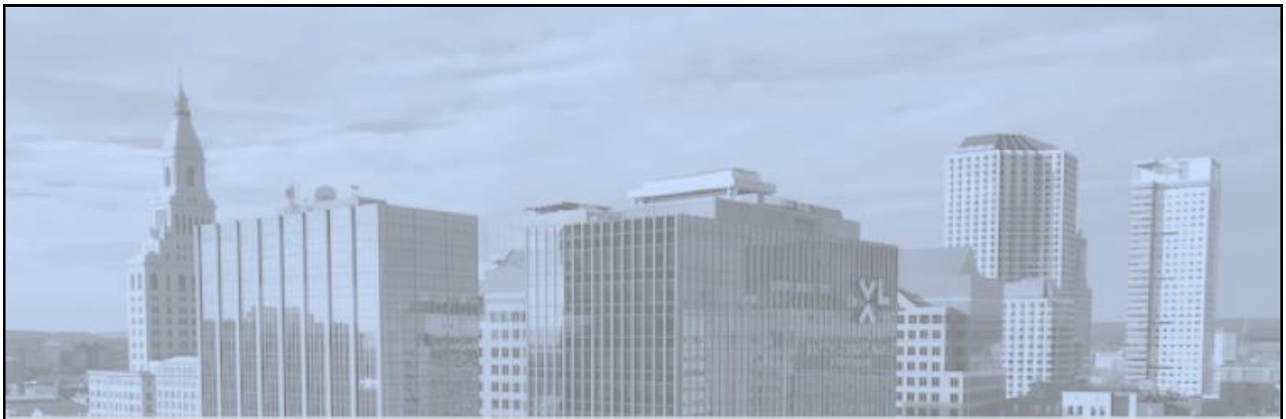

Part 1: Risk Categories and Structural Design Criteria

Part 2: Metal Building Systems - What an Inspector Should Know

Spring 2019 Career Development Series

Thomas A. DiBlasi, P.E., SECB
DiBlasi Associates, P.C

DAS Office of Education and Data Management

Part 1: Risk Categories and Structural Design Criteria

DiBlasi Associates, PC
Structural Engineers

Risk Categories

- ***§1604.5 Each building and structure shall be assigned a risk category in accordance with Table 1604.5***
- ***Risk Categories I to IV***

TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing Group E occupancies with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2 occupancies with an occupant load of 50 or more resident care recipients but not having surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.[a] • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b]
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Group I-2 occupancies having surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages. • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the *International Fire Code*; and Are sufficient to pose a threat to the public if released.[b] • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

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Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

- *Impacts the Magnitude of Design Loads for Snow, Wind and Earthquakes*
- *Terminology Added in 2012 IBC*
- *Formerly referred to as Occupancy Category or Building Category*

BOCA/1990

Table 1112.2b
CLASSIFICATION OF BUILDINGS AND OTHER STRUCTURES FOR WIND LOADS

Nature of occupancy	Category
All buildings and structures except those listed below	I
Buildings and structures of Use Group A in which more than 300 people congregate in one area	II
Buildings and structures designated as essential facilities including, but not limited to: 1. I-2 uses having surgery or emergency treatment areas 2. Fire or rescue and police stations 3. Primary communication facilities and disaster operation centers 4. Power stations and other utilities required in an emergency 5. Structures having critical national defense capabilities 6. Designated shelters for hurricanes	III
Buildings and structures that represent a low hazard to human life in the event of failure, such as agricultural buildings, production greenhouses, certain temporary facilities and minor storage facilities	IV

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Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

- *Risk Category vs. Occupancy Category*
  - *"Occupancy" relates primarily to non-structural fire and life-safety provisions, not the risk of structural failure*
  - *Some structures are not even occupied but were assigned an Occupancy Category because their failure could pose a substantial risk to the public.*
  - *"Risk Category" better reflects the intent*
  - *Aligns with ASCE 7,* **"Minimum Design Loads and Associated Criteria for Buildings and Other Structures"**

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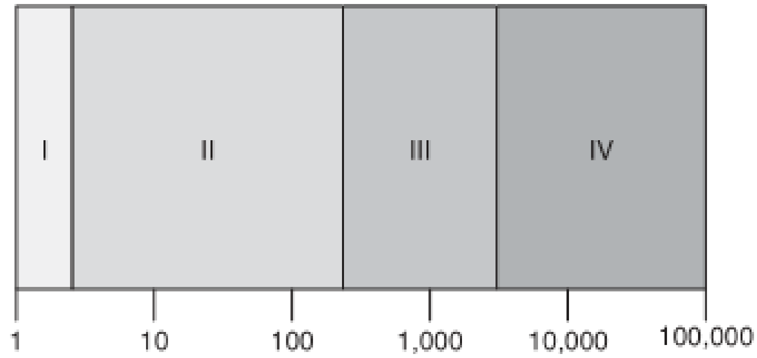
Risk Categories

- ***Classifications from lowest consequences (Risk Category I) to highest consequences (Risk Category IV)***



Approximate relationship between number of lives at risk by failure based on Risk Category

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Risk Categories

Risk Category I

- ***Buildings and other structures that represent a low hazard to human life in the event of failure***
  - ➢ ***Agricultural facilities***
  - ➢ ***Certain temporary facilities***
  - ➢ ***Minor storage facilities***

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Risk Categories

Risk Category II

- Buildings and other structures except those listed in Risk Categories I, III and IV.

Risk Categories

Risk Category III

- Buildings and other structures that represent a substantial hazard to human life in the event of failure
  - Public assembly structures with occupant load > 300
  - Group E with occupant load > 250
  - Higher education with occupant load > 500
  - Group I-2 with ≥ 50 resident care recipients; no surgery/emergency facilities
  - Group I-3
  - Occupant load > 5,000
  - Power generating stations, water/wastewater treatment and public utilities not in Risk Category IV
  - Buildings containing toxic or explosive materials exceeding cited limits that are sufficient to pose a threat to the public if released (not RC IV)

Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

Risk Category IV

- Buildings and other structures designated as essential facilities
  - Group I-2 with surgery or emergency treatment facilities
  - Fire, rescue, ambulance and police stations; emergency vehicle garages
  - Designated earthquake, hurricane or other emergency shelters
  - Designated emergency preparedness/communications/operations centers
  - Power generating stations and other public utility facilities required as emergency back-up for Risk Category IV structures
  - Buildings containing highly toxic materials exceeding cited limits that are sufficient to pose a threat to the public if released
  - Aviation control towers
  - Critical national defense functions
  - Water storage facilities and pump structures required to maintain pressure for fire suppression

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Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

Risk Category IV

- IBC 2018
  - Ambulatory care facilities having emergency surgery or emergency treatment facilities

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Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

Why are they important?

- Used to establish Importance Factors

Risk Category	Snow	Earthquake
I	0.80	1.00
II	1.00	1.00
III	1.10	1.25
IV	1.20	1.50

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Part 1: Risk Categories and Structural Design Criteria

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Risk Categories

Why are they important?

- Used to establish Design Wind Speeds
  - ➢Importance factors for wind embedded in wind speed maps

Risk Category	Hartford	New London
I	115 mph	125 mph
II	125 mph	135 mph
III/IV	125 mph	145 mph

- IBC 2018: Separate wind speed maps for RC III and RC IV

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Risk Categories

Multiple Occupancies in Different Risk Categories

- Building/structure assigned to higher risk category
  - Exception: If structurally separated, portions of the building may be assigned separate risk categories.
  - Exception to the exception: Where a structurally separated portion of a building provides required access to, required egress from, or shares life-safety components with another portion having a higher risk category, both portions shall be assigned the higher risk category.

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Risk Categories

Change in Occupancy to Higher Risk Category

- IEBC §1007
  - Snow and Wind Loads (§1007.2): Comply with IBC provisions for new buildings
  - Seismic Loads:
    - Recommend getting code modification to use 2018 IEBC if using Work Area Method of compliance
    - Exemption if going to RC III from RC I or II and S_{DS} < 0.33g
    - Exemption if area of new occupancy is less than 10% of building area and new occupancy is <u>not</u> RC IV
    - Access to Risk Category IV – structures that provide operational access to RC IV must comply with IBC-level seismic forces

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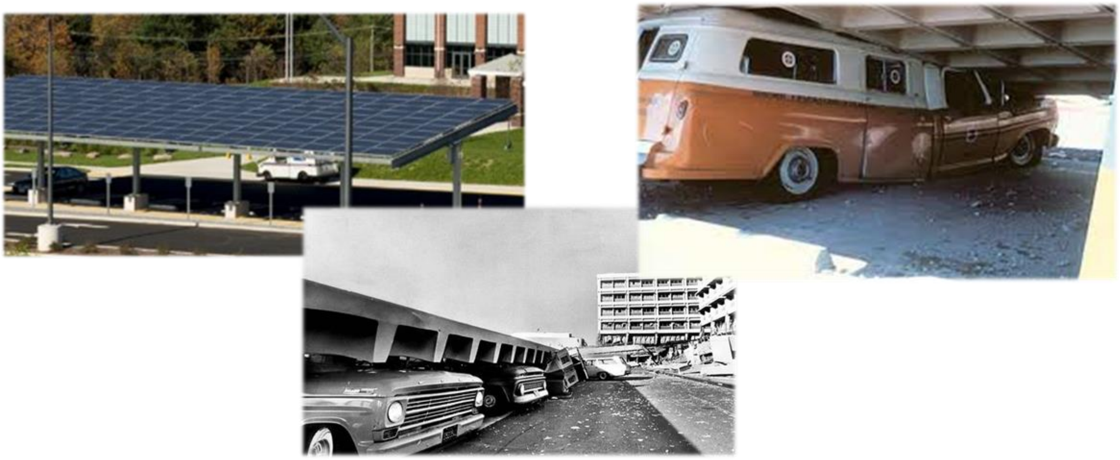
Risk Categories

Risk Category is not always obvious



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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

