Night School 23: Topics on Industrial Building Design and Design of Non-building Structures

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AISC Night School

Session 2 – Industrial Buildings -- Part 1

June 23, 2020

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Course Description

Industrial Buildings -- Part 1 (submitted for AIA continuing education approval)
June 23, 2020

This session will provide a general review of the design of industrial buildings. The session will address planning, including project requirements, building layout, roof and wall system and selection of column spacing. Loads will be addressed including process loads, material handling requirements and load combinations. Lastly, the session will framing systems will be reviewed.

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Learning Objectives

- Define what an industrial building is and what makes it unique or different than other buildings.
- List the common participants in the design team for an industrial building and describe their roles and responsibilities.
- Describe the development of structural design criteria and “Basis of Design” document.
- Describe the process of determining the building layout and column spacing requirements.

Night School 23: Industrial Structures

Session 2: Industrial Buildings – Part 1

June 23, 2020

John Rolfes, PE, SE, CSD Structural Engineers

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INTRODUCTION

SESSION 1 INTRODUCTION AND CODE PROVISIONS

SESSION 2 INDUSTRIAL BUILDINGS – PART 1

SESSION 3 INDUSTRIAL BUILDINGS – PART 2

SESSION 4 CRANE SUPPORTING STRUCTURES

SESSION 5 FATIGUE DESIGN FOR INDUSTRIAL STRUCTURES

SESSION 6 HIGH & LOW TEMPERATURE DESIGN FOR INDUSTRIAL STRUCTURES

SESSION 7 NON-BUILDING STRUCTURES –PART 1

SESSION 8 NON-BUILDING STRUCTURES –PART 2

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SESSION 2: INDUSTRIAL BUILDINGS - PART 1

LEARNING OBJECTIVES:

- Define what an industrial building is and what makes it unique or different than other buildings
- Who are the common participants in the design team for an industrial building? What are their roles and responsibilities
- Development of structural design criteria and "Basis of Design" document
- Determination of building layout and column spacing requirements
- Selection of roof and wall systems
- Inspection and Maintenance requirements for industrial buildings

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INSPECTION AND MAINTENANCE REFERENCE

LEARNING OBJECTIVES:

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DEFINITION OF INDUSTRIAL BUILDING

An industrial building is typically considered to be any structure that encloses or supports a manufacturing or industrial process and/or is used to store manufactured product.

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MANUFACTURING BUILDING

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INDUSTRIAL BUILDING

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LARGE OR HEAVY INDUSTRIAL BUILDING

14

POWER PRODUCTION FACILITY

15

AIRPLANE HANGAR

16

WAREHOUSE

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DIFFERENCES BETWEEN COMMERCIAL & INDUSTRIAL BLDGS

❑ Commercial Building

- Typically designed and configured to support a specific occupancy
- The objectives, requirements and resulting configuration of a commercial building is typically determined by an architect working in conjunction with the owner
- Commonly one to four-story buildings with floor-to-floor heights ranging from 11 ft. to 15 ft. and column/bay spacings of 20 ft. to 30 ft.

❑ Industrial Building

- Typically designed and configured to accommodate and support the enclosed manufacturing or industrial process.
- The configuration and layout of an industrial buildings is defined by the enclosed industrial process. This process is developed by process engineers and equipment vendors working with the owner
- Commonly one-story building (possibly with mezzanine framing) with eave heights ranging from 20 ft. to 100 ft. and typical column/bay spacings of 25 ft. to 60 ft.

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DIFFERENCES BETWEEN COMMERCIAL & INDUSTRIAL BLDGS

❑ Commercial Building

- Design loads
  - Environmental Loads per Building Code
  - Prescriptive Live Loads based on occupancy per Building Code

❑ Industrial Building

- Design loads
  - Environmental Loads per Building Code
  - Prescriptive Live Loads provided in Building Code
  - Higher Live Loads may be applicable for certain activities
  - Process Loads and Equipment Loads per Process Engineers and Equipment Vendors. Equipment Loads include material handling equipment such as cranes, conveyors, forklift trucks, etc.,

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DIFFERENCES BETWEEN COMMERCIAL & INDUSTRIAL BLDGS

❑ Commercial Building

- Design Criteria
  - Strength Criteria established by the Building Code
  - Serviceability Criteria generally include drift and deflection criteria and potentially acceleration criteria in high-rise buildings. Design limits based on occupancy and building materials used
  - Tolerances established by AISC Code of Standard Practice (typically)

❑ Industrial Building

- Design Criteria
  - Strength Criteria established by the Building Code and possibly other design standards and guides related to type of facility
  - Fatigue Design Criteria established by the Building Code for repetitive equipment or process loading
  - Serviceability Criteria include drift and deflection criteria, vibration criteria. Design limits commonly established by process engineer or equipment vendors
  - Tolerances based on AISC Code of Standard Practice and Process Requirements

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- Selection of roof and wall systems
- Maintenance requirements for industrial buildings
- Inspection requirements / recommendations

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INDUSTRIAL BUILDING DESIGN TEAM

DESIGN TEAM

- Owner
- Process Engineer
- Process Equipment Vendor
- Structural Engineer
- Industrial Architect
- Other Engineering Disciplines (Geotechnical, Civil, Electrical, Mechanical, Plumbing)
- Contractor

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ROLES OF TEAM MEMBERS

❖ **Owner:** Manufacturer, Industrial Process Company, or Developer that is purchasing the process and building and commonly will operate this facility upon its completion.

