appropriate live loads?
     - Snow drift areas
     - “See Structural”

2. General Structural Notes
   - Design Criteria
   - Material Requirements
   - Statement of Special Inspections
   - Deferred Submittals

   A very important part of structural review!
2.A. Design Criteria

- **IBC 1603.1.1: Floor/Roof Live Loads**
  - Verify live loads based on use → IBC Table 1607.1

<table>
<thead>
<tr>
<th>Document Source</th>
<th>Minimum Load</th>
<th>Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Loads</td>
<td>20 psf</td>
<td></td>
</tr>
</tbody>
</table>

Let’s look at two examples:

1. **Roof Loads**
2. **Heavy Vehicle Loads**

- **Accessible Roofs: What live load is appropriate?**

  - Roof areas used for assembly purposes: 140 psf
  - Roof areas used for recreational or other assembly purposes: 140 psf
  - Roof areas not used for assembly purposes: 80 psf

2.A. Design Criteria

- **IBC 1607.1 & IBC 1606.5: Vegetative & Landscaped Roofs**
  - Live Load = 20psf
  - Dead Load = weight of “saturated” materials
  - Is 80pcf dead load sufficient?
### 2.A. Design Criteria

- **Heavy Vehicles:** What live load is appropriate?

<table>
<thead>
<tr>
<th>Item</th>
<th>Code</th>
<th>Description</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td></td>
<td>Fire escape</td>
<td>100</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Fire ladder</td>
<td>40</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>Garages</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>Marshalls, guards, etc.</td>
<td>See Section 5007.9</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>Escapes</td>
<td></td>
</tr>
</tbody>
</table>

- **IBC 1607.8: Heavy Vehicle Loads**
  - IBC 1607.8.1 – Loads
  - IBC 1607.8.2 – Fire truck and emergency vehicles
  - IBC 1607.8.3 – Heavy vehicle garages
  - IBC 1607.8.4 – Forklifts and movable equipment
  - IBC 1607.8.5 – Posting

- **Heavy Vehicles =** Gross Vehicle Weight Rating (GVWR) > 10,000#

- **GVWR =** Maximum allowable weight a vehicle can carry including itself.
2.A. Design Criteria

- **IBC 1607.8.2: Fire Trucks**
  - Must be designed for the greater of:
    - Actual operational loads, including outrigger reactions
    - Live load specified in IBC 1607.7.1

- **IBC 1607.8.3: Heavy Vehicle Garages**
  - Rational analysis allowed, but LL shall not be < 50psf

- **IBC 1607.8.5: Max weight of vehicles allowed into a parking garage or other structure shall be posted.**

---

2.A. Design Criteria

- **IBC 1607.8.4: Forklifts and movable equipment**
  - “…structure shall be designed for the total vehicle or equipment loads… These loads shall be posted…”

- **Compare to architectural plans…**
2.A. Design Criteria

IBC 1603.1.3: Snow Loads
- This was checked as part of the “Hazard Review”. Now we simply verify that the values noted on the plans are correct.
  - Ground Snow Load (P_g)
  - Flat-roof Snow Load (P_f)
  - Snow Exposure Factor (C_e)
  - Thermal factor (C_t)
  - Snow Importance Factor (I_s)

IBC 1603.1.4: Wind Design Data
- This was checked as part of the “Hazard Review”. Now we simply verify that the values noted on the plans are correct.
  - Basic Wind Speed
  - Wind Exposure
  - Internal Pressure Coefficient
  - Component & Cladding Pressures & Applicable Zones

IBC 1603.1.5: Earthquake Design Data
- This was checked as part of the “Hazard Review”. Now we simply verify that the values noted on the plans are correct.
  - Risk Category
  - Seismic Importance Factor (I_e)
  - Mapped Accelerations (S_S, S_1)
  - Soil Site Class
  - Design Accelerations (S_DS, S_D1)
  - Seismic Design Category

Additional items...
- Analysis Procedure Used
- Basic Seismic Force-Resisting System(s) → R
- Are all systems listed?
2.A. Design Criteria

Table 12.2-1 of ASCE 7-16:

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Elevation</th>
<th>Frequency</th>
<th>Peak Ground Acceleration</th>
<th>Maximum Dynamic Elevation</th>
<th>Response Spectrum</th>
<th>Period of Vibration</th>
<th>Design Criteria</th>
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</thead>
<tbody>
<tr>
<td>Reinforced Masonry Shear Walls</td>
<td>Ordinary</td>
<td>0.25</td>
<td>0.05</td>
<td>0.5</td>
<td>0.02</td>
<td>0.5</td>
<td>R = 2.0</td>
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<td></td>
<td>Intermediate</td>
<td>0.35</td>
<td>0.10</td>
<td>0.7</td>
<td>0.03</td>
<td>0.7</td>
<td>R = 3.5</td>
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<tr>
<td></td>
<td>Special</td>
<td>0.45</td>
<td>0.15</td>
<td>0.9</td>
<td>0.04</td>
<td>0.9</td>
<td>R = 5.0</td>
</tr>
</tbody>
</table>

IBC 1603.1.5: Earthquake Design Data
- Example: Reinforced Masonry Shear Walls
  - Ordinary → R = 2.0 ≤ 40% of special
  - Intermediate → R = 3.5 ≤ 57% of special
  - Special → R = 5.0 ≤ Required for high seismic

IBC 1603.1.6: Geotechnical Information
- IBC 1603.1.7: Flood Design Data
- This was checked as part of the “Hazard Review”. Now we simply verify that the values noted on the plans are correct.

IBC 1603.1.8: Special Loads
- This could include items such as...
  - PV systems
  - Machinery
  - Pools/spas
  - Etc.
2.A. Design Criteria

- **IBC 1603.1.9: Rain Load Data**
  - The rain intensity, I (in/hr), must be listed regardless of whether rain loads govern the design.

2.B. Material Requirements

- **Wood, Concrete, Masonry, Steel, etc.**
  - Are design/construction standards specified?

<table>
<thead>
<tr>
<th>Standard</th>
<th>Version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACI 318</td>
<td>2019</td>
<td>Structural Concrete</td>
</tr>
<tr>
<td>ASCE 360</td>
<td>2016</td>
<td>Structural Steel Buildings - Specifications</td>
</tr>
<tr>
<td>ASCE 7</td>
<td>2016</td>
<td>Minimum Design Loads for Buildings</td>
</tr>
<tr>
<td>AWC NDS</td>
<td>2018</td>
<td>National Design Specification for Wood</td>
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<tr>
<td>AWC SDPWS</td>
<td>2021</td>
<td>Special Design Provisions for Wind &amp; Seismic</td>
</tr>
<tr>
<td>TMS 402</td>
<td>2016</td>
<td>Masonry Structures - Provisions</td>
</tr>
<tr>
<td>TMS 402</td>
<td>2016</td>
<td>Masonry Structures - Specifications</td>
</tr>
</tbody>
</table>

- Are materials and design strengths specified?
  - Concrete per IBC 1901.3, etc.
- Do specific installations meet code?
  - Is concrete cover being met?
  - Is treated lumber and preservative fasteners called out?
- Is extraneous information listed?
2.B. Material Requirements

2.C. Special Inspections

- History of Special Inspections
  - Inspections of structural components were included in first edition of the UBC (1927)
  - Term “Special Inspections” appeared in the 1961 UBC
  - BOCA first introduced special inspection requirements in 1988.
  - The 2000 IBC merged the UBC and BOCA special inspection provisions into Chapter 17.
  - The requirements keep growing!

- Can the architect or SER act as the special inspector?
- Where are special inspection requirements typically provided?
- Do only structural elements require special inspections?

- IBC 1704.3: Statement of Special Inspections (SSI)
  - Shall be prepared by the Registered Design Professional in Responsible Charge.
  - Shall identify the following:
    - Work required to have special inspections or testing
    - Type & extent of special inspection or testing
    - Frequency (continuous or periodic)
2.C. Special Inspections

- **Continuous:**
  - Full-time observation
  - “100% of the work must be inspected and it must be inspected as the work is being performed.”