Section 1603 – Construction Documents

- ***1603.1***
  - ***…The design loads and other information pertinent to the structural design required by Section 1603.1.1 through 1603.1.8 shall be indicated on the construction documents.***

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

Section 1603 – Construction Documents

- 1603.1.1 Floor Live Load
- 1603.1.2 Roof Live Load
- 1603.1.3 Roof Snow Load Data
- 1603.1.4 Wind Design Data
- 1603.1.5 Earthquake Design Data
- 1603.1.6 Geotechnical Information
- 1603.1.7 Flood Design Data
- 1603.1.8 Special Loads

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.1 Floor Live Load

- Live Load: a load produced by the use or occupancy of the building
- Uniformly Distributed Loads
- Concentrated Loads
- Table 1607.1
- Live Load Reduction – 1607.10
- Partition Loads – 1607.5

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o, AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (pounds)
1. Apartments (see residential)	—	—
2. Access floor systems Office use Computer use	 50 100	 2,000 2,000
3. Armories and drill rooms	150[m]	—
4. Assembly areas Fixed seats (fastened to floor) Follow spot, projections and control rooms Lobbies Movable seats Stage floors Platforms (assembly) Other assembly areas	 60[m] 50 100[m] 100[m] 150[m] 100[m] 100[m]	—
5. Balconies and decks[h]	Same as occupancy served	—
6. Catwalks	40	300
7. Cornices	60	—
8. Corridors First floor Other floors	 100 Same as occupancy served except as indicated	—

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Structural Design Criteria

1603.1.2 Roof Live Load

- *Section 1607.1*
- *Ordinary Roofs (Non-Occupied)*
  - *20 psf per Table 1604.5; modified for slope and area per §1607.12.2.1*
- *Occupiable Roofs*
  - *100 psf per Table 1604.5 for Assembly and Roof Gardens*
- *Fabric Awnings and Canopies*
  - *5 psf per Table 1604.5*

Roof Pitch	Tributary Area	
	≤ 200 s.f.	≥ 600 s.f.
≤ 4:12	20 psf	12 psf
≥ 12:12	12 psf	12 psf

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- *Snow Exposure Factor, C_e*
- *Snow Load Importance Factor, I_s*
- *Thermal Factor, C_t*
- *Drift Surcharge Loads, p_d*
- *Width of Snow Drifts, w*
- *Existing Roofs (CT)*

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- Ground Snow Load, p_g
  - Appendix N
- Flat Roof Snow Load, p_f
- Snow Exposure Factor, C_e
- Snow Load Importance Factor, I_s
- Thermal Factor, C_t
- Drift Surcharge Loads, p_d
- Width of Snow Drifts, w
- Existing Roofs (CT)

Municipality	Ground Snow Load (psf)
Andover	30
Ansonia	30
Ashford	35
Avon	35
Barkhamsted	40
Beacon Falls	30
Berlin	30
Bethany	30

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- Ground Snow Load, p_g
- Flat Roof Snow Load, p_f
  - ASCE 7, Equation 7.3-1
  - 30 psf minimum (CT)
- Snow Exposure Factor, C_e
- Snow Load Importance Factor, I_s
- Thermal Factor, C_t
- Drift Surcharge Loads, p_d
- Width of Snow Drifts, w
- Existing Roofs (CT)

$$p_f = 0.7C_eC_tI_sp_g$$

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- ***Snow Exposure Factor, C_e***
  - ***ASCE 7, Table 7-2***
- *Snow Load Importance Factor, I_s*
- *Thermal Factor, C_t*
- *Drift Surcharge Loads, p_d*
- *Width of Snow Drifts, w*
- *Existing Roofs (CT)*

Terrain Category	Exposure of Roof		
	Fully Exposed	Partially Exposed	Sheltered
B	0.9	1.0	1.2
C	0.9	1.0	1.1
D	0.8	0.9	1.0

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- *Snow Exposure Factor, C_e*
- ***Snow Load Importance Factor, I_s***
  - ***ASCE 7, Table 1.5-1***
- *Thermal Factor, C_t*
- *Drift Surcharge Loads, p_d*
- *Width of Snow Drifts, w*
- *Existing Roofs (CT)*

Risk Category	I_s
I	0.80
II	1.00
III	1.10
IV	1.20

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- *Snow Exposure Factor, C_e*
- *Snow Load Importance Factor, I_s*
- ***Thermal Factor, C_t***
  - ***ASCE 7, Table 7-3***
- *Drift Surcharge Loads, p_d*
- *Width of Snow Drifts, w*
- *Existing Roofs (CT)*

Thermal Condition	C_t
All structures not listed below	1.0
Structures kept just above freezing and those with cold, ventilated roofs	1.1
Unheated and open-air structures	1.2
Structures intentionally kept below freezing	1.3
Continuously heated greenhouses	0.85

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Part 1: Risk Categories and Structural Design Criteria

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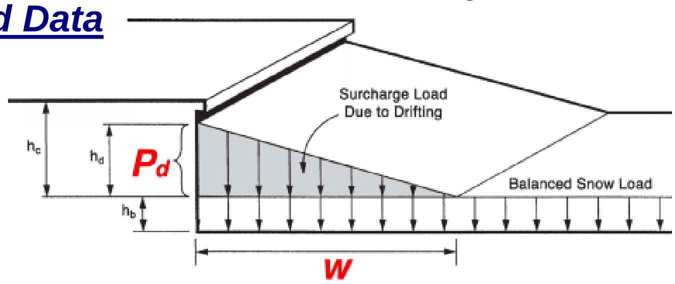
Structural Design Criteria

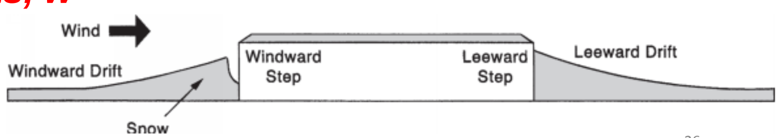
1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- *Snow Exposure Factor, C_e*
- *Snow Load Importance Factor, I_s*
- *Thermal Factor, C_t*
- ***Drift Surcharge Loads, p_d***
- ***Width of Snow Drifts, w***
  - ***ASCE 7, §7.7***
- *Existing Roofs (CT)*

$$\gamma = 0.13p_g + 14 \text{ (pcf)}$$



$$h_d = 0.43\sqrt[3]{l_u}\sqrt[4]{p_g+10} - 1.5$$



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Part 1: Risk Categories and Structural Design Criteria

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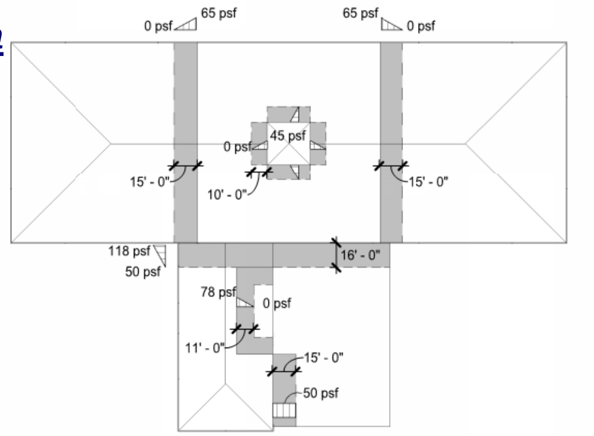
Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, p_f*
- *Snow Exposure Factor, C_e*
- *Snow Load Importance Factor, I_s*
- *Thermal Factor, C_t*
- ***Drift Surcharge Loads, p_d***
- ***Width of Snow Drifts, w***
  - ***ASCE 7, §7.7***
- *Existing Roofs (CT)*



Snow Drift and Sliding Snow Surcharge Diagram
(APPLIED ABOVE 30 PSF FLAT ROOF SNOW LOAD OR UNBALANCED SNOW LOAD)

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *Ground Snow Load, p_g*
- *Flat Roof Snow Load, P_f*
- *Snow Exposure Factor, C_e*
- *Snow Load Importance Factor, I_s*
- *Thermal Factor, C_t*
- *Drift Surcharge Loads, p_d*
- *Width of Snow Drifts, w*
- ***Existing Roofs (CT)***
  - ***ASCE 7, §7.12***

Existing roofs shall be evaluated for increased snow loads caused by additions or alterations. Owners or agents for owners of an existing lower roof shall be advised of the potential for increased snow loads where a higher roof is constructed within 20 feet.

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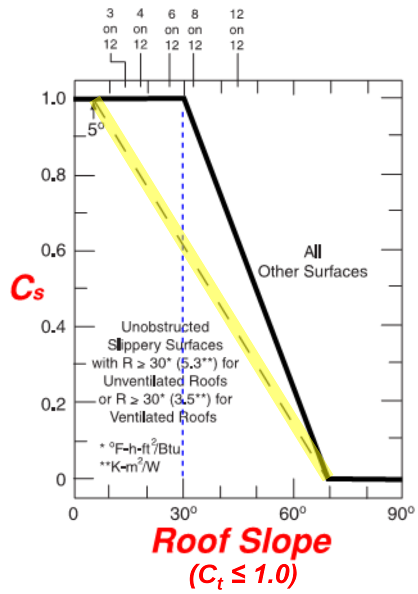
Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.3 Roof Snow Load Data

- *IBC 2018*
  - *Slope factor(s), C_s*
    - Function of thermal conditions and roof surface
    - CT Limitations: *"Values for unobstructed slippery roofs … shall not be utilized, unless approved by the building official"*

$$p_s = C_s p_f$$ *(ASCE 7 – Eq. 7.4-1)*



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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.4 Wind Design Data

- *Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}*
- *Risk Category*
- *Wind Exposure*
- *Applicable Internal Pressure Coefficient*
- *Design Wind Pressures for Exterior Component and Cladding Materials*

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.4 Wind Design Data

- **Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}**
  - Appendix N
  - 2018 IBC Nomenclature Changes
    - V_{ult} → V - Basic Design Wind Speed
    - V_{asd} – Allowable Stress Design Wind Speed
- Risk Category
- Wind Exposure
- Applicable Internal Pressure Coefficient
- Design Wind Pressures for Exterior Component and Cladding Materials