- Generally works hand-in-hand with the Process Engineer and Equipment Vendor to define and procure the process equipment and develop the layout of the facility that aligns with the intended operational or material flow through the facility

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ROLES OF TEAM MEMBERS

❖ **Process Engineer:** Engineering group responsible for the design of the overall process, incorporating the purchased equipment.

- Often operates as the Owner's Representative on the Design Team.
- The Process Engineer works with the owner and equipment vendors to develop the general arrangement drawings for the process
- Commonly designs the associated process piping, power supply, controls and automation for the equipment.
- The Equipment Vendor sometimes operates as the Process Engineer.

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ROLES OF TEAM MEMBERS

- **Process Equipment Vendor:** Equipment Manufacturer responsible for providing the Process Equipment for the Project. Typically this is the same entity that manufactures the equipment.
  - As noted above, may operate as the Process Engineer for the project too.
  - Material handling equipment vendors may also be integrated into the team

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ROLES OF TEAM MEMBERS

- **Structural Engineer:** Entity responsible for the structural design of the building structure containing (and sometimes supporting) the process equipment.
  - Commonly retained by the Owner and, in these instances, also acts as the Owner's representative on the Design Team. May play a larger role in the project as compared to commercial building projects.
  - Services can also include the design of the equipment foundations (when needed), elevated platforms for support or maintenance of equipment, and possibly other non-building structures associated with the process that are supported on the building structure or on separate foundations (e.g. storage bins, silos, stacks, etc.,).
  - The Structural Engineer needs to work closely with the Owner, Process Engineer, and Equipment Vendors to understand all pertinent process loading and design criteria related to these structures and foundations.

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ROLES OF TEAM MEMBERS

❖ **Industrial Architect:** Entity responsible for verifying the building complies with the building code and for developing requirements for the weather tightness of the structure.

- This entity sometimes will play a more significant role in the project, working with the Owner, Process Engineer, Equipment Vendors and Engineers to coordinate and plan the overall project. To do this, the Industrial Architect must have a strong understanding of the industrial process for the project

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ROLES OF TEAM MEMBERS

❖ **Industrial Architect:**

- Duties include:
  - Determination of Bldg. Code Occupancy Classification
  - Determination of Bldg. Code restrictions on height and area of the building
  - Development of Architectural Layouts for internal program requirements
  - Development of exiting requirements to meet Bldg. Code
  - Location and layout of Toilet Room Requirements
  - Development of Site Plan / Site Circulation
  - Compliance with ADA requirements
  - Advocate for client with state and local building code officials and zoning departments

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ROLES OF TEAM MEMBERS

❖ **Other Engineering Disciplines:** Geotech, Civil**,** MEP Engineers

- Work together with the Process Engineer, Structural Engineer and Industrial Architect to develop designs for utilities, power, lighting, ventilation, etc., for the building and to support the process and material handling equipment.

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ROLES OF TEAM MEMBERS

❖ **Contractor:** In some instances, the Owner may elect to use a Design-Build process with the General Contractor acting as the Owner's representative and all, or some, of the other Design Team members procured by the General Contractor.

- Owner typically still very involved on the project.
- Common arrangement is to have the Process Engineer/Equipment Vendors working directly for the Owner and for the Owner to enter into a Design-Build arrangement with the Contractor for the building/foundation work that may or may not include the equipment and process installation related to these structures and foundations.

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DESIGN TEAM COORDINATION

1. For each project, must clearly define specific responsibilities for all members of the design team. These responsibilities should be very detailed and complete and should be clearly stated in scope statements of contracts for each member of team.
2. Determine specific information that each design team member needs to perform their work.
3. Determine required time durations for each work activity
4. Develop a project schedule, including dates when pertinent information is required for each party to perform their work in accordance with the developed schedule.

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SESSION 2: INDUSTRIAL BUILDINGS - PART 1

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DEVELOPMENT OF STRUCTURAL DESIGN CRITERIA

Structural Engineer is dependent on the Process Engineer and Equipment Vendor for much of the information pertaining to design criteria. This information includes:

- Process layout (General Arrangement Drawings) and associated process loads for building and foundation design
- Equipment drawings, loads and anchorage requirements for building and foundation design
- Material handling equipment layouts and loadings
- Building geometry requirements to accommodate process and material handling requirements

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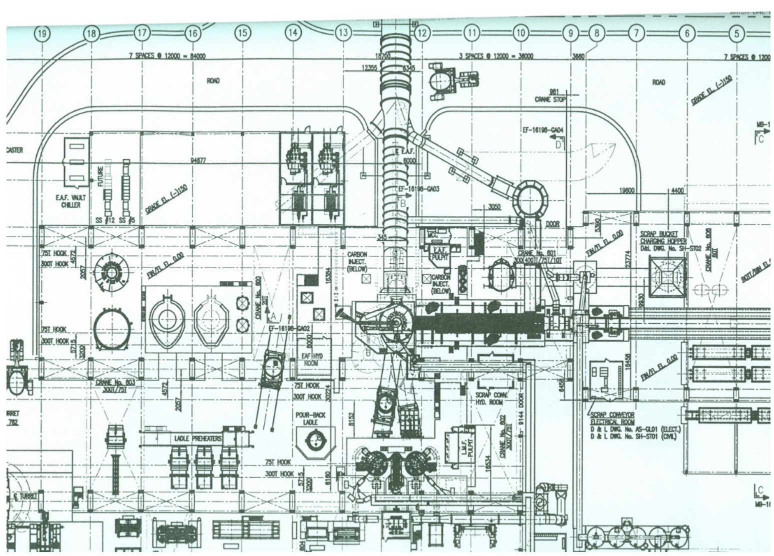
GENERAL ARRANGEMENT DRAWINGS

