Designing for the Code: Green Might Not Always Be Right

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MiTek®

Handout Sponsor

Designing for the Code: Green Might Not Always Be Right

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Summary

- Who is responsible?
  - Determining the loads and design criteria used to design trusses
- Review of loads & design criteria
- Other considerations

Building Codes

- **101.3 Intent.** *The purpose of building codes is to establish the minimum requirements* to provide a reasonable level of safety, public health and general welfare through structural strength, *means of egress* facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

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In Other Words

- Designing to meet the code = minimum legal design

But is that the whole story?

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Truss Design Software

- As with any computer program, the software used to design trusses is only as good as the operator.
- Remember:

Garbage in = Garbage out

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Who is Responsible for Determining Loads and Design Criteria?

- Design responsibilities
  - **Chapter 2 of TPI 1-07 & 14**
- Construction documents
- Building code
- ASCE 7
- SBCA – load guide
- Applied Technology Council
  - https://hazards/atcouncil.org/

- Engineer of Record or Building Designer?
- Is this the case in your day-to-day?
- Are all building designers the same?

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Brief Review of Loads & Design Criteria

- Type of loads
  - Dead
  - Live
  - Environmental
- Load duration factors
- Basic load combinations

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Dead Loads

- Gravity load due to all permanent components of the structure
  - Specified by building designer or;
  - Determined from actual weights of specified materials
  - This must be approved by building official or building designer
- TPI-nonbearing partitions
- Excessive DL
  - Kitchen island
  - How about a tile wall?

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Live Loads

- Load superimposed by the use & occupancy of the building
  - Includes impact loads
  - Does not include environmental loads such as wind, snow, rain, or seismic
- Bedroom reduction
  - Good or bad?
- Corridor

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Environmental Loads

- Snow
  - Ground
  - Roof
  - Balanced & unbalanced
- Rain
- Wind
- Earthquake

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IBC – Construction Documents

- **1603.1.3 Roof snow load data.** The ground snow load, P_g, shall be indicated. In areas where the ground snow load, P_g, exceeds 10 pounds per square foot (psf), ***the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof***:
  - Flat-roof snow load, P_f
  - Snow exposure factor, C_e
  - Snow load importance factor, I_s
  - Thermal factor, C_t
  - Slope factor(s), C_s
  - Drift surcharge load(s), P_d, where the sum of P_d and P_f exceeds 20 psf
  - Width of snow drift(s), w

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Snow Loading Can Be Complicated!

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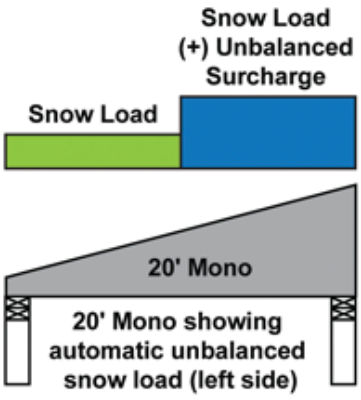
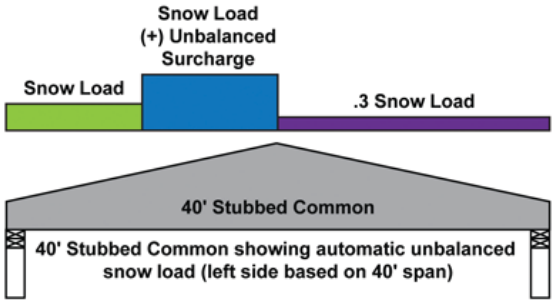
Unbalanced Snow Loads





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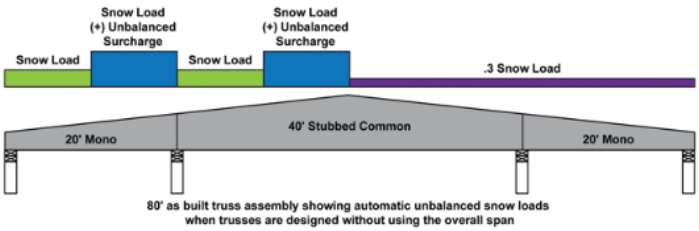
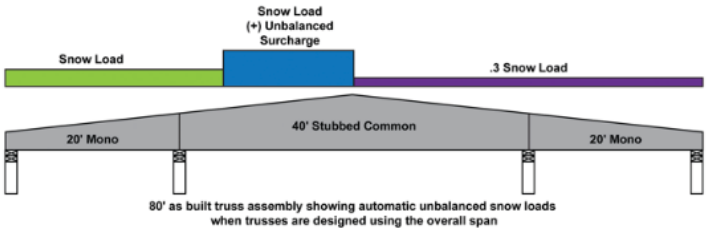
Unbalanced Snow Loads

- Understand the software limitations
- Ask for more information





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Wind Loads

- Basic wind speed, *V* (mph) is converted into velocity pressure, q, which is used to calculate design pressure, p, to be used to determine wind loads for buildings in lb/ft^2

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Minimum Information Required to Design Trusses for Wind