Municipality	Ground Snow Load (psf)	MCE Spectral Accelerations (%g)		Ultimate Design Wind Speeds, V_{ult} (mph)			Nominal Design Wind Speeds, V_{asd} (mph)		
		S_s	S_1	Risk Cat.I	Risk Cat.II	Risk Cat III-IV	Risk Cat. I	Risk Cat. II	Risk Cat. III-IV
Andover	30	0.176	0.063	120	130	140	93	101	108
Ansonia	30	0.195	0.064	115	125	135	89	97	105
Ashford	35	0.173	0.063	120	130	140	93	101	108
Avon	35	0.181	0.064	110	120	130	85	93	101
Barkhamsted	40	0.177	0.065	110	120	125	85	93	97
Beacon Falls	30	0.192	0.064	115	125	135	89	97	105
Berlin	30	0.183	0.063	115	125	135	89	97	105
Bethany	30	0.189	0.063	115	125	135	89	97	105

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.4 Wind Design Data

- Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}
- Risk Category
- **Wind Exposure**
  - IBC §1609.4
  - Surface Roughness Definitions
  - Exposure Categories B, C or D
- Applicable Internal Pressure Coefficient
- Design Wind Pressures for Exterior Component and Cladding Materials

Exposure Category	Velocity Pressure Exposure Coefficient at 33' (K_z)
B	0.72
C	1.00
D	1.18

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Part 1: Risk Categories and Structural Design Criteria

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Wind Exposure Categories

Surface Roughness B

Urban and suburban areas, wooded areas and other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

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Wind Exposure Categories

Surface Roughness C

Open terrain with scattered obstructions generally less than 30 feet. This category includes flat, open country, and grasslands.

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Wind Exposure Categories

Surface Roughness D

Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

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Part 1: Risk Categories and Structural Design Criteria

Wind Exposure Categories

Exposure B

- For buildings with mean roof height up to 30', Surface Roughness B prevails in the upwind direction for a distance of at least 1,500' (greater of 20 times the building height or 2,600' for mean roof height > 30').

Exposure C

- Applies where Exposures B and D do not apply

Exposure D

- For buildings where Surface Roughness D prevails in the upwind direction for a distance of at least 5,000'. Also applies upwind of the site a distance of 600' or 20 times the building height from the Exposure D condition.

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Wind Exposure Categories

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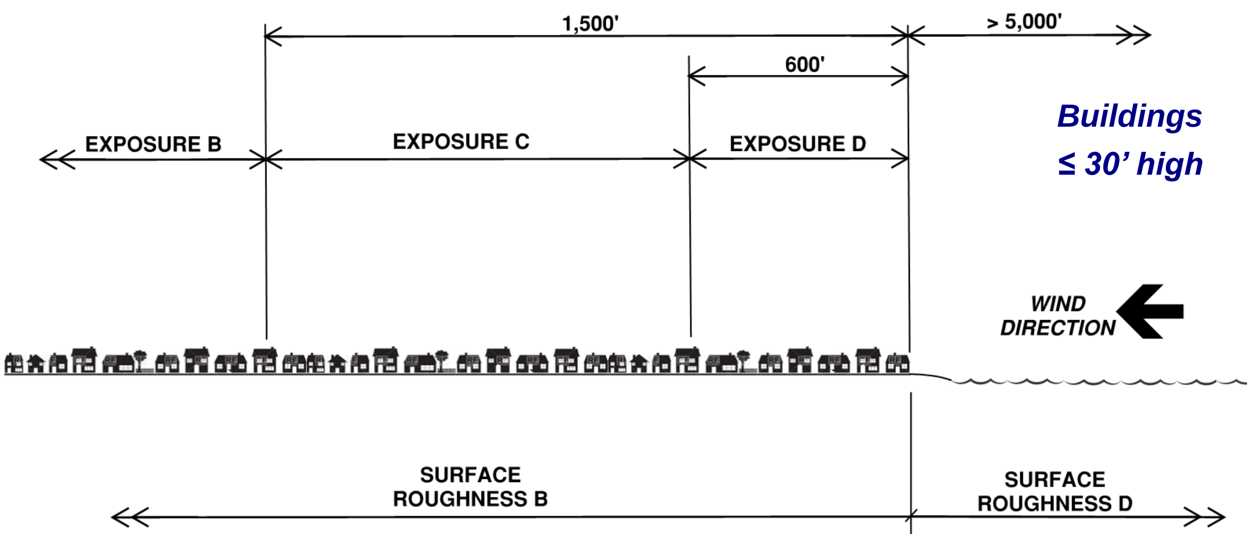
Wind Exposure Categories



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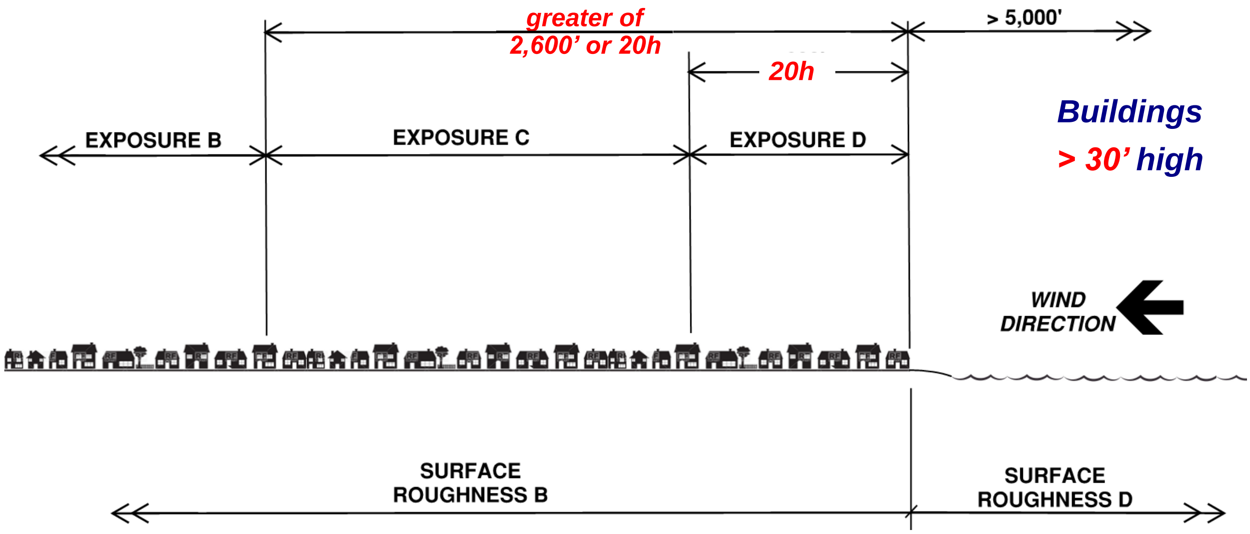
Wind Exposure Categories



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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.4 Wind Design Data

- *Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}*
- *Risk Category*
- *Wind Exposure*
- ***Applicable Internal Pressure Coefficient***
  - *Open, Partially Enclosed and Enclosed Buildings*
  - *ASCE 7 – Table 26.11-1*
  - *2018 IBC – Partially Open Buildings Added*
- *Design Wind Pressures for Exterior Component and Cladding Materials*

Exposure Classification	GC_{pi}
Open	0.00
Partially Enclosed	± 0.55
Enclosed	± 0.18

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

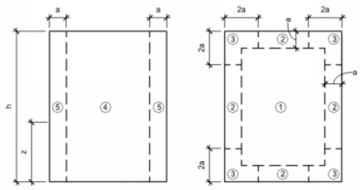
1603.1.4 Wind Design Data

- *Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}*
- *Risk Category*
- *Wind Exposure*
- *Applicable Internal Pressure Coefficient*
- ***Design Wind Pressures for Exterior Component and Cladding Materials***
  - ➢ ***Used for design of elements not specifically designed by the registered design professional***
  - ➢ ***Deferred Submittals (§107.3.4.1)***
  - ➢ ***ASCE 7 – Chapter 30***

COMPONENT AND CLADDING WIND LOADS

TRIBUTARY AREA (SQ. FT.)	WALL AND ROOF LOADS						
	PRESSURE		SUCTION				
	AREA④	AREA⑤	AREA①	AREA②	AREA③	AREA④	AREA⑤
≤10	31	31	34	56	85	33	41
20	30	30	33	50	70	32	38
50	28	28	32	42	51	30	35
100	26	26	31	36	36	29	32
≥500	23	23	31	36	36	26	26
PARAPETS	87	115	-	-	-	64	72

NOTES:
1. DISTANCE "a" = 6.0 FEET.
2. LINEAR INTERPOLATION BETWEEN TRIBUTARY AREAS IS PERMITTED.
3. FOR WALL AND ROOF SUCTION AREAS, SEE "COMPONENT AND CLADDING DIAGRAMS".
4. HIGHER LOADS WITHIN "a" ZONE ARE APPLICABLE AT ALL SIGNIFICANT BUILDING CORNERS AND ROOF STEPS.
5. THESE LOADS ARE BASED ON ASCE 7-10 AND ARE FACTORED LRFD WIND LOADS. MULTIPLY VALUES ABOVE BY 0.6 TO REDUCE TO ASD EQUIVALENT.