Plans, Section Views and Elevations that show:

- Equipment layout
- Equipment geometry and spacing
- Process flow
- Layout and geometry for associated equipment support platforms and maintenance platforms
- Routing of associated process piping and utilities



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DEVELOPMENT OF DESIGN CRITERIA

Key Project Design Parameters

- Site and soil information
- Wall and roof material preferences
- Utility routing and support requirements
- Equipment maintenance access
- Future expansion plans
- Building Code prescribed building height and area restrictions
- Preferred building bay and module sizes
- Loading dock and door requirements
- Material-handling requirements including conveyors, overhead cranes, fork-lift trucks and other conveyance equipment
- Conveyor routing and support requirements
- Crane types, quantities and capacity requirements

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DETERMINATION OF PROJECT REQUIREMENTS

Additional Key Project Design Parameters

- Serviceability design criteria based on building materials, process equipment and material handling equipment requirements
- Equipment foundation requirements
- Floor slab design criteria (for slab-on-grade and elevated floors)
- Fall protection and fall arrest system requirements
- Fire protection requirements
- Exiting requirements
- Expansion joint requirements and type of expansion joint detail to be used
- Building environment considerations based on the contained process or generated by the contained process
- Project budget and schedule requirements

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BASIS OF DESIGN DOCUMENT

Structural Engineer should consider incorporating all critical design parameters and loading requirements into a single written "Basis of Design" document.

- Document to be reviewed with the Owner and Process Engineer or Contractor before proceeding with design.
- As project progresses, the "Basis of Design" should be periodically reviewed and updated when necessary as additional design considerations evolve.
- Provides a good record summary document that can be used when reviewing future alterations or additions to the facility.

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SESSION 2: INDUSTRIAL BUILDINGS - PART 1

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INDUSTRIAL BUILDING LAYOUT

- For industrial facilities with significant process equipment, the structural configuration for the building is driven by process layout
- General Arrangement Drawings required to develop building layout
- Input from structural engineer is useful to guide Process Engineer / Equipment Vendor

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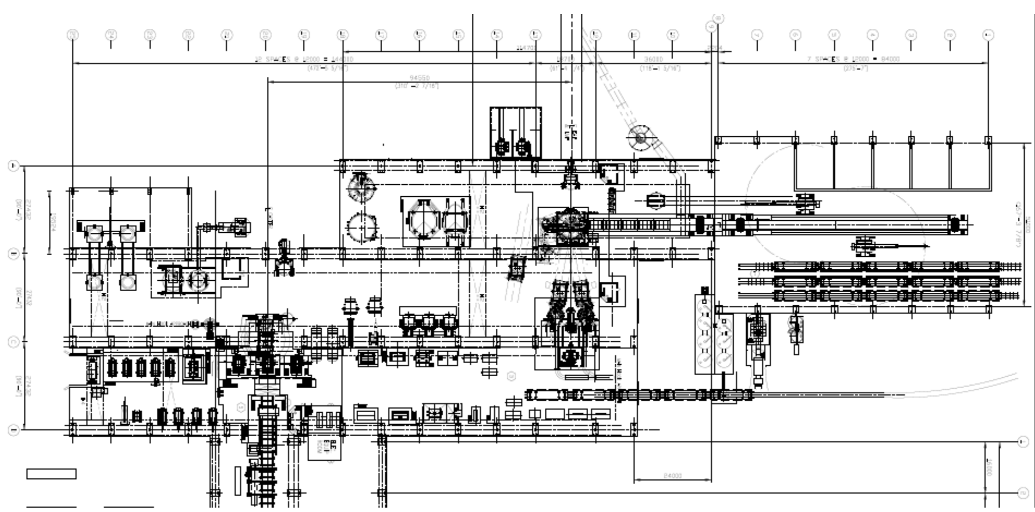
INDUSTRIAL BUILDING LAYOUT



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INDUSTRIAL BUILDING LAYOUT

For Industrial Facilities with less significant process equipment and warehouse facilities, layout of building may be more flexible, allowing layout to be driven by economics

- *What configuration provides the necessary space for the least dollars?*

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INDUSTRIAL BUILDING LAYOUT FOR ECONOMY

For large one-story industrial buildings, improved economy is obtained with square or nearly square building layout.

- Length of the building perimeter and subsequent cost of exterior wall system is minimized for a given footprint area with a square layout

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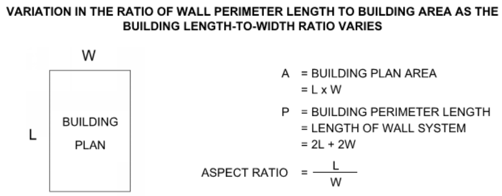
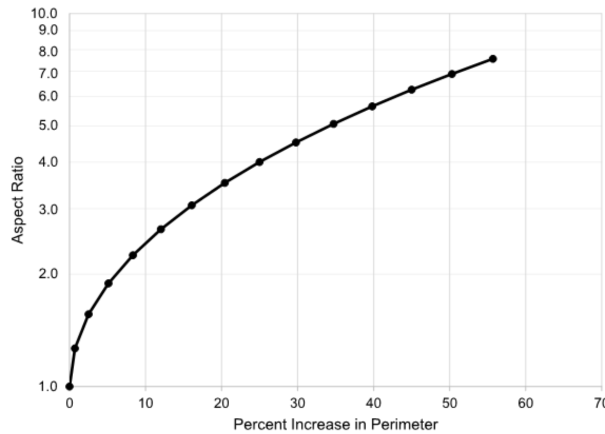
INDUSTRIAL BUILDING LAYOUT FOR ECONOMY