- Method to use for calculating wind pressures (i.e., MWFRS, C&C, or both)
- Procedure to be used for determining wind loads (i.e., envelope or directional)
- Basic wind speed, V

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Minimum Information Required to Design Trusses for Wind

- Wind directionality factor K_d,
- Exposure,
- Topographic factor, K_{zt},
- Ground elevation factor, K_e,
- Gust-effect factor,
- Enclosure classification,
- Internal pressure coefficient, GC_{pi},

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TPI – Construction Documents

- **2.3.2.4 Required Information in the Construction Documents**
  - (d) The location, direction, and magnitude of all dead, live, and lateral loads applicable to each Truss including, but not limited to, loads attributable to: roof, floor, partition, mechanical, fire sprinkler, attic storage, rain and ponding, wind, snow (including snow drift and unbalanced snow), seismic; and any other loads on the Truss;

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Deflection

- The *IBC* includes specific requirements regarding deflection in Section 1604.3 and specific requirements for floor structural members in Table 1604.3.
- Table 1604.3 also includes consideration of creep in footnote d.

TABLE 1604.3 DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	*L*	*S* or *W*[f]	*D* + *L*[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	//360	//360	//240
Supporting nonplaster ceiling	//240	//240	//180
Not supporting ceiling	//180	//180	//120
Floor members	//360	—	//240
Exterior walls:			
With plaster or stucco finishes	—	//360	—
With other brittle finishes	—	//240	—
With flexible finishes	—	//120	—
Interior partitions:[b]			
With plaster or stucco finishes	//360	—	—
With other brittle finishes	//240	—	—
With flexible finishes	//120	—	—
Farm buildings	—	—	//180
Greenhouses	—	—	//120

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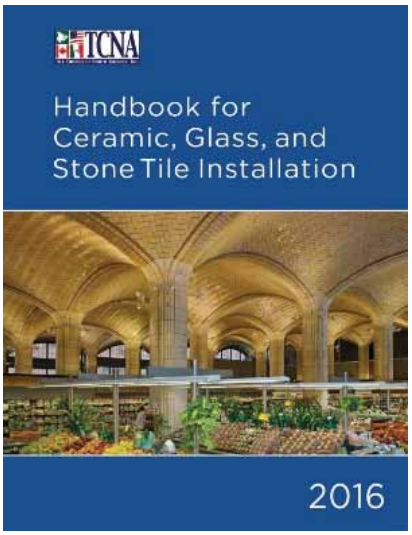
Deflection

- Are you accounting for tile?
  - What kind of tile?
  - Stone?
  - Granite?
  - Other requirements: Tile Council of America “TCA”
- Lateral loading on gable end trusses?
  - Stucco?
  - 150 mph?



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Other Considerations

- Fabrication tolerance
- Creep factor and truss deflection
- Repetitive member factor
- Others?

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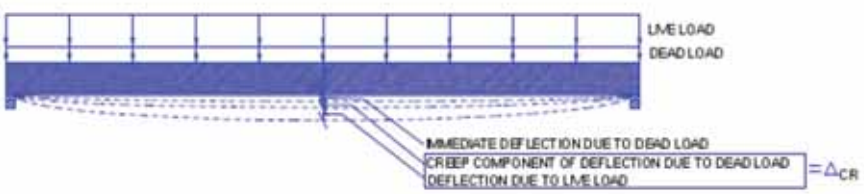
ANSI/TPI 1

- Section 7.6 provides guidance for deflection limits for trusses
- TPI 1-2014 has been updated to account for the recent clarifications in the IBC regarding creep



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Final Thoughts

- Loading can be complicated, know your resources!
- Garbage in = garbage out
- Sometimes green is not always right!
- Know/communicate with your customer

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Questions?

- Jeff Arneson
  - Email: jeff.arneson@apextechnology.com
- Jim Vogt
  - Email: jvogt@qualtim.com

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SBCA Resources

- For more resources on this topic, visit www.sbcindustry.com and search for the below titles:
  - SBCA Load Guide
  - Technical Best Practices
  - Design Responsibilities
  - Webinar: Loads on Trusses Part 1
  - Webinar: Loads on Trusses Part 2
  - Webinar: Loads on Trusses Part 3
  - Webinar: Loads on Trusses Part 4
  - Webinar: Loads on Trusses Part 5
  - Bracing & Installation

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Learning Labs

Wednesday

- 1 pm – Partnering with a National Builder
- 2:30 pm – Best Practices for Developing a Local Workforce
- 4:00 pm – Designing for the Code

Thursday

- 12 pm – Knowing Your People to Keep Your People
- 1:30 pm – Safety
- 3 pm – Cybersecurity

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Next Session

- 11:00 am - What It Takes to Partner with a National Builder
  - Chad Nuessle
  - Kemp Gillis
  - Doyle Headrick
  - Jason Walsh

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Please Fill Out Your Session Evaluation

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Notes:

Notes:

Notes:

How BCMC Contributes to Your Business Success

Best practices are shared by industry experts in every educational session.

Conversations with peers lead to ideas that transform individual businesses.

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Coming together for one week every October generates ideas and energy that drive the industry forward throughout the year.

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