WALL ELEVATION   ROOF PLAN

COMPONENT AND CLADDING DIAGRAMS
(ROOF SLOPE < 10°)

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- ***Risk Category***
- ***Seismic Importance Factor, I_e***
- ***Spectral Response Acceleration Parameters, S_s and S_1***
- ***Site Class***
- ***Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}***
- ***Seismic Design Category***
- ***Basic Seismic Force-Resisting System(s)***
- ***Design Base Shear(s)***
- ***Seismic Response Coefficient, C_s***
- ***Response Modification Coefficient(s), R***
- ***Analysis Procedure Used***

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- *Risk Category*
- ***Seismic Importance Factor, I_e***
  - *ASCE 7, Table 1.5-1*
- *Spectral Response Acceleration Parameters, S_s and S_1*
- *Site Class*
- *Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}*
- *Seismic Design Category*
- *Basic Seismic Force-Resisting System(s)*
- *Design Base Shear(s)*
- *Seismic Response Coefficient, C_s*
- *Response Modification Coefficient(s), R*
- *Analysis Procedure Used*

Risk Category	I_e
I	1.00
II	1.00
III	1.25
IV	1.50

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- *Risk Category*
- *Seismic Importance Factor, I_e*
- ***Spectral Response Acceleration Parameters, S_s and S_1***
  - *Appendix N*
- *Site Class*
- *Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}*
- *Seismic Design Category*
- *Basic Seismic Force-Resisting System(s)*
- *Design Base Shear(s)*
- *Seismic Response Coefficient, C_s*
- *Response Modification Coefficient(s), R*
- *Analysis Procedure Used*

Municipality	Ground Snow Load (psf)	MCE Spectral Accelerations (%g)	
		S_s	S_1
Andover	30	0.176	0.063
Ansonia	30	0.195	0.064
Ashford	35	0.173	0.063
Avon	35	0.181	0.064
Barkhamsted	40	0.177	0.065
Beacon Falls	30	0.192	0.064
Berlin	30	0.183	0.063
Bethany	30	0.189	0.063
Bethel	30	0.215	0.066
Bethlehem	35	0.190	0.065
Bloomfield	35	0.180	0.064
Bolton	30	0.177	0.063

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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
  - ASCE 7 – Chapter 20
  - Site Classes A to F
  - Default Site Class D per IBC §1613.3.2
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- Design Base Shear(s)
- Seismic Response Coefficient, C_s
- Response Modification Coefficient(s), R
- Analysis Procedure Used

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Part 1: Risk Categories and Structural Design Criteria

DiBlasi Associates, PC Structural Engineers

Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
  - Function of Site Class, S_s and S_1
  - Derived per IBC §1613.3.3 and §1613.3.4
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- Design Base Shear(s)
- Seismic Response Coefficient, C_s
- Response Modification Coefficient(s), R
- Analysis Procedure Used

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Part 1: Risk Categories and Structural Design Criteria

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Structural Engineers

Structural Design Criteria

1603.1.5 Earthquake Design Data

- *Risk Category*
- *Seismic Importance Factor, I_e*
- *Spectral Response Acceleration Parameters, S_s and S_1*
- *Site Class*
- *Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}*
- ***Seismic Design Category***
  - ➢ *Function of Risk Category, S_{DS} and S_{D1}*
  - ➢ *Established from IBC Tables 1613.3.5(1) and (2)*
  - ➢ *SDC from A to D in Connecticut*
- *Basic Seismic Force-Resisting System(s)*
- *Response Modification Coefficient(s), R*
- *Seismic Response Coefficient, C_s*
- *Design Base Shear(s)*
- *Analysis Procedure Used*

S_{DS}	Risk Category		
	I II	III	IV
< 0.167g	A	A	A
≥ 0.167g < 0.33g	B	B	C
≥ 0.33g < 0.50g	C	C	D
≥ 0.50g	D	D	D

Table 1613.3.5(1)

Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- *Risk Category*
- *Seismic Importance Factor, I_e*
- *Spectral Response Acceleration Parameters, S_s and S_1*
- *Site Class*
- *Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}*
- *Seismic Design Category*
- ***Basic Seismic Force-Resisting System(s)***
  - ➢ *ASCE 7 – Table 12.2-1*
  - ➢ *Height limitations and design parameters*
- *Response Modification Coefficient(s), R*
- *Seismic Response Coefficient, C_s*
- *Design Base Shear(s)*
- *Analysis Procedure Used*

Table 12.2-1 Design Coefficients and Factors for Seismic Force-Resisting Systems

Seismic Force-Resisting System	ASCE 7 Section Where Detailing Requirements Are Specified	Response Modification Coefficient, R[a]	Overstrength Factor, Ω_0[g]	Deflection Amplification Factor, C_d[b]	Structural System Limitations Including Structural Height, h_n (ft) Limits[c] — Seismic Design Category: B	C	D[d]	E[d]	F[e]
A. BEARING WALL SYSTEMS									
1. Special reinforced concrete shear walls[l, m]	14.2	5	2½	5	NL	NL	160	160	100
2. Ordinary reinforced concrete shear walls[l]	14.2	4	2½	4	NL	NL	NP	NP	NP
3. Detailed plain concrete shear walls[l]	14.2	2	2½	2	NL	NP	NP	NP	NP
4. Ordinary plain concrete shear walls[l]	14.2	1½	2½	1½	NL	NP	NP	NP	NP
5. Intermediate precast shear walls[l]	14.2	4	2½	4	NL	NL	40[k]	40[k]	40[k]
6. Ordinary precast shear walls[l]	14.2	3	2½	3	NL	NP	NP	NP	NP
7. Special reinforced masonry shear walls	14.4	5	2½	3½	NL	NL	160	160	100
8. Intermediate reinforced masonry shear walls	14.4	3½	2½	2¼	NL	NL	NP	NP	NP
9. Ordinary reinforced masonry shear walls	14.4	2	2½	1¾	NL	160	NP	NP	NP
10. Detailed plain masonry shear walls	14.4	2	2½	1¾	NL	NP	NP	NP	NP
11. Ordinary plain masonry shear walls	14.4	1½	2½	1¼	NL	NP	NP	NP	NP
12. Prestressed masonry shear walls	14.4	1½	2½	1¾	NL	NP	NP	NP	NP
13. Ordinary reinforced AAC masonry shear walls	14.4	2	2½	2	NL	35	NP	NP	NP
14. Ordinary plain AAC masonry shear walls	14.4	1½	2½	1½	NL	NP	NP	NP	NP
15. Light-frame (wood) walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1 and 14.5	6½	3	4	NL	NL	65	65	65
16. Light-frame (cold-formed steel) walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1	6½	3	4	NL	NL	65	65	65
17. Light-frame walls with shear panels of all other materials	14.1 and 14.5	2	2½	2	NL	NL	35	NP	NP
18. Light-frame (cold-formed steel) wall systems using flat strap bracing	14.1	4	2	3½	NL	NL	65	65	65
B. BUILDING FRAME SYSTEMS									
1. Steel eccentrically braced frames	14.1	8	2	4	NL	NL	160	160	100
2. Steel special concentrically braced frames	14.1	6	2	5	NL	NL	160	160	100
3. Steel ordinary concentrically braced frames	14.1	3¼	2	3¼	NL	NL	35[j]	35[j]	NP[j]

Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- **Response Modification Coefficient(s), R**
  - ASCE 7 – Table 12.2-1
- Seismic Response Coefficient, C_s
- Design Base Shear(s)
- Analysis Procedure Used

Steel Building Frame Systems

Seismic Force-Resisting System	R
Unreinforced Masonry Shear Walls	1½
Intermediate Reinforced Masonry Shear Walls	4
Steel Special Concentrically Braced Frames*	6
Steel Eccentrically Braced Frames*	8
Steel Systems Without Special Seismic Detailing	3

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- Response Modification Coefficient(s), R
- **Seismic Response Coefficient, C_s**
  - Derived per ASCE 7
  - Function of S_{DS}, S_{D1}, R, I_e, and the fundamental period of vibration of the structure
- Design Base Shear(s)
- Analysis Procedure Used

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- Response Modification Coefficient(s), R
- Seismic Response Coefficient, C_s
- **Design Base Shear(s)**
  - Total seismic force at base of structure
  - Derived per ASCE 7
- Analysis Procedure Used

$$V = C_s W$$

[Eq. 12.8-1]

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Structural Design Criteria

1603.1.5 Earthquake Design Data

- Risk Category
- Seismic Importance Factor, I_e
- Spectral Response Acceleration Parameters, S_s and S_1
- Site Class
- Design Spectral Response Acceleration Parameters, S_{DS} and S_{D1}
- Seismic Design Category
- Basic Seismic Force-Resisting System(s)
- Response Modification Coefficient(s), R
- Seismic Response Coefficient, C_s
- Design Base Shear(s)
- **Analysis Procedure Used**
  - ASCE 7:
    - Equivalent Lateral Force Analysis (§12.8)
    - Modal Response Spectrum Analysis (§12.9)
    - Seismic Response History Analysis (Chapter 16)

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Structural Design Criteria

1603.1.6 Geotechnical Information

- ***Design Load Bearing Values of Soils***
  - ***Table 1806.2 (CT) – Presumptive Load Bearing Values***
  - ***Geotechnical Engineering Report***

(Amd) **Table 1806.2 PRESUMPTIVE LOAD-BEARING VALUES**

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	100,000	1,200	0.6	----
2. Sedimentary and foliated rock	20,000	400	0.35	----
3. Cemented sand, gravel, silt, clay (hard pan)	8,000	300	0.35	----
4. Sandy gravel and/or gravel (GW and GP)	6,000	200	0.35	----
5. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM, and GC)	4,000	150	0.25	----
6. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH, and CH)	1,500	100	----	130

Structural Design Criteria

1603.1.7 Flood Design Data

(Limited to buildings located in flood hazard areas)

- ***Flood Design Class***
- ***Critical Elevations***

Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.7 Flood Design Data

- **Flood Design Class**
  - ASCE 24, Table 1-1
  - Classes 1 to 4
  - Similar (but not identical) to Risk Categories
- Critical Elevations

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.7 Flood Design Data

- Flood Design Class
- **Critical Elevations**
  - Referenced to FEMA Flood Insurance Rate Map (FIRM)

Flood Hazard Classification	Elevation
Coastal High Hazard Area and Coastal A Zones	Proposed elevation of the lowest horizontal structural member of the lowest floor (incl. basement)
Other Flood Hazard Areas	Elevation of the proposed lowest floor (incl. basement)
Other Flood Hazard Areas	Elevation to which non-residential buildings will be dry floodproofed

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Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