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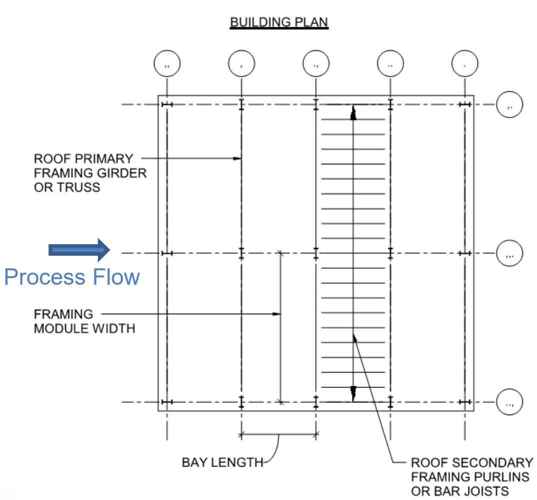
COLUMN SPACING (BAY SPACING AND MODULE SIZE)



Module Width:

- Typically based on process requirements
- Common dimensions range from 40 ft. to 100 ft.

Bay Length:

- Function of type of secondary framing members used (light gage Z or C), hot rolled purlins and girts, or bar joists
- When light gage secondary framing is used, bay length commonly 20 ft. to 30 ft.
- For hot rolled secondary framing, bay length commonly 20 ft. to 40 ft.
- For bar joists, bay length commonly 20 ft. to 60 ft.

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RESULTS OF ECONOMIC STUDIES

Based on economic studies that CSD has performed for a variety of industrial buildings, most economical bay spacing is typically between 40 ft. and 50 ft. long

- This incorporates consideration for cost of building superstructure and building foundations.
- Also incorporates potential fabrication and erection savings
  - Least cost is often not least weight
  - Fewer pieces often leads to reduced cost

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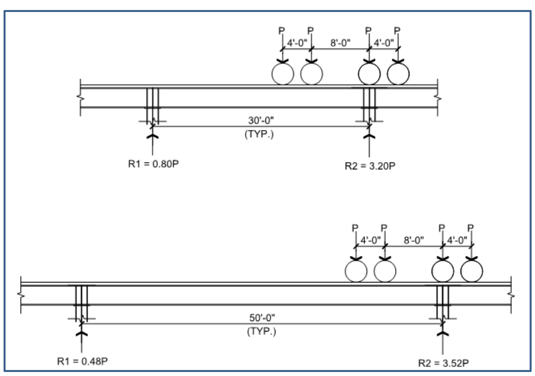
RESULTS OF ECONOMIC STUDIES

Note that for crane loads, maximum column load may not change appreciably with increased bay length



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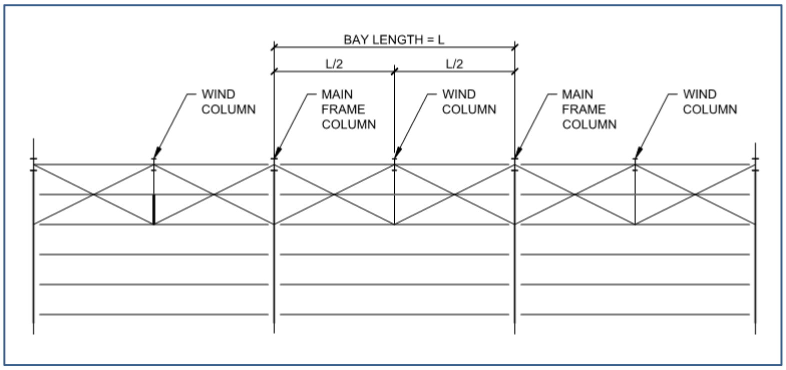
USE OF WIND COLUMNS WITH LARGER BAY LENGTHS

Wind columns may be used with larger bay lengths to reduce the span of wall girts, allowing use of light-gage steel girts



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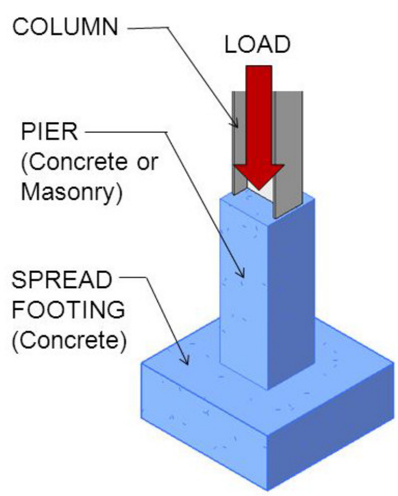
FOUNDATION CONSIDERATIONS

Shallow Foundations (spread ftgs.)

- Typical cost of installed spread footings is a fraction of the erected building superstructure cost, even for a one-story building
- For one-story building with 50 ft. x 50 ft. bays,
  spread footing cost ≈ 5% of erected steel roof and column framing



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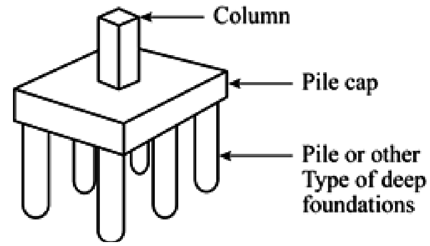
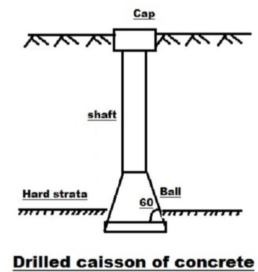
FOUNDATION CONSIDERATIONS