- **Periodic:**
  - Part-time or intermittent observation
  - “The registered design professional… should indicate the frequency of inspection that is required. The frequency varies depending on the size and complexity of the project.” - Structure Magazine, May 2006

---

2.C. Special Inspections

- **Bad Example:**
  - Large single-story retail shell → CMU construction
  - Original plans provided the following:
    - Special Inspection: Special inspection is required in accordance with IBC 1701.
    - A. All concrete masonry units and reinforcing.
    - B. Field welding.
    - C. Epoxy bolts.

---

2.C. Special Inspections

- **Bad Example:**
  - Our initial review comment stated the following:
    The “special inspection” portion of sheet Sxxx does not meet the requirements for a “Statement of Special Inspections” as required by IBC 1704.3. Not only should the items requiring special inspection/testing be noted, but the extent of the inspections/tests should be defined and the frequency (i.e. continuous or periodic) noted. Additional items requiring special inspection may include soils, concrete, etc. Please address.

---

2.C. Special Inspections

- **Bad Example:**
  - Revision #1 was as follows:

    Special Inspection: Special inspection is required in accordance with IBC 1701.
    - A. All concrete masonry units and reinforcing, level II, periodic.
    - B. Field welding, Periodic
    - C. Epoxy bolts. If apply. During installation.
    - D. Inspection of soil as noted on soil report. Periodic.
2.C. Special Inspections

- See Handout for an example of what we should be seeing in relation to a Statement of Special Inspections.

2.C. Special Inspections

- **Exemptions:**
  - Not required for construction of minor nature.
  - Group U occupancies accessory to R-3.
  - Construction per conventional construction provisions.
  - Approved fabricators (Certificate of Compliance)
  - Isolated footings supporting 3-stories or less.
  - Continuous footings supporting 3-stories or less of light-frame construction and designed using a concrete strength (f’c) of 2,500psi.
  - Nonstructural slabs on grade, driveways, and sidewalks

2.D. Deferred Submittals

- Required for structural components in which the structural design has not been submitted.
- Does the B.O. have to allow them?
- Must be listed on the construction documents.
- Prior to submittal to the city, designs must be submitted to, and approved by, the EOR.
- None of the deferred submittal items shall be installed until submittal is approved by the city.
2.D. Deferred Submittals

Should the following items be accepted as deferred submittals?
- Concrete mix designs
- Deep foundation systems
- Tilt-up panel lifting design
- Open web steel joists
- Prefabricated metal buildings

2.D. Deferred Submittals

IBC 107.3.4.1: “...shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed for general conformance to the design of the building.”

2.D. Deferred Submittals

2. General Structural Notes

A. Design Criteria
B. Material Requirements
C. Statement of Special Inspections
D. Deferred Submittals

A very important part of structural review!
3. Foundation Plan

- **Minimum Dimensions:**
  - Minimum depth = 12-inches
  - Minimum width = 12-inches
  - Extend to below frost line
  - Plain concrete thickness = 8-inches (Group R-3 = 6-inches)

- **Frost Protection:**
  - Verify footings meet required frost depth.

- **Footing Thickness:**
  - Plain Concrete ≥ 8-inches (IBC 1809.8)
    - Same in §14.3.2.1 of ACI 318-19
  - Reinforced ≥ 10-inches
    - §13.3.1.2 of ACI 318-19
      - 6” min. to bottom reinforcement
      - Diameter of reinforcing
      - Concrete cover
    - §14.1.4 of ACI 318-19 limits plain concrete in SDC ‘D’ or above.

- **Holdown Sizes and Locations:**
Foundation Plan

- **Footing Seismic Ties:**
  - Site Class 'E' or 'F', and...
  - SDC ‘D or above’

Foundation Plan

- **IBC Table 1808.8.1: Footing Concrete Strength**
  - $f_{cmin} = 2,500\text{psi}$ (Light-framed, ≤ 2 stories)
  - $f_{cmin} = 3,000\text{psi}$ (All others)

Foundation Plan

- **Footing & Foundation Prep:**
  - Are the requirements of the geotechnical report clear on the plans?
    - Engineered Fill
    - Mitigation measures

Foundation Plan

- **Foundation Walls:**
  - Are they restrained?
  - Is appropriate backfill material specified?
  - Is foundation wall drainage provided?

