Presentations
on
Steel Joists, Joist Girders and Steel Deck

List of Presentations:

- Overview and Introduction to Design using Steel Joists, Joist Girders and Steel Deck

- Building Codes

- Roof Design with Joists and Joist Girders

- Roof Design with Steel Deck

- Diaphragm Design

- Floor Design

- Design Hints and Design References

- Design Tools

Note: It is suggested that the presentations be presented in the order shown.

Credits

The eight presentations have been prepared to introduce Civil, Structural, and Architectural students to the use of steel joists, Joist Girders and steel deck. The presentations were authored by:

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Steel Joists, Joist Girders and Steel Deck

Introduction to Design using
Steel Joists, Joist Girders and Steel Deck

Presented by NUCOR/Vulcraft
with
Contributions by the Steel Joist Institute and the Steel Deck Institute

Introduction to Design using Steel Joists, Joist Girders and Steel Deck

Topics Covered in this Presentation:

- Usage of Joists, Joist Girders and Deck
- Advantages of Joists, Joist Girders and Deck
- The Major Reference and its Contents
- Design Concepts

Joists, Joist Girders and Steel Deck

Up to this point in your education you have learned about structural steel and concrete design. You may or may have not been told about Open Web Steel Joists, Joist Girders or Steel Deck.

Usage of Joists, Joist Girders and Deck

Joists, Joist Girders and Steel Deck are used for the construction of many buildings such as: warehouses, industrial plants, offices, commercial shops/malls, academic facilities, civic/institutional structures and large clear span structures such as fieldhouses and convention centers.

Joists, Joist Girders and Deck

Joists, Joist Girders and Steel Deck are manufactured products. The EOR specifies the deck, and the joist and Joist Girder loads and arrangement to the manufacturer. The manufacturer designs the individual members for the joists and Joist Girders.

Advantages of Open Web Steel Joists

- Steel joists are economical
- They have a high strength to weight ratio
- Variety of depths and shapes
- Openings permit passage of pipes and duct work

Major Reference

The book "Designing with Vulcraft Steel Joists Joist Girders Steel Deck" serves as the major reference for these presentations. A free pdf download of the book is available from the Vulcraft Website. Book Reference

Book Topics: Roof and Floor Systems

- Design loads
- Serviceability
- Framing concepts
- Joist span direction
- Joist spacing
- Joist and Joist Girder depth
- Connections
- Composite systems
- How to specify deck, joists and Joist Girders

Book Topics: Lateral Load Systems

- **Steel deck diaphragm systems**
- Moment frames and braced frames
- Seismic considerations
- Selection of the lateral load system

Diaphragm Chord

Diaphragm Chord
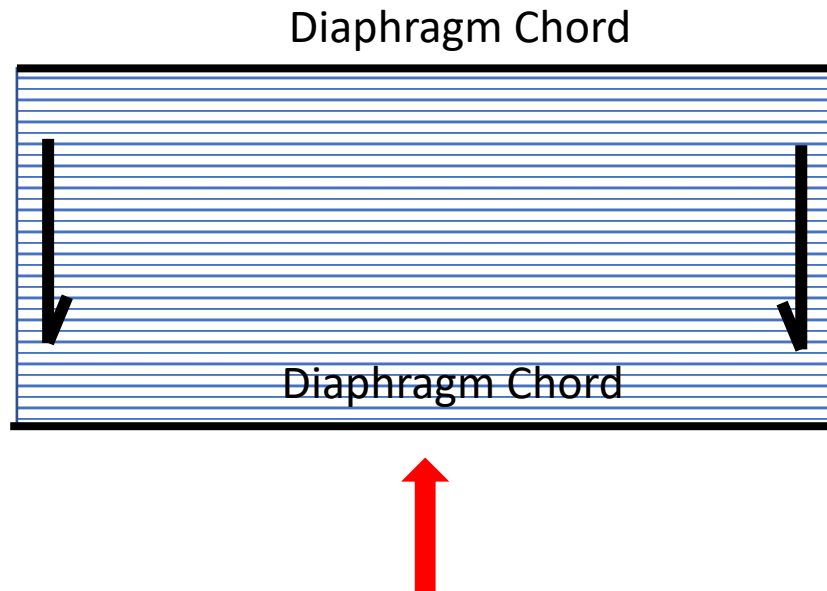
Book Topics: Special Design Situations

- Hanging Loads
- Headers and Openings
- Roof-top Mechanical Units
- Joist Reinforcement for Additional Loads after Construction
- Floor Vibration
- Spandrel Systems
- Roof Ponding
- Fire Resistance
- Other Special Situations

These are specific topics and are not covered in these presentations but are noted for your reference.