Deep Foundations
(Piles or Drilled Shafts / Caissons)

- Cost of deep foundations is an order of magnitude higher than shallow foundations
- Typical installed pile cost ≈ $2,500/pile
- Cost of Drilled Shafts varies depending on size, depth, soil conditions, and presence of ground water





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SELECTION OF ROOF AND WALL SYSTEMS

- Roof and wall system should be selected early in the design process, before starting significant work on the structural design of the building
- Structural Engineer, Industrial Architect and Owner may all have a hand in selecting the roof and wall system for the project
- Decision typically based on cost, functionality, durability, and standards for large industrial corporations

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ROOF SYSTEMS

Options:

- Built-up roofs (BUR)
- Membrane roofs
    - Ethylene Propylene Diene Terpolymer (EPDM)
    - Thermosplastic Polyolefin (TPO)
- Exposed metal roofs
    - Screw-down metal roof
    - Standing seam metal roof

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BUILT-UP ROOF (BUR)

- Have been in use for over 100 years
- Good for low-slope roofs
- Composed of alternating layers of reinforcing fabric and bitumen
- Top layer has small stone or fine gravel finish to protect roof from UV, blown or falling debris and to provide good walking surface
- Bitumen may be applied hot or cold and serves as adhesive
- Life Span – 15 to 30 years

Advantages		Disadvantages	
Waterproofing	☑	Slow installation	☹
UV protection	☑	Fumes	☹
Low Maint.	☑	High install. cost	☹
Fire-resist.	☑	Wind problems	☹

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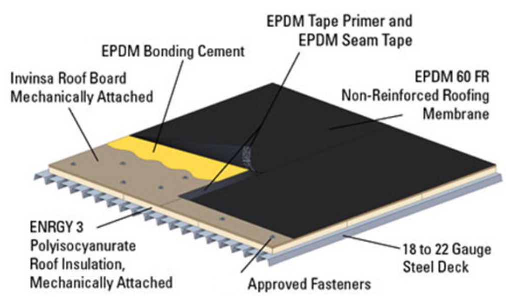
MEMBRANE (EPDM) ROOF

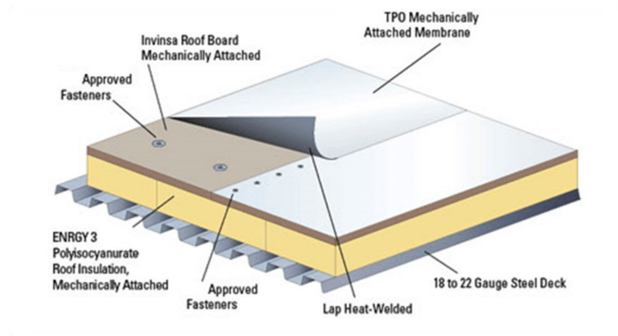
- Durable, synthetic, single-ply rubber roof membrane
- Widely used for low-slope roofs
- Installed as either
  - Fully adhered
  - Mechanically Fastened
  - Ballasted
- Seams are sealed with liquid adhesive or specially formulated tape
- Life Span – 25 to 35 years



Advantages		Disadvantages	
Low Cost	☑	UV deterioration	☹
Fast Install	☑	Easy to damage	☹
Few seams	☑	Appearance	☹
Low Weight	☑	Maintenance	☹
Fire-resist.	☑		
Long Lasting	☑		
Penetrations	☑		

MEMBRANE (TPO) ROOF

- Durable, synthetic, single-ply roof membrane
- Actually typically a membrane made from a blend of rubbers
- Installed as either
  - Fully adhered
  - Mechanically Fastened
- Seams are heat welded
- Life Span – 15 to 20 years



Advantages
Low Cost ☑
Fast Install ☑
Low Weight ☑
Fire-resist. ☑
Penetrations ☑
Color ☑

Disadvantages
Newness ☹
Quality Variation ☹
More seams ☹
Laminations ☹

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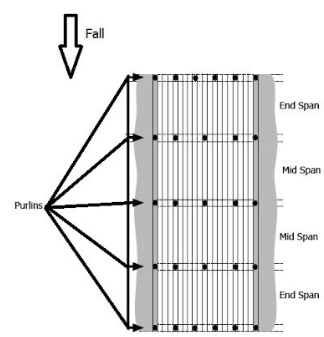
METAL ROOF – SCREW DOWN

- Metal roof deck provides structural support and weather tightness
- Roof deck fastened to underlying roof secondary framing with either self-drilling screws or screw bolts with rubber gaskets beneath screw head
- End laps and side laps of deck are screwed together also
- Use mastic tape to provide sealed joint at end laps and side laps.



Advantages
Long life ☑
Low Cost ☑
Low Weight ☑
Appearance ☑

Disadvantages
Water tightness ☹
Fastener problems ☹
Maintenance ☹
No low-slope ☹
Penetrations ☹

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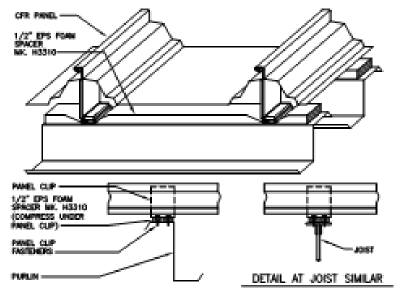
METAL ROOF – STANDING SEAM

- Metal roof panel provides structural support and weather tightness
- Roof panel fastened with screws at eave and supported on sliding clips on remaining roof purlins
- Roof side laps are commonly seamed
- Roof panel allowed to move beneath ridge cap
- End laps are screwed together
- Use mastic tape to provide sealed joint at end laps



Advantages	
Long life	☑
Water Tightness	☑
Low Weight	☑
Appearance	☑
Low-slope	☑

Disadvantages	
Expensive	☹
Penetrations	☹

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ROOF DRAINAGE

Roof drainage is an important variable to consider when evaluating building geometry and roof system options.