1603.1.8 Special Loads

- *Includes Machinery or Equipment Loads*
- *Photovoltaic Panel Systems - §1603.1.8.1*
  - *PV system dead load, including rack support systems (and ballast load)*

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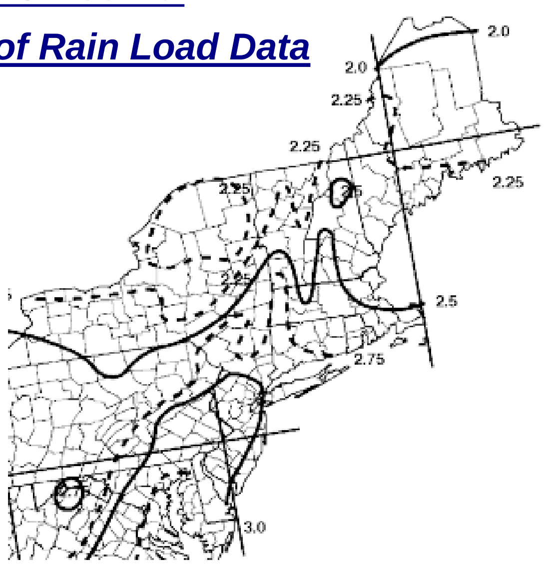
Part 1: Risk Categories and Structural Design Criteria

Structural Design Criteria

2018 IBC: 1603.1.9 Roof Rain Load Data

- *Rain Intensity, i*
  - *Figure 1611.1*



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Part 1: Risk Categories and Structural Design Criteria

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Structural Design Criteria

Exception for Structures Designed Using Conventional Light-Frame Construction Provisions of §2308

- *Floor and Roof Live Loads*
- *Ground Snow Load, p_g*
- *Ultimate Design Wind Speed, V_{ult}, and Nominal Design Wind Speed, V_{asd}*
- *Wind Exposure*
- *Seismic Design Category*
- *Seismic Site Class*
- *Flood Design Data (if applicable)*
- *Design load-bearing values of soils*

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Part 2: Metal Building Systems

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Metal Building Systems

a.k.a. Pre-Engineered Metal Buildings, Butler Buildings

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Part 2: Metal Building Systems

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Metal Building Systems

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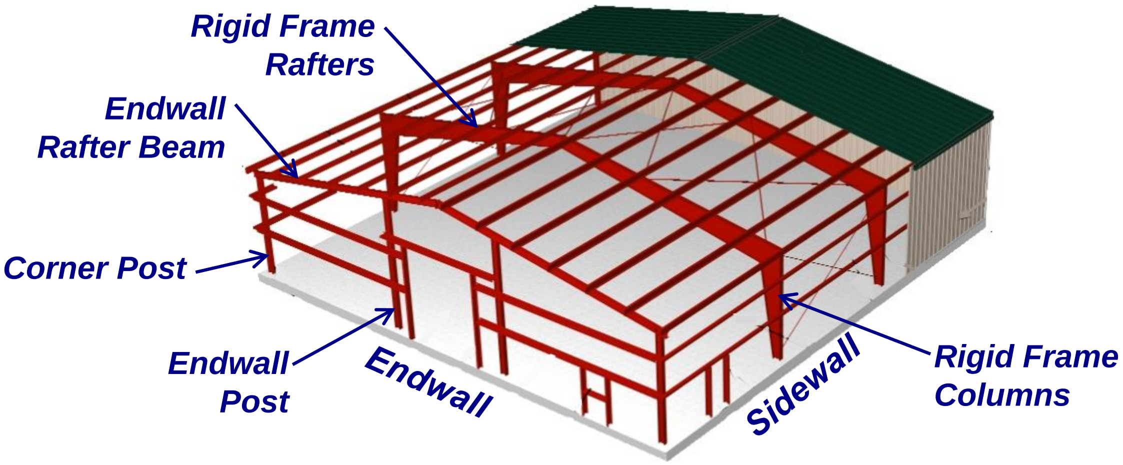
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Primary Framing

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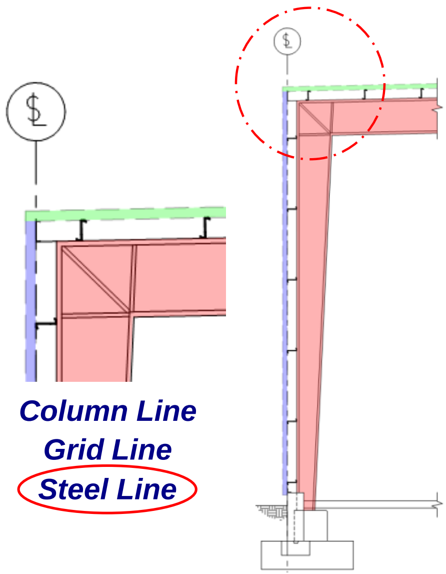
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Primary Framing

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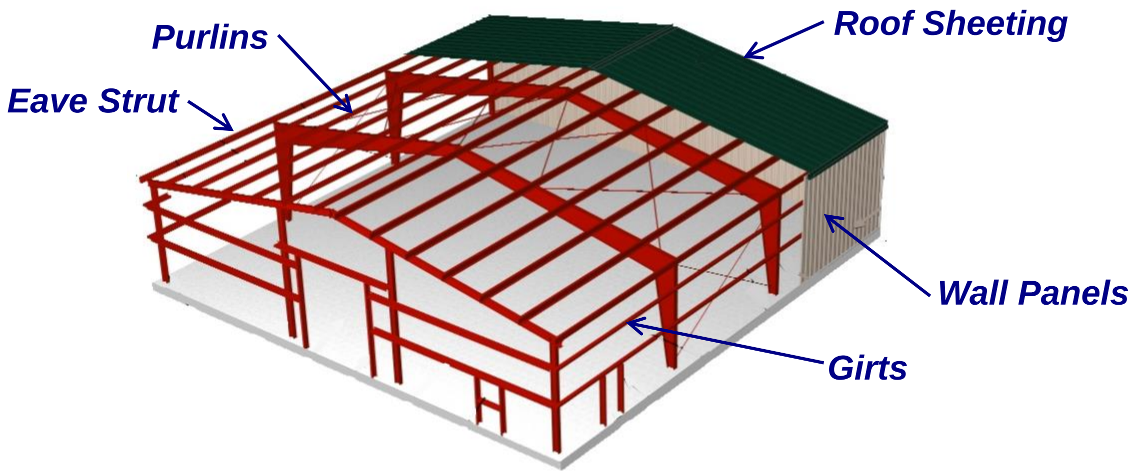
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Secondary Framing

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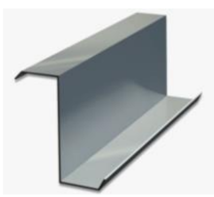
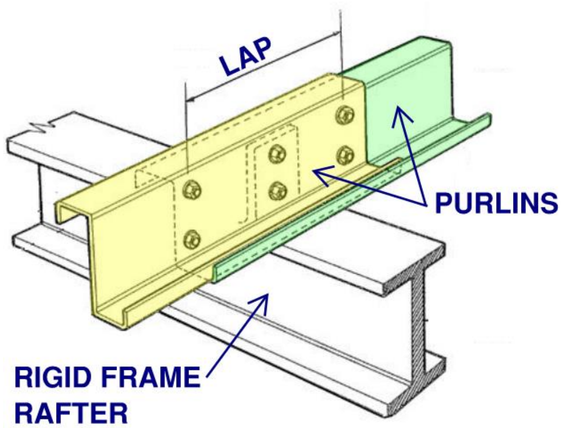
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Zee Purlins/Girts



Secondary Framing

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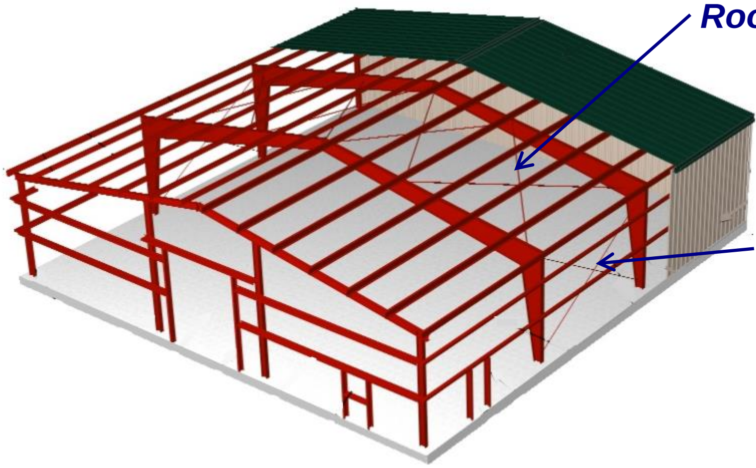
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Wall and Roof Bracing

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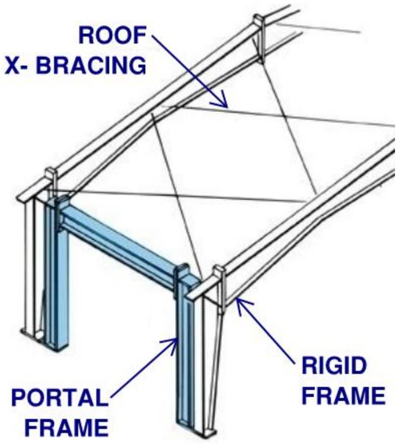
Part 2: Metal Building Systems

Metal Building Systems Nomenclature



Conventional X-Bracing

Wall and Roof Bracing

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Part 2: Metal Building Systems