Design Concepts

In your course work you have probably not been given freedom to select what elements should be combined, and what the overall geometry should be used for a given structural system, e.g., member types, depths, lengths, etc.

Remember the following:

Design is neither solely calculations, nor construction documents; rather it is a synthesis of techniques used to communicate a conception that constructors bring to reality.

Engineering design is not purely science. Structural engineering is also an art. It is the art of design that is difficult to quantify and model.

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Design Concepts

You have received classroom instructions on the design of structural elements such as steel beams, columns etc. Connecting these elements together is of paramount importance to create a good design.

What do you think is the most important principle for a successful design?

LOAD PATH

Design Concepts- Load Path

- Load path means you identify and follow how forces are transferred from member to member in your structure, until all forces reach mother earth

- Connection between members is critical to the load path

Load Path- Gravity Loads

The load path for roof gravity loads is simple:

- The roofing materials are adhered to the deck
- The deck bears on the joists and is fastened to the joist by welds or mechanical fasteners
- The joist transfers its load to the Joist Girders via joist seats which bear on the top chord of the Joist Girder. The seats are attached to the Joist Girder by welds or bolts
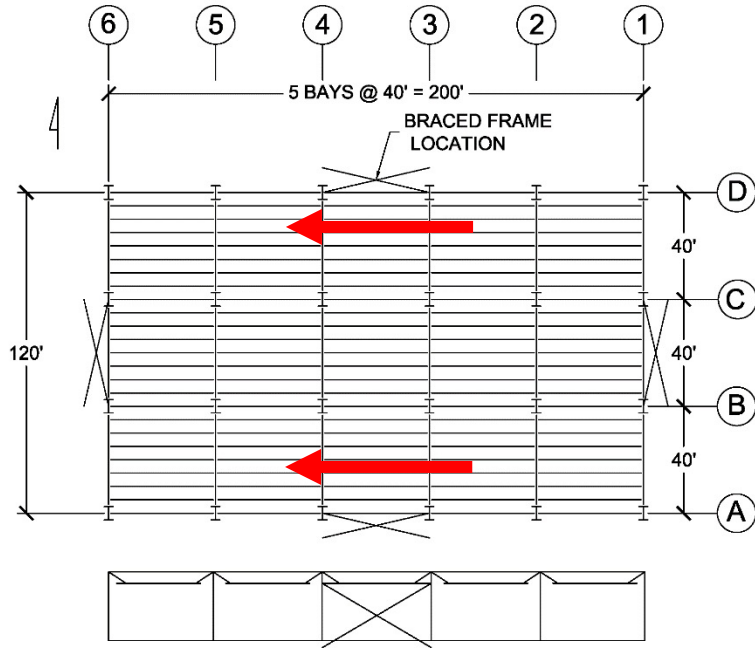