Foundation Plan

- **Footings on Slopes:**
Foundation Plan

- Footings specified on plan?
- Proper Reinforcement?
- Calculations Provided?

4. Floor Framing

- Beam & joist sizes, spans, and spacing
- Column sizes
- Wall framing (stud size & spacing, reinforcement)
- Shear walls (sheathing, nailing, blocking, masonry)
- Uplift floor ties (holdowns, anchor bolts, sill plates, boundary reinforcement, etc.)
- Connection callouts (correct detail references)
- Diaphragm requirements (sheathing, nailing, blocking, steel deck, HSA’s, reinforcement, etc.)

4. Floor Framing

- Verify Trusses/Beams
- Locate Shear Walls and Verify Shear Transfer Details
- Verify Holdowns
- Verify that Snow Loads are Shown on Low Roof Plans
4. Floor Framing
- Verify Trusses/Beams
- Locate Shear Walls and Verify Shear Transfer Details
- Verify Holdowns
- Verify that Snow Loads are Shown on Low Roof Plans

5. Roof Framing
- Beam & joist sizes, spans, and spacing
- Column sizes
- Assumed truss layout
- Design loads (i.e. unbalanced, sliding, & drift snow)
- Connection callouts (verify detail references)
- Diaphragm requirements (i.e. sheathing, nailing, blocking)
- Rooftop units and other projections

5. Roof Framing
- Verify Trusses/Beams
- Locate Shear Walls
- Verify Details
- Special Loads

6. Sections & Details
- Connections, Connections, Connections!
  - Primary Structural
    - Framing details
    - Foundation details
    - Joist-to-Beam
    - Beam-to-Beam
    - Beam-to-Column
    - Column-to-Foundation
  - Secondary Structural
    - Canopies
    - Parapets
    - Fascias
- Diaphragm requirements (i.e. sheathing, nailing, blocking)
- Rooftop units and other projections
6. Sections & Details

Eave Blocking:

- Direct connection (load path)
- Parallel to truss
- As in detail
- Engineered girder truss
- Perpendicular to truss
- Shear wall panels
- Truss blocking

Interior Shear Walls:

Concentrated Loads:

- Watch for specific point loads
6. Sections & Details

Gable Wall Bracing:
- Knee bracing or ceiling bracing at hinge points in gable walls.

6. Sections & Details

 Specific Material Requirements:
A. Wood Construction
B. Concrete Construction
C. Masonry Construction
D. Steel Construction

6.A. Wood Construction

 Shear Walls:
- All panels shall have 2x blocking
  - 3x required when edge nailing is 2" o.c., or...
  - 10d nails and 3" o.c., or...
  - Panels applied to each face, and they are not offset

6.A. Wood Construction

 Segmented Shear Walls:
- Allowable aspect ratios
  - Seismic → 2:1 (3.5:1 if reduced)
  - Wind → 3.5:1 (e.g., 8'-0" x 2'-3")
- Example: 9-foot wall
  - 2:1 → 4.5 feet
  - 3.5:1 → 2.57 feet
  - 43% reduction in capacity!
6.A. Wood Construction

- **Perforated Shear Walls:**
  - Allowable aspect ratios
    - Seismic & Wind: 3.5:1
  - Example: [https://www.structuremag.org/?p=11564](https://www.structuremag.org/?p=11564)

---

### Shear Capacity Adjustment Factor % Full-Height Sheathing

<table>
<thead>
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<th>Wall Height (h)</th>
<th>Maximum Opening Height Ratio &amp; Height</th>
<th>Shear Capacity Adjustment Factor</th>
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<tr>
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<td>h/3</td>
<td>h/2</td>
</tr>
<tr>
<td>8'-0&quot;</td>
<td>2'-8&quot;</td>
<td>4'-0&quot;</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>3'-4&quot;</td>
<td>5'-0&quot;</td>
</tr>
<tr>
<td>% Full-Height Sheathing</td>
<td>10%</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>1.00</td>
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<tr>
<td></td>
<td>40%</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>1.00</td>
</tr>
</tbody>
</table>