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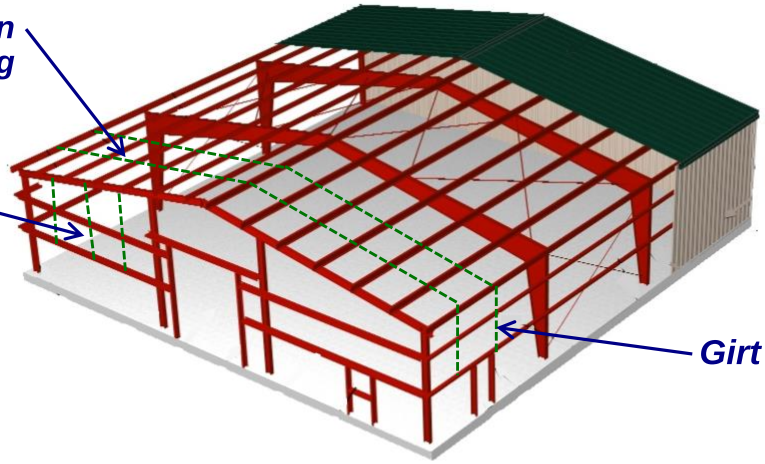
Metal Building Systems Nomenclature



Secondary Bracing

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Part 2: Metal Building Systems

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Metal Building Systems Nomenclature

Purlin Bracing ***Girt Bracing***

Secondary Bracing

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Part 2: Metal Building Systems

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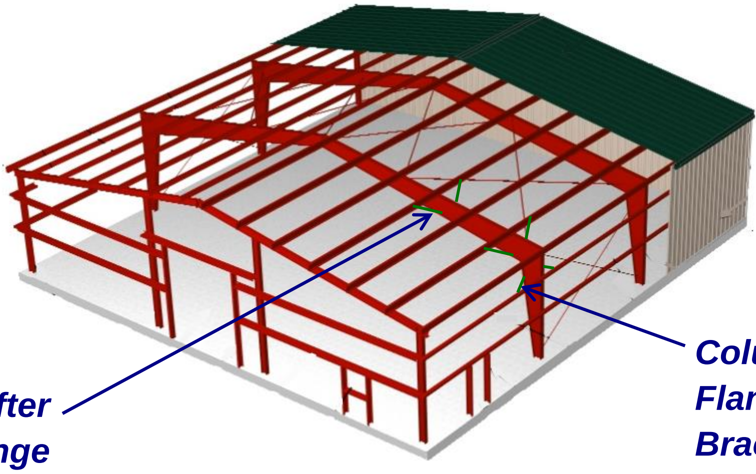
Metal Building Systems Nomenclature



Rafter Flange Braces

Column Flange Braces

Flange Braces

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Part 2: Metal Building Systems

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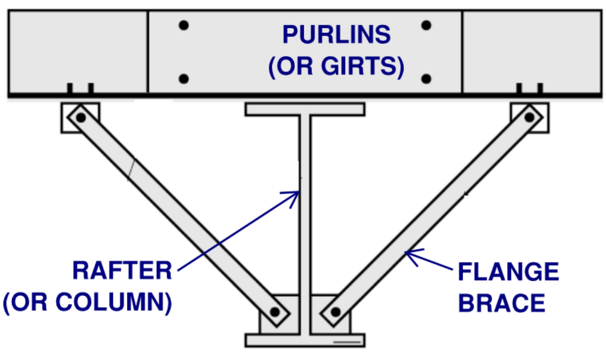
Metal Building Systems Nomenclature



Rafter Flange Braces

Flange Braces

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Metal Building Systems Nomenclature

COLLATERAL LOADS

- The weight of any permanent loads, other than the structural system dead loads, that are suspended from the structure including lighting systems, fire-suppression systems, ductwork, ceilings, ceiling fans, etc.

DEAD LOADS

- The weight of the steel frames, purlins, girts, roof sheeting, walls panels, etc.

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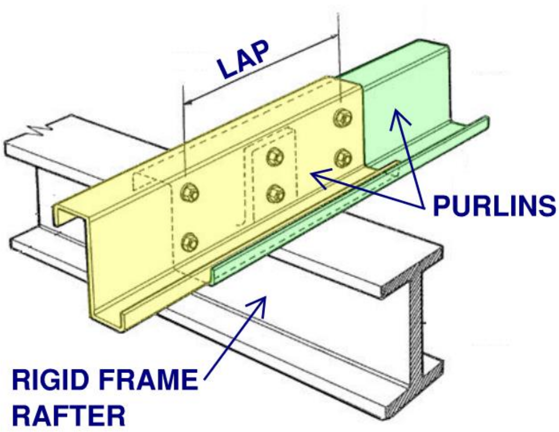
Structural Engineering Concepts

CONTINUITY

- Purlins and girts
- Reduces bending stresses
- Reduces deflection
- Reduces material
- Saves $$$



Part 2: Metal Building Systems

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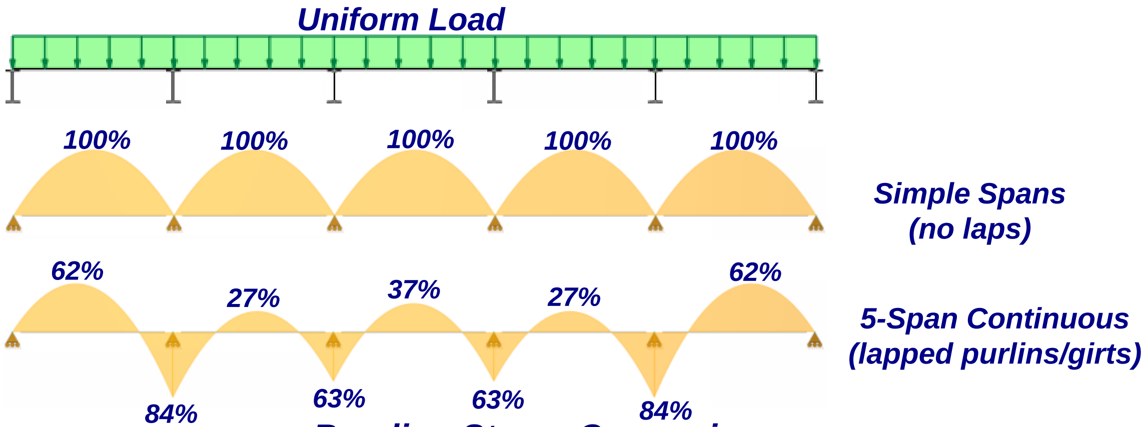
Structural Engineering Concepts

CONTINUITY



Bending Stress Comparison

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Part 2: Metal Building Systems

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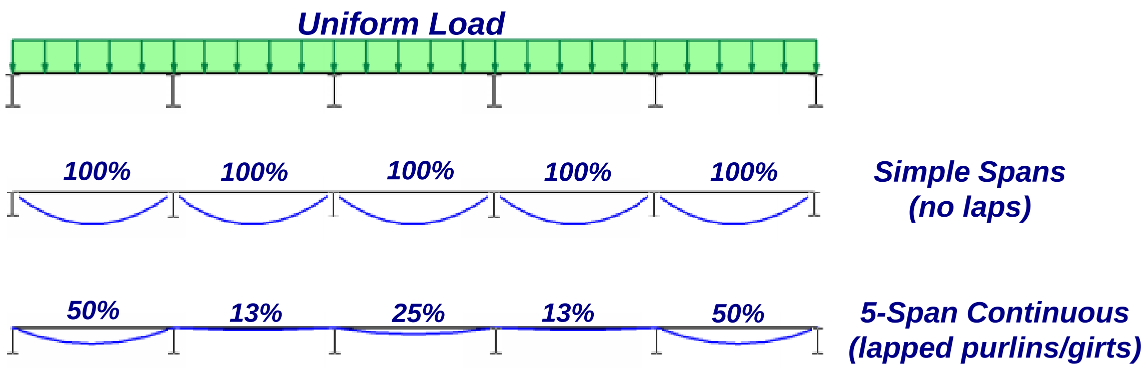
Structural Engineering Concepts

CONTINUITY



Deflection Comparison

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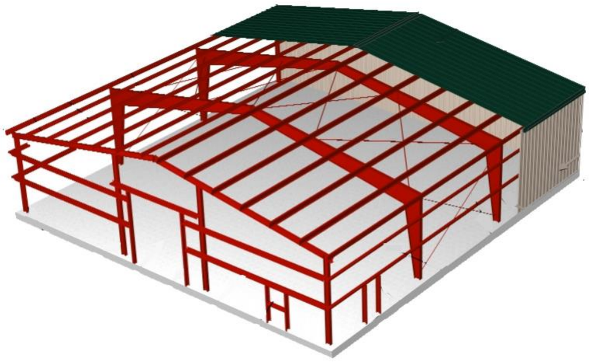
Part 2: Metal Building Systems

Structural Engineering Concepts

X-BRACING

- In roof, acts as a horizontal truss (or diaphragm) to transmit lateral wind loads from end walls into braced frames
- In walls, acts to transmit lateral wind loads from roof to foundation



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Part 2: Metal Building Systems

Structural Engineering Concepts

DISCRETE COMPONENT BRACING

- Inhibits buckling of components with slender cross-sections
- Reduces unbraced length of compression flange
- Allows for use of deeper, lighter-weight components
- Permits the use of higher allowable bending stresses
- Reduces material
- Saves $$$
- Elements that receive discrete component bracing include:
  - Rigid Frames
  - Purlins
  - Girts

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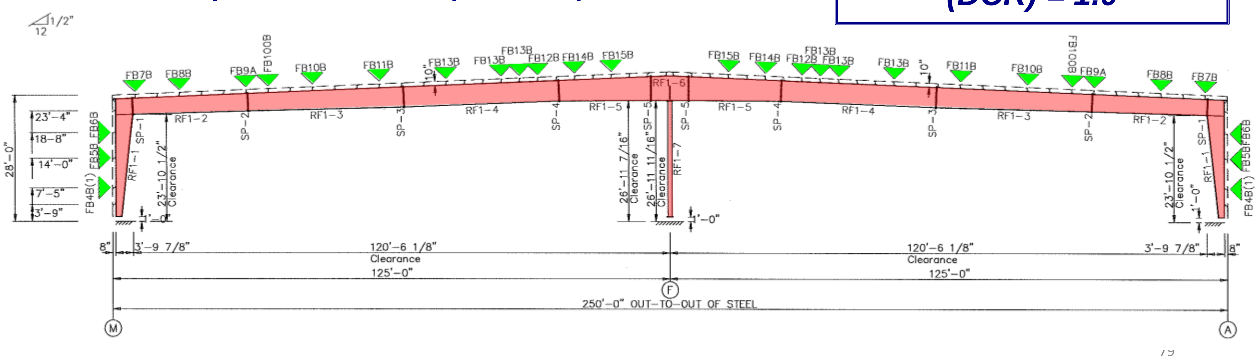
Part 2: Metal Building Systems