Joist Seat

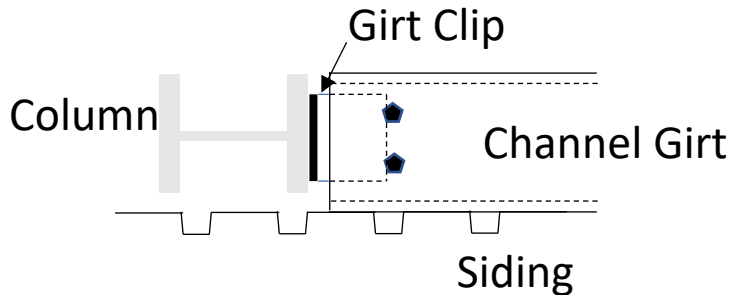# Load Path- Gravity Loads

The Joist Girders are supported by columns or walls

Do Not Weld
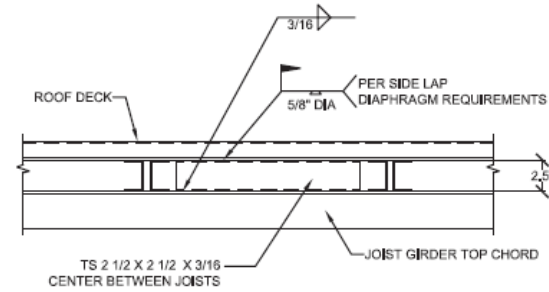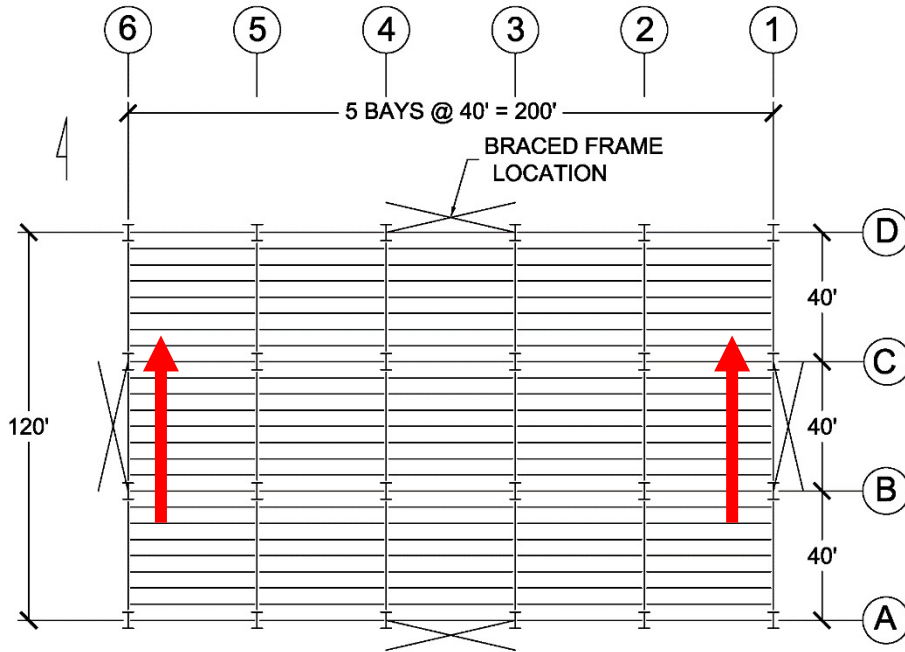
Stabilizer Plate
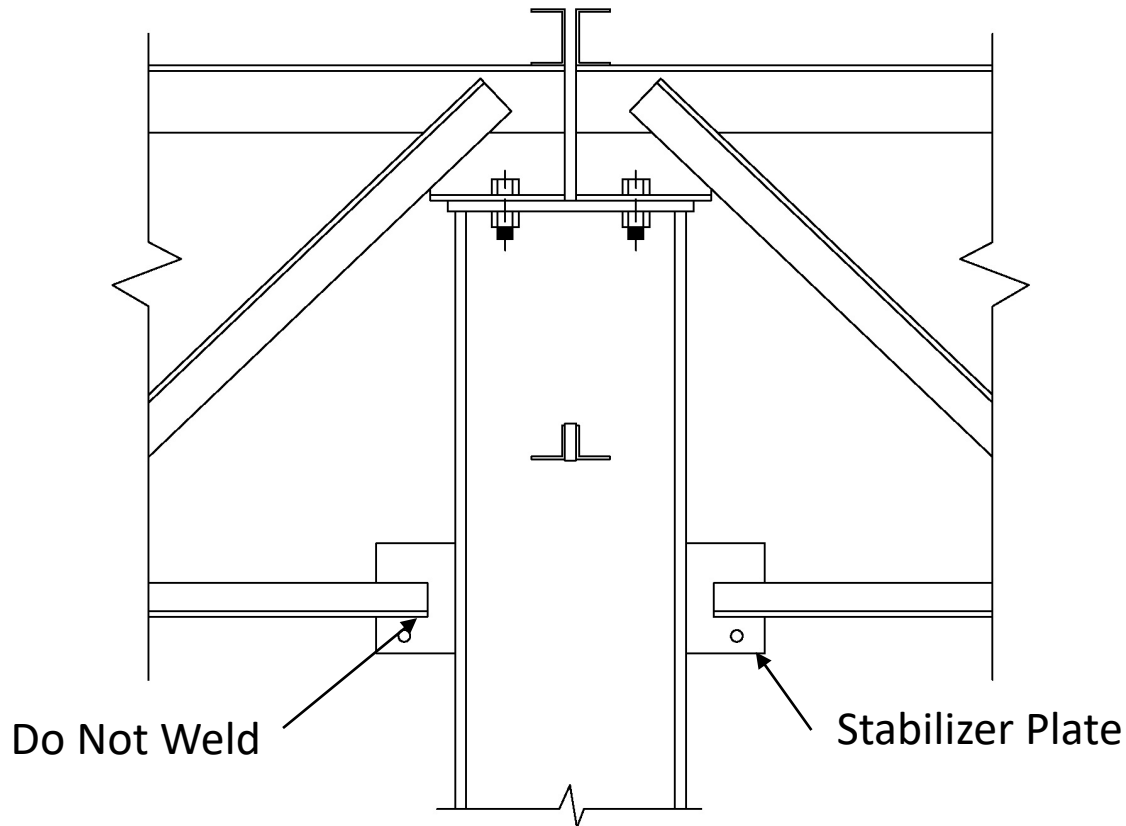
Typical connection at column