---

### Maximum Opening Height Ratio & Height Wall Height (h)

<table>
<thead>
<tr>
<th>h</th>
<th>5h/6</th>
<th>2h/3</th>
<th>h/2</th>
<th>h/3</th>
</tr>
</thead>
<tbody>
<tr>
<td>8'-0&quot;</td>
<td>6'-8&quot;</td>
<td>5'-4&quot;</td>
<td>4'-0&quot;</td>
<td>2'-8&quot;</td>
</tr>
<tr>
<td>10'-0&quot;</td>
<td>8'-4&quot;</td>
<td>6'-4&quot;</td>
<td>5'-0&quot;</td>
<td>3'-4&quot;</td>
</tr>
</tbody>
</table>
6.A. Wood Construction

- **Force-Transfer Shear Walls:**
  - Allowable aspect ratios
    - Same as segmented, but...
  - Design & Detailing:
    - Each wall pier ≥ 2-feet
    - Full-height segment at each end
    - No out-of-plane offsets
    - Collectors shall be full length

- **Shrinkage:**
  - Wood walls supporting > two floors and a roof must provide an analysis of the potential shrinkage.

- **Shrinkage:**
  - The analysis should show that the shrinkage will not cause an adverse effect on the...
    - Structure
    - MEP equipment and systems
    - Roof drainage
6.A. Wood Construction

- **Shrinkage:**
  - Western Wood Products Association – Tech Note: [https://www.wwpa.org/resources/?id=shrinkage-calculations-for-multistory-wood-frame-construction](https://www.wwpa.org/resources/?id=shrinkage-calculations-for-multistory-wood-frame-construction)

6.B. Concrete Construction

- **Concrete Cover:**
  - How comfortable are you with concrete cover requirements?

6.B. Concrete Construction

- **Column Ties:**
  - § 25.7.2 of ACI 318-14 requires…
  - Minimum Bar Size
    - 1/1 vertical bar → 3 ties minimum
    - #11, 14 or 18 → 4 tie minimum
  - Maximum Vertical Spacing
    - 16db vertical bars (e.g. #5 bars = 10”)
    - #6 tie bars (e.g. #3 ties = 18”)
    - Least dimension of compression member

- **Column Ties:**
  - § 25.7.2.3 of ACI 318-19…
  - “Every corner or alternate longitudinal bar shall have lateral support provided by the corner of a tie… No bar shall be further than 6” clear… from such a laterally supported bar.”
6.B. Concrete Construction

- **Column Ties:**
  - § 10.7.6.1.6 of ACI 318-19...
  - Anchor bolts placed in the top of column or pedestal shall be enclosed by ties surrounding at least four vertical bars.
  - Ties shall consist of...
    - (2) #4 or (3) #3 ties
    - Distributed within top 5”

B. Concrete Construction

- **Footings:**
  - § 13.3 of ACI 318-19 requires compliance with Chapter 7
  - § 7.6.1.1 of ACI 318-19 \( A_{s,min} = 0.0018A_g \)
  - What does that mean?
  - Example: 42” wide x 12” thick wall footing w/ (3) #5 bars
    - \( A_g = 504 \text{ in}^2 \)
    - \( A_s = 0.60 \text{ in}^2 \)
    - Ratio = 0.00119 < 0.0018 \textbf{No Good!}

- **Concrete Piers:**
  - SDC ‘D’: IBC 1810.3.9.4.2 requires...
    - At least 4 vertical bars
    - \( \rho_{min} = 0.005 \)

- **Footing Reinforcement:**
  - Footings F-2 and F-5 do not appear to meet the minimum reinforcing requirements of ACI 318-19 Sections 13.3 and 7.6.1.1. Please address.
6.B. Concrete Construction