- Min. roof slope = ¼:12 for BUR, EPDM, TPO and Standing Seam Metal Panel roof systems (IBC criteria)
- Min. roof slope = ½:12 for most Screw Down Metal Panel roof systems
- Exposed metal roof panel systems are generally restricted to buildings with perimeter drainage systems
- When interior drainage systems are used, design must evaluate for potential impounded water
  - IBC requires consideration of blocked primary drain system for this evaluation
  - Plumbing engineer to provide height of impounded water based upon characteristics of secondary drainage system and code-prescribed design level rainstorm
  - Controlled-Flow Roof Drainage Systems

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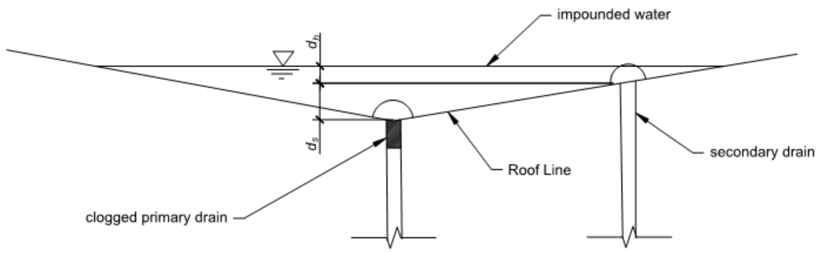
RAIN LOADS – INTERIOR DRAIN SYSTEM



Note:
1. Prediction of water depth is a function of the design rainfall intensity and the tributary area to the roof drain
2. Evaluation used principles of hydraulics / fluid mechanics
3. Plumbing engineer should provide this information

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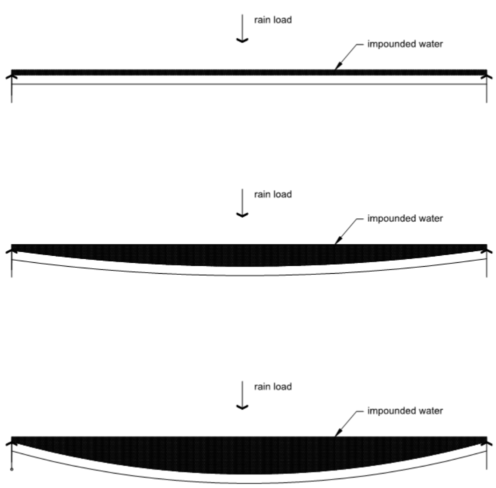
PONDING

Section 8.4 ASCE 7-16 Ponding Instability & Ponding Load

- "Ponding" refers to the retention of water due solely to the deflection of relatively flat roofs.
- Roof framing bays must possess adequate stiffness to preclude progressive deflection (i.e. instability) as rain falls on them or meltwater is created from snow on them
- Susceptible bays include bays with a roof slope less than ¼:12 or on which water is impounded upon them (in whole or in part) when the primary drain system is blocked, but the secondary drain system is functional.
- Larger of snow load or the rain load equal to the design condition for a blocked primary drain system shall be used in this analysis
- Reference SJI Technical Digest #3 (2018 Edition) and SJI Ponding Tool



https://www.aisc.org/education/continuingeducation/education-archives/roof-design-using-iterative-analysis-for-ponding-loads-n24/

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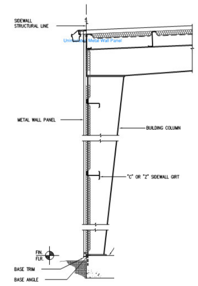
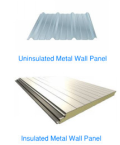
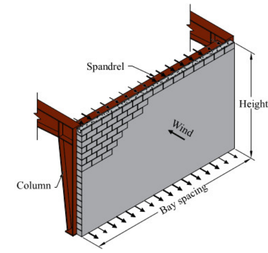
WALL SYSTEMS

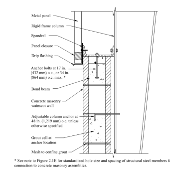
Options:

- Metal wall panel (insulated or uninsulated)
- Masonry
- Precast concrete wall panels
- Tilt-up concrete wall panels
- Combined (wainscot) wall system
    - Hardwall (masonry or concrete) lower wall section with metal wall panel above
    - Hardwall system provides durability for lower section of wall that is likely more subject to abuse









SESSION 2: INDUSTRIAL BUILDINGS - PART 1

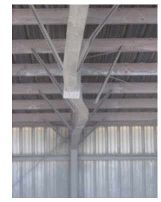
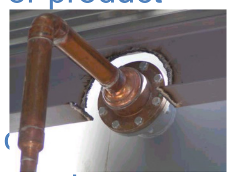
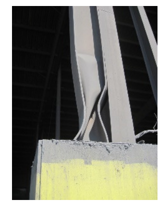
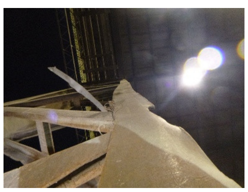
LEARNING OBJECTIVES:

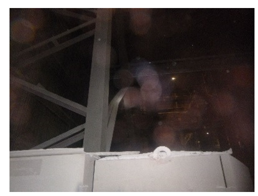
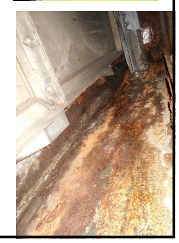
- Define what an industrial building is and what makes it unique or different than other buildings.
- Who are the common participants in the design team for an industrial building? What are their roles and responsibilities
- Development of structural design criteria and “Basis of Design” document
- Determination of building layout and column spacing requirements
- Selection of roof and wall systems
- Inspection and Maintenance requirements for industrial buildings

IMPORTANCE OF INSPECTION & MAINTENANCE

Industrial buildings are susceptible to abuse and wear and require routine inspection and maintenance. Damage due to:

- Abuse from impact between structure and equipment or product
- Abuse from overload
- Damage associated with fatigue
- Damage associated with environment (e.g. corrosion (
- Non-documented changes and modifications by personnel

IMPORTANCE OF INSPECTION

Purpose of Regular Inspection Program

- Maintain safe structures and avoid risk to personnel & equipment
- Avoid cost of unplanned shutdowns
- Avoid excessive repair costs
- Allows for planned maintenance activities
- Address operational or maintenance problems
- Improve the service life of the structure and maintain the value of the structure
- Identify and correct operation activities or equipment malfunctions that are damaging the structure

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REFERENCE FOR INSPECTION/MAINTENANCE

2020 Edition of AIST Technical Report #13, Guide for Design and Construction of Mill Buildings

Appendix C - Recommended Practice for Inspection and Upgrading of Existing Structures

- *C1.0 – Purpose*
- *C2.0 – Reasons for Performing an Inspection*
- *C3.0 – Inspection*
- *C4.0 – Reasons for Upgrading an Existing Structure*
- *C5.0 – Upgrading*

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SESSION 2: INDUSTRIAL BUILDINGS - PART 1

LEARNING OBJECTIVES:

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Session 2
the End

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Thank you!

AISC | Questions?

Smarter.
Stronger.
Steel.

Individual Session Registrants

PDH Certificates

- You will receive an email on how to report attendance from: registration@aisc.org.
- Be on the lookout: Check your spam filter! Check your junk folder!
- Completely fill out online form. Don't forget to check the boxes next to each attendee's name!

Individual Session Registrants

PDH Certificates

- Reporting site (URL will be provided in the forthcoming email).
- Username: Same as AISC website username.
- Password: Same as AISC website password.

Individual Session Registrants

PDH Certificates

- Accommodations for Work-From-Home situations:
- AISC will provide the list of attendees from your company to report attendance. These are the only individuals that you should report for attending this session.
- The lists will be send out within 3 business days.

8-Session Registrants

PDH Certificates

One certificate will be issued at the conclusion of all 8 sessions.

8-Session Registrants

Access to the quiz

Information for accessing the quiz will be emailed to you by Thursday. It will contain a link to access the quiz. EMAIL COMES FROM NIGHTSCHOOL@AISC.ORG.

Quiz and attendance records

Posted Thursday mornings. www.aisc.org/nightschool -- Click on Current Course Details.

Reasons for quiz

- EEU – You must take all quizzes and the final exam to receive EEU.
- PDHs – If you watch a recorded session, you must pass quiz for PDHs.
- REINFORCEMENT – Reinforce what you learn tonight. Get more out of the course.

Note: If you attend the live presentation, you do not have to take the quizzes to receive PDHs

8-Session Registrants

Access to the recording

Information for accessing the recording will be emailed to you by Thursday. The recording will be available for four weeks. (For 8-session registrants only.) EMAIL COMES FROM NIGHTSCHOOL@AISC.ORG.

PDHs via recording

If you watch a recorded session, you must take *and pass* the quiz for PDHs.

8-Session Registrants

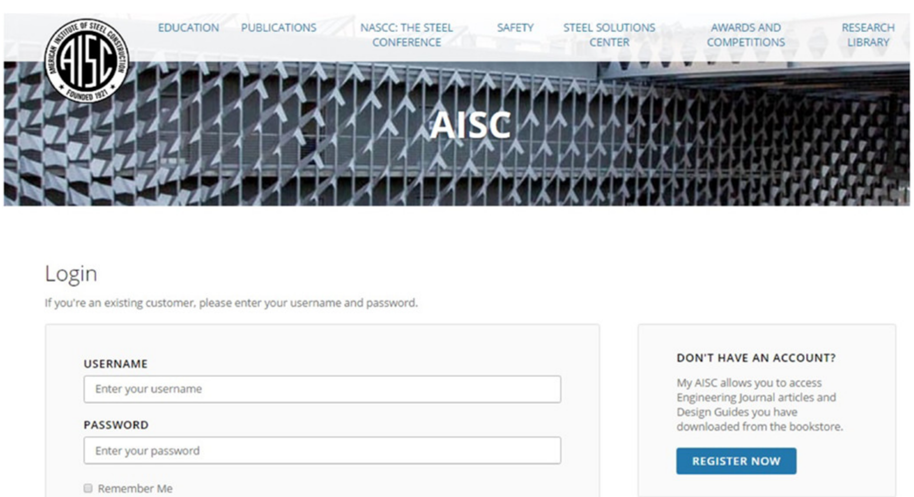
Night School Resources

Find all your handouts, quizzes and quiz scores, recording access, and attendance information all in one place!