Load Path- Lateral wind
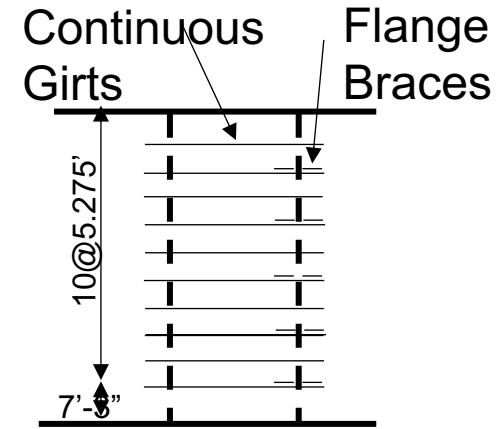
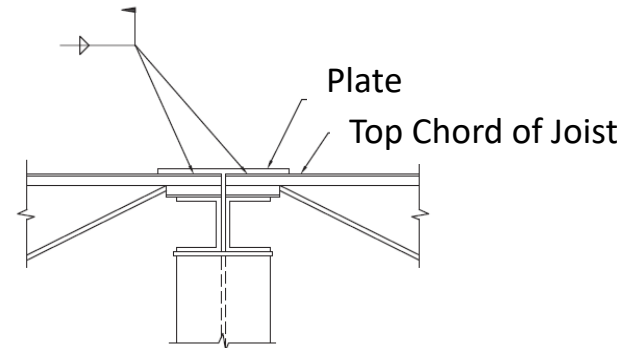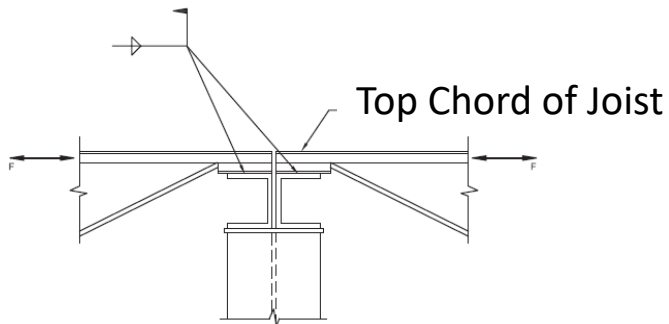Girt loads are transferred to the columns with girt clips. The girts are usually channels or Zee Sections.

Load Path- Lateral Wind

Load Path- Lateral Wind Loads

Diaphragm Shear Collector

Top Chord of Joist

Plate
Top Chord of Joist

Diaphragm Chord Forces

Design Concepts

An efficient design process is as follows:

1. Determine the loads and load combinations
2. Select the roof deck to be used
3. Determine the bay size
4. Select the members
5. Design all connections

Greater detail on the design process is presented in the presentation on "Design Process & Tools"