Concrete Piers:
- Enclosed Ties
  - #3 bar if ≤ 20”Ø
  - Otherwise #4 bar
  - Spacing shall be least of:
    - 1/2 least dimension of compression member; and
    - 12 inches

Exceptions:
- Not required in Groups R-3 or U of 2-stories or less when...
- Element is not subject to lateral loads, or...
- Only supports posts from decks and patios and the calculated lateral does not exceed 200#
- In these cases a single #4 vertical bar must be provided without ties or spirals

C. Masonry Construction

Materials:
- CMU: 1,500psi min, 4,000psi max
- Grout: ≥ CMU, but not less than 2,000psi
- § 5.3.1.4: Similar tie requirements as for concrete...
  - Spacing ≤ 16bd longitudinal or 48bd of tie
  - ≤ 6-inch clearance from laterally supported bar

Tied Bars:
Please review the lateral tie requirements shown in the masonry column details. Vertical bars should be tied in such a fashion as to ensure the maximum distance between laterally tied bars is less than or equal to 6-inches. See Section 5.3.1.4 of TMS 402-16.
C. Masonry Construction

- **Special Reinforced Example:**
  - § 7.3.2.6 of TMS 402-16
  - Maximum reinforcement spacing
    - 1/3 length of wall, or…
    - 1/3 height of wall, or…
    - 48” o.c.

**EXAMPLE**
Given: 9-foot walls
- 25’/3 = 8.33’
- 9’/3 = 3.0’
- 48”

6.C. Masonry Construction

- **Reinforcing:**
  - Ratio of reinforcing
    - $\rho_{\text{min}} \geq 0.0007$ in each direction ($\rho_h$ & $\rho_v$)
    - $\rho_{\text{total}} \geq 0.002$ ($\rho_h + \rho_v$)
  - Plan Review Cheat Sheet…

6.C. Masonry Construction

- **Nonparticipating Elements:**
  - If not intended to resist lateral forces…
  - Must be isolated in their own plane per §7.3.1 of TMS 402-16

6.C. Masonry Construction

- **Masonry Veneer:**
  - Height Limitations
    - Wood backing ≤ 30-feet above noncombustible foundation (38-feet at gables)
    - Metal stud backing ≤ 30-feet above noncombustible foundation (Can be supported above this height)
6.C. Masonry Construction

Masonry Veneer:
- Attachment Requirements
  - Provide at least one anchor for every 20"² of wall area
  - Space anchors at max. 32” horizontally and 25” vertically
  - Continuous #9 wire reinforcement at 18” o.c. to which anchors are attached is no longer required.

6.D. Steel Construction

Protected Zones:
- Areas of expected yielding
- Fabrication discontinuities are repaired
- Detrimental attachments are not permitted
- AISC 341-16 requires drawings to show protected zones for:
  - Special Steel Moment Frames
  - Intermediate Steel Moment Frames
  - Special Concentrically Braced Frames
  - Eccentrically Braced Frames
  - Buckling Restrained Braced Frames

Demand Critical Welds:
- These are welds that...
  - Are subject to yield-level stresses, and...
  - Could cause catastrophic results if they fail
- AISC 341 requires that drawings show the demand critical welds for:
  - Special Steel Moment Frames
  - Intermediate Steel Moment Frames
  - Special Concentrically Braced Frames
  - Eccentrically Braced Frames
  - Column Splices
  - Column Anchorages
6.D. Steel Construction

- **Demand Critical Welds:**
  - The plans must clearly identify the following...
    - Weld Filler Metal: CVN of 20ft-lbs at -20°F
    - Ultrasonic testing is required

6.D. Steel Construction

- **Steel Columns:**
  - Bolt embedment
  - Bolt diameter
  - Bolt spacing requirements
  - Non-shrink grout
  - Column-to-plate weld
  - Base plate thickness

7. Miscellaneous

- Verify that structural drawings are consistent with architectural and MEP.
- Ensure dimensions are provided.
- Verify proper code references.
- Verify each sheet bears the seal of an appropriate design professional.
- Do structural irregularities exist?
### Sample Comments

#### General Notes #1:
Please list all deferred submittal items on the cover sheet and note that they are to be reviewed by the Design Professional in Responsible Charge and that they are not to be installed until approval has been obtained from the building official in accordance with IBC 107.3.4.1.