8-Session Registrants

Night School Resources

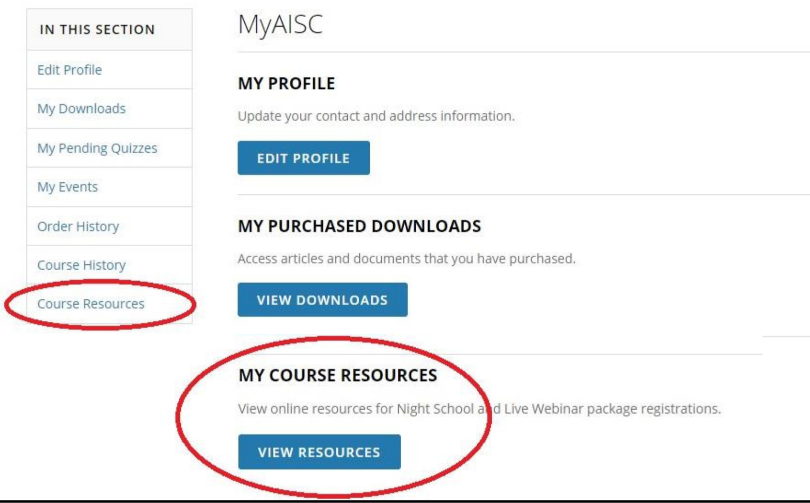
Go to www.aisc.org and sign in.



8-Session Registrants

Night School Resources

Go to www.aisc.org and sign in.



8-Session Registrants

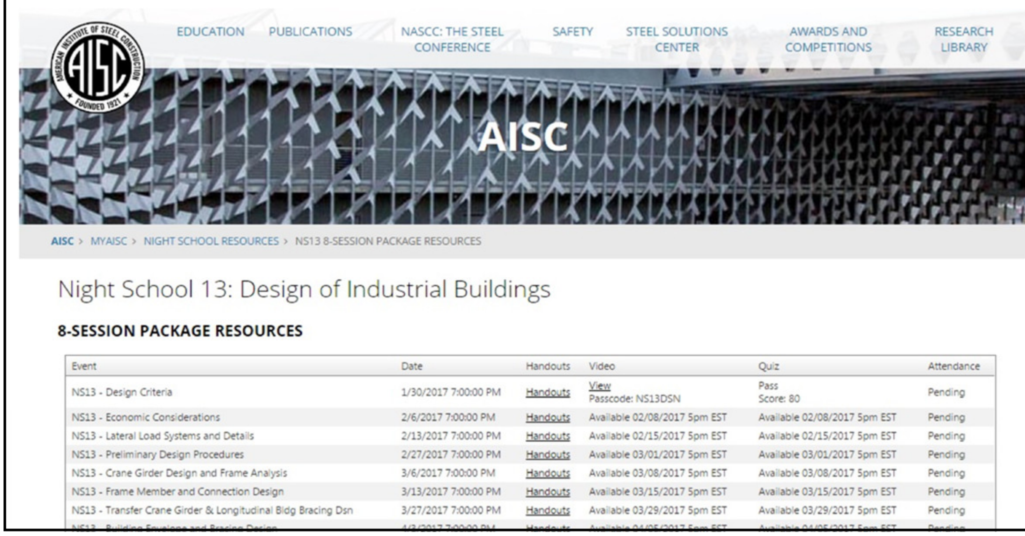
Night School Resources

Course Resources

Event	Start Date
NS 13 8-Session Package-Night School 13 - Design of Industrial Buildings	1/30/2017 7:00:00 PM
NS 14 8-Session Package-Night School 14 - Fundamentals of Stability	6/5/2017 7:00:00 PM

8-Session Registrants

Night School Resources


EDUCATION PUBLICATIONS NASCC: THE STEEL CONFERENCE SAFETY STEEL SOLUTIONS CENTER AWARDS AND COMPETITIONS RESEARCH LIBRARY

AISC

AISC > MYAISC > NIGHT SCHOOL RESOURCES > NS13 8-SESSION PACKAGE RESOURCES

Night School 13: Design of Industrial Buildings

8-SESSION PACKAGE RESOURCES

Event	Date	Handouts	Video	Quiz	Attendance
NS13 - Design Criteria	1/30/2017 7:00:00 PM	Handouts	View Passcode: NS13DSN	Pass Score: 80	Pending
NS13 - Economic Considerations	2/6/2017 7:00:00 PM	Handouts	Available 02/08/2017 5pm EST	Available 02/08/2017 5pm EST	Pending
NS13 - Lateral Load Systems and Details	2/13/2017 7:00:00 PM	Handouts	Available 02/15/2017 5pm EST	Available 02/15/2017 5pm EST	Pending
NS13 - Preliminary Design Procedures	2/27/2017 7:00:00 PM	Handouts	Available 03/01/2017 5pm EST	Available 03/01/2017 5pm EST	Pending
NS13 - Crane Girder Design and Frame Analysis	3/6/2017 7:00:00 PM	Handouts	Available 03/08/2017 5pm EST	Available 03/08/2017 5pm EST	Pending
NS13 - Frame Member and Connection Design	3/13/2017 7:00:00 PM	Handouts	Available 03/15/2017 5pm EST	Available 03/15/2017 5pm EST	Pending
NS13 - Transfer Crane Girder & Longitudinal Bldg Bracing Dsn	3/27/2017 7:00:00 PM	Handouts	Available 03/29/2017 5pm EST	Available 03/29/2017 5pm EST	Pending

8-Session Registrants

Night School Resources

- Weekly “quiz and recording” email.
- Weekly updates of the master quiz and attendance record, found at www.aisc.org/nightschool23. Scroll down to Quiz and Attendance records.
  - Updated on Thursday mornings.

8-Session Registrants

Night School Resources

- Webinar connection information
    - Reminder email sent out Tuesday mornings
- Links to handouts also found here

AISC | Thank you

Smarter.
Stronger.
Steel.