#### General Notes #2:
The “special inspection” portion of sheet S001 does not meet the requirements for a “Statement of Special Inspections” as required by IBC 1704.3. All elements requiring special inspection must be noted, the extent of the inspection and testing listed, and the frequency (e.g. continuous or periodic) specified.

#### General Notes #3:
Please provide the material strength and specific construction requirements for the various construction materials. As an example, the block, mortar and grout strengths should be provided within the masonry notes.

#### General Notes #4:
Please add a note to the plans stating that all fasteners (i.e. nails, screws, anchor bolts, etc.) which are to be installed in preservative treated wood (i.e., sill plates) shall meet the requirements of IBC 2304.10.5.

#### Foundation Plan:
No details or notes are provided for endwall blocking at the floor joists which run parallel to the foundation walls. Please provide a detail showing the blocking requirements as required by Section 12.11.2.2 of ASCE 7-16.

#### Roof Framing Plans:
Sheet SF103: The calculated snow drift loads are not shown at the roof. Per IBC 2207.2 these loads should be shown for the fabricator to consider in the final design of the roof joists. Please address.

#### Wood Shrinkage:
No calculations were included for the analysis of wood shrinkage in the proposed structure. Per IBC 2304.3.3, a wood-framed structure supporting the framing of more than two floors and a roof must provide an adequate shrinkage analysis to the building official. Please provide a satisfactory analysis.

#### Column Ties:
Please review the lateral tie requirements shown in detail ______. Vertical bars should be tied in such a fashion as to ensure the maximum distance between laterally tied bars is less than or equal to 6-inches (see Section 7.10.5.3 of ACI 318).

#### Protected Zones:
Per IBC 2205.2.2, structural steel structures located within high seismic regions shall be designed and detailed in accordance with AISC 341. AISC 314 requires that drawings define and show protected zones. Protected zone requirements could not be found on the plans. Please address.

### PART F
**Structural Calculations**

#### Common Relationships

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<tr>
<th>Load</th>
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<th>0</th>
<th>Constant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear</td>
<td></td>
<td></td>
<td>[ \text{Linear} ]</td>
</tr>
<tr>
<td>Moment</td>
<td>Linear</td>
<td>Linear</td>
<td>Parabolic</td>
</tr>
</tbody>
</table>

- **Load**: 8%
- **Shear**: Linear
- **Moment**: Linear, Parabolic
Calculations (8%)

1. Proper Code References
2. Wind Design
3. Seismic Design
4. Flood Design
5. Snow Loads
6. Do Calculations Match Plans?

1. Proper References

Structural Calculation Note #1:
Many of the calculations were performed in reference to outdated building codes and standards. Please confirm that calculations meet the requirements of the 2021 IBC and its referenced standards as listed in Chapter 35.

2. Wind Design

We already checked this as part of the “Hazard Review” and when checking the design criteria on the structural general notes.

3. Seismic Design

• We already checked this as part of the “Hazard Review” and when checking the design criteria on the structural general notes.
• Verify that the appropriate $S_{DS}$ and SDC are used in the lateral calculations.
4. Flood Design

- We already checked this as part of the “Hazard Review” and when checking the design criteria on the structural general notes.
- If within a flood hazard area, flood hazard documentation must be provided per IBC 1612.4.

5. Snow Loads

- Verify that drift and sliding snow calculations have been provided.
- Perform a spot check that they match the loads shown on the plans.
- Overhangs shall be capable of supporting Ice Dams along the eaves. (2" Pf)

6. Do They Match Plans

- Perform a check of as many as possible.
Specifications (2%)

- Do they comply with the structural plans, structural calculations, and geotechnical report?

Summary

- Simplified approach for small to moderate projects.
- Are complete load paths provided?
- Are appropriate dead & live loads considered?
- Is the design criteria correct?
- Are there any local hazards to consider?
- Is the current code and standard being used?
- Are all elements considered & specified?

Any Questions?

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