Structural Engineering Concepts

DISCRETE COMPONENT BRACING

- Example: Rigid frame with two spans of 125'; 28' eave height
  - Risk Category III (high occupant load)
  - 30 psf snow load
  - 135 psf ultimate wind speed – Exposure C

Demand-Capacity Ratio (DCR) = 1.0



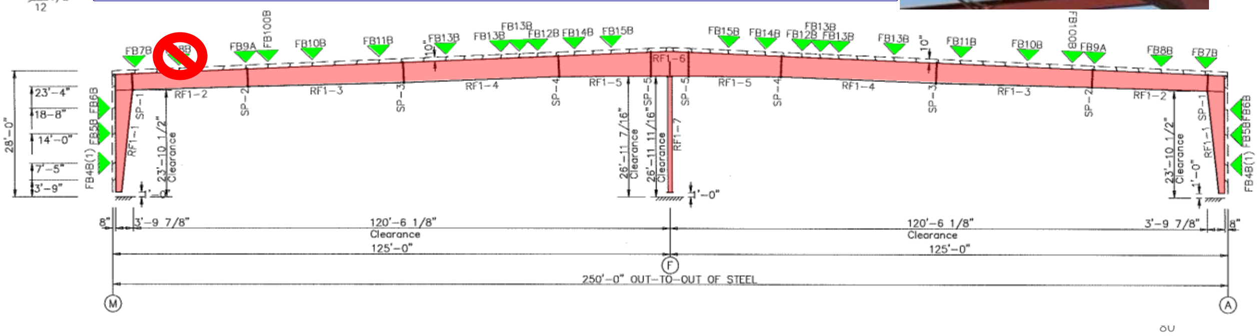
Part 2: Metal Building Systems

Structural Engineering Concepts

DISCRETE COMPONENT BRACING

- How important are the flange braces?

With loss of only one flange brace, DCR under same loading conditions increases from 1.0 to 2.93



Part 2: Metal Building Systems

Structural Engineering Concepts

DISCRETE COMPONENT BRACING

- How important are the flange braces?

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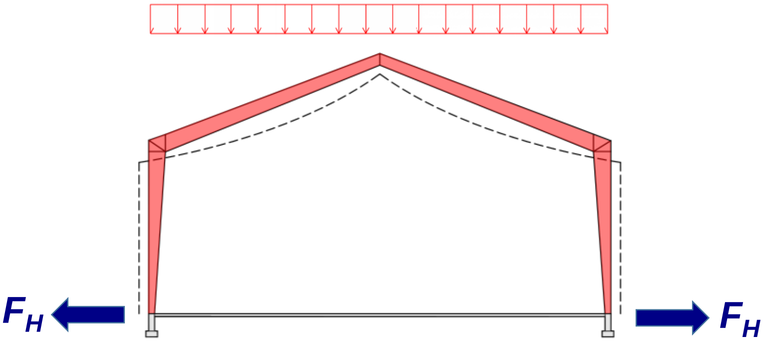
Part 2: Metal Building Systems

Structural Engineering Concepts

THRUST

- Outward horizontal reaction at the base of column
  - Due to lateral wind (or earthquake) loads
  - Due to gravity loads (dead loads and snow loads)



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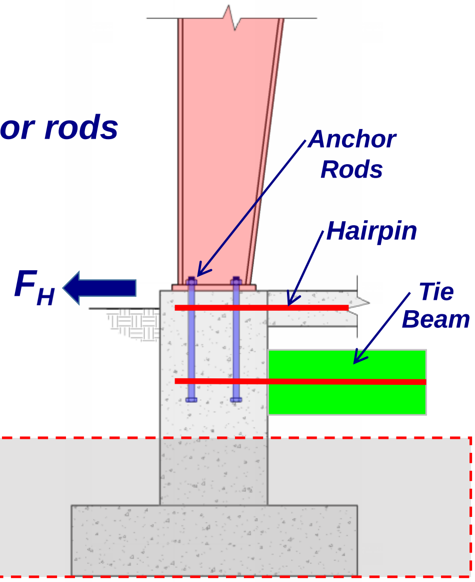
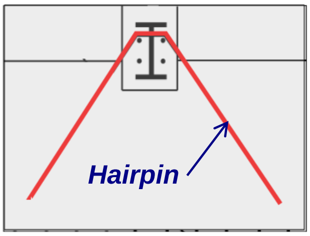
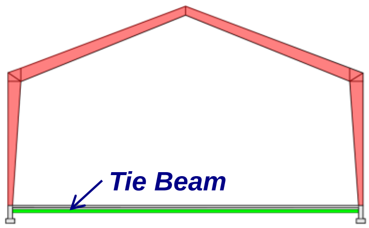
Structural Engineering Concepts

THRUST

- *Thrust is delivered to foundation via anchor rods*
  - *Who is responsible for design?*
- *How is thrust resisted by foundations?*
  - *Hairpins into slab*
  - *Tie beams across building*
  - *Moment-resisting footings/piers*







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Part 2: Metal Building Systems

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Problems

- *Blurred Lines of Responsibility*
  - *Who is responsible for what? Depends on the delivery system.*
    - *Conventional Design/Bid/Build*
      - *Owner's A/E team produces design*
      - *Structural engineer from A/E team designs foundations and establishes structural performance criteria for metal building system*
      - *Contractor with successful bid is awarded project*
      - *Metal building system supplier designs building and submits calculations and drawings to A/E team for review and approval*
      - *Structural engineer from A/E team verifies foundations loads and adjusts foundation design as required*
      - *Deferred Submittal (CSBC §107.3.4.1): Design Professional in Responsible Charge sends letter to Building Official confirming that metal building system design has been reviewed and found to be in general conformance with building design.*

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Problems

- ***Blurred Lines of Responsibility***
  - ***Who is responsible for what? Depends on the delivery system.***
    - ***Conventional Design/Bid/Build***
    - ***Design/Build with Separate Engineers for Metal Building & Foundation***
      - ***Contractor with metal building franchise sells building to Owner***
      - ***Metal building manufacturer designs metal building system***
      - ***Contractor engages other structural engineer to design foundation system using column reactions provided by metal building system manufacturer***
        - ***Other structural engineer designs anchor rod embedment depths***

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Part 2: Metal Building Systems

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Problems

- ***Blurred Lines of Responsibility***
  - ***Metal Building System engineer is <u>NOT</u> the Engineer of Record***

    MBMA Systems Manual: "The manufacturer is responsible only for the structural design of the MBS it sells… Neither the manufacturer nor the manufacturer's engineer is the … engineer of record for the construction project. The manufacturer is not responsible for the design of any component or materials not sold by it or their interface and connection with MBS…"
  - ***Design criteria used by the Metal Building System engineer are provided by others, oftentimes the metal building franchise-holders who are frequently <u>not</u> design professionals***
    - ***No familiarity with the project site***
      - ***Wind exposure***
      - ***Adjacent buildings***

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Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems

- ***Blurred Lines of Responsibility***
  - ***Who coordinates the design with other components?***
    - **"The building provided by XXXX may create a condition that could cause a snow drift load on an adjacent, lower structure. It is the responsibility of the Buyer/ Contractor and/or End Owner of any existing structure to have it analyzed…"**
    - **"The steel deck is provided as a form only for the placement of the concrete slab… the concrete and its reinforcement must be capable of supporting the design loads … It is the responsibility of the Buyer/ Contractor and/or End Owner of any existing structure to have the design performed by a registered design professional."**
    - **"Excessive ice and snow should be removed from the roof immediately to prevent damage to roof and possible collapse…"**

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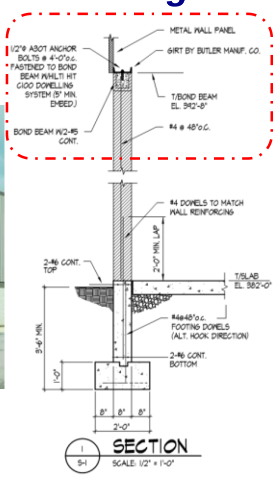
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

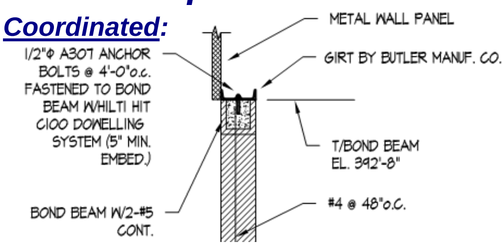
Problems

- ***Blurred Lines of Responsibility***
  - ***Who coordinates the design with other components?***

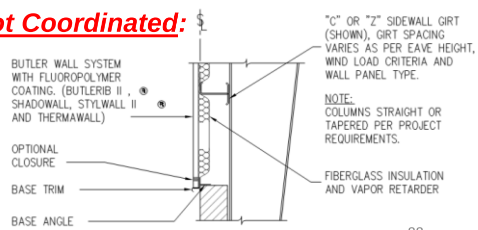
Masonry Wall Example



Coordinated:



Not Coordinated:



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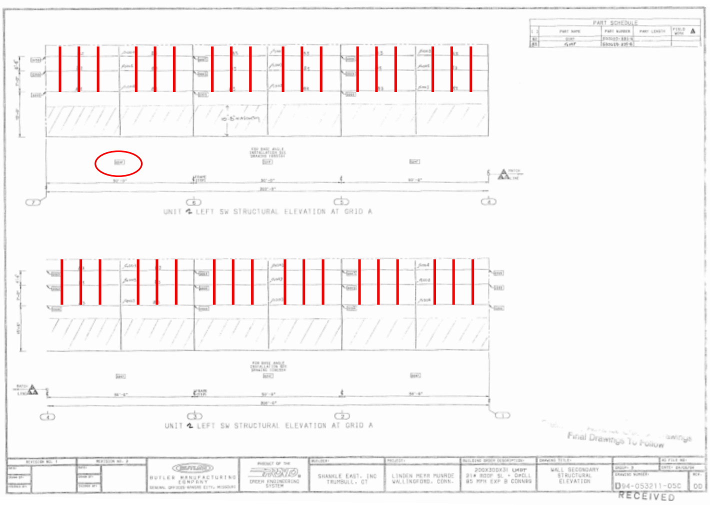
Problems

- **Complexity of Metal Building Systems**
  - *Very intricate drawings*
  - *Extensive amount of information*
  - *Multitude of components, many of which are critical to the structural integrity*
  - *Obscure cross references*
    - **"The top of each and every end wall panel should have been bolted to both the outer curve angle and the inner curve angle, as required on page 45 of the Construction Guidelines."**

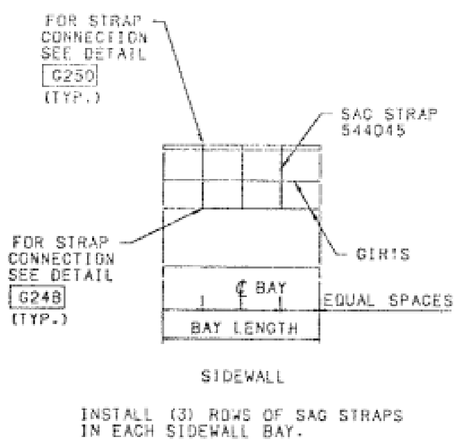
```
3. SPECIFIC NOTES AND DETAILS SHOWN ON THE DRAWINGS
   SHALL TAKE PRECEDENCE OVER THE BUILDING MANUAL
   SUPPLIED.
```


Problems: *CASE STUDIES*

- **Missing Girt Bracing (Sag Straps)**



G247



Part 2: Metal Building Systems

Problems: *CASE STUDIES*

May 1999 Windstorm

University Building

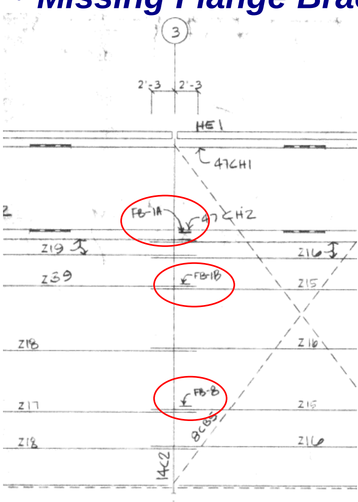
- ***1994 Substantial Completion***
- ***1989 CSBC***
- ***Special Inspections Required***

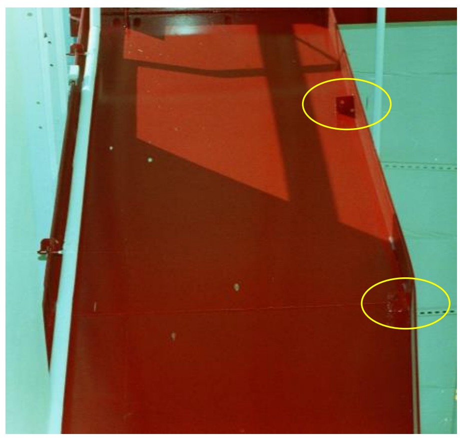
 91

Part 2: Metal Building Systems

Problems: *CASE STUDIES*

- ***Missing Flange Braces***





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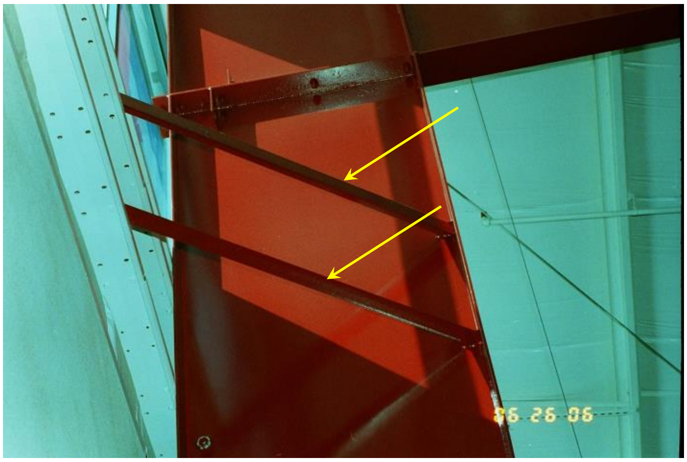
Part 2: Metal Building Systems

Problems: CASE STUDIES

- Missing Flange Braces



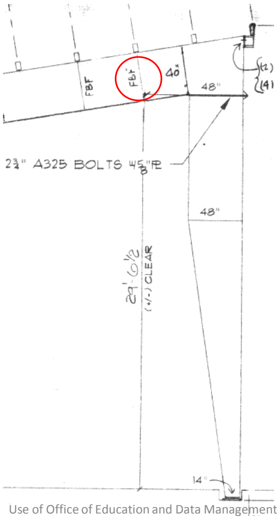
Example of properly installed flange braces

 93

Part 2: Metal Building Systems

Problems: CASE STUDIES

- Missing Flange Brace



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Part 2: Metal Building Systems

Problems: CASE STUDIES

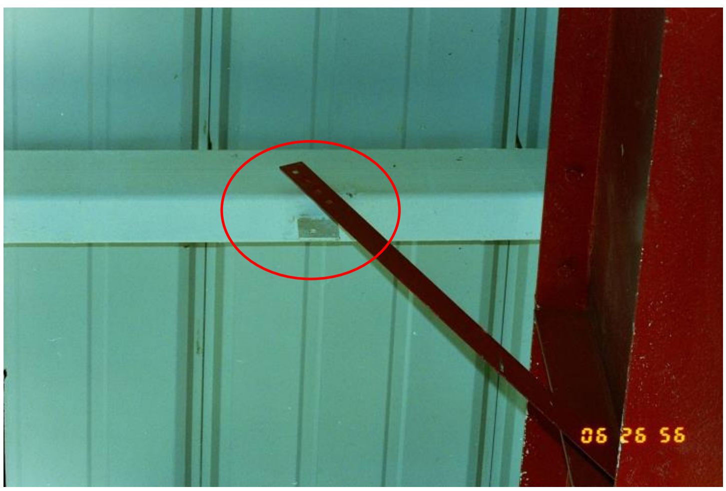
- **Missing Flange Brace?**
  - ➢ **Improperly installed purlin**

 95

Part 2: Metal Building Systems

Problems: CASE STUDIES

- **Missing Flange Brace Connection**



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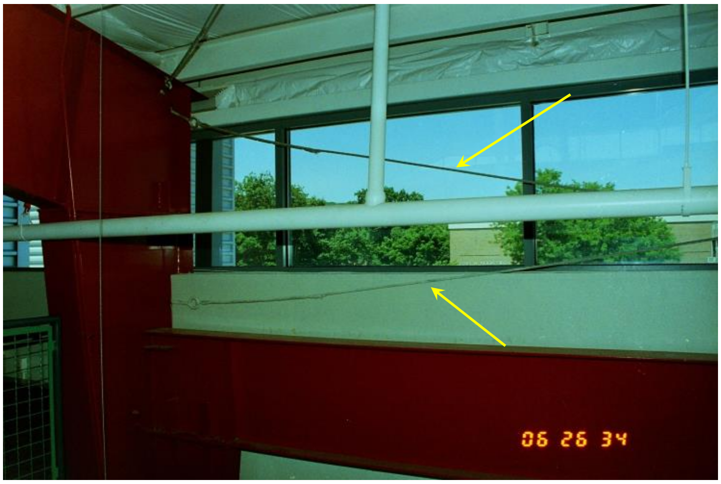
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- *Sagging Wall X-Bracing*

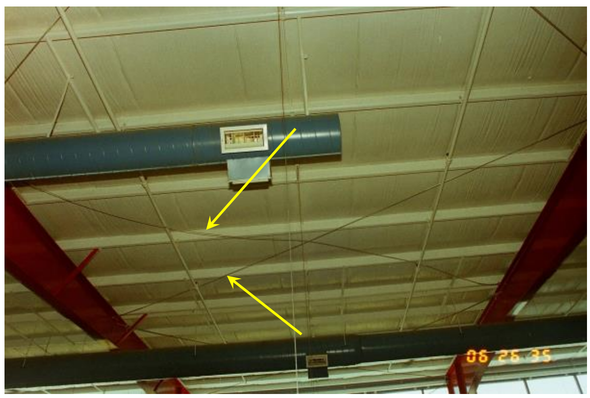


Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- *Sagging Roof X-Bracing*

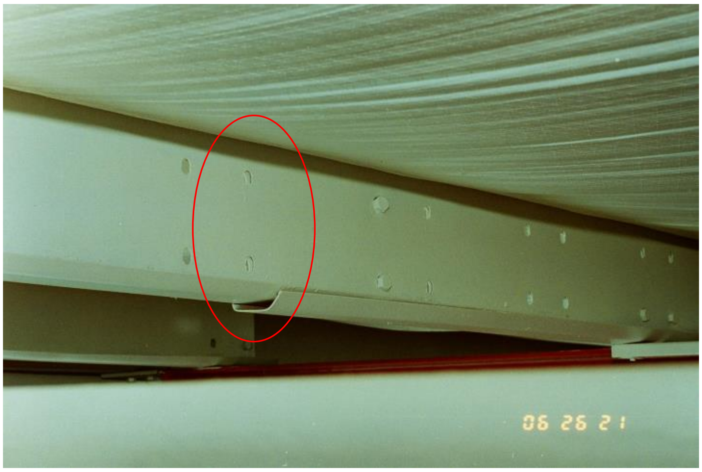


Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Improper Purlin Lap Connection (missing bolts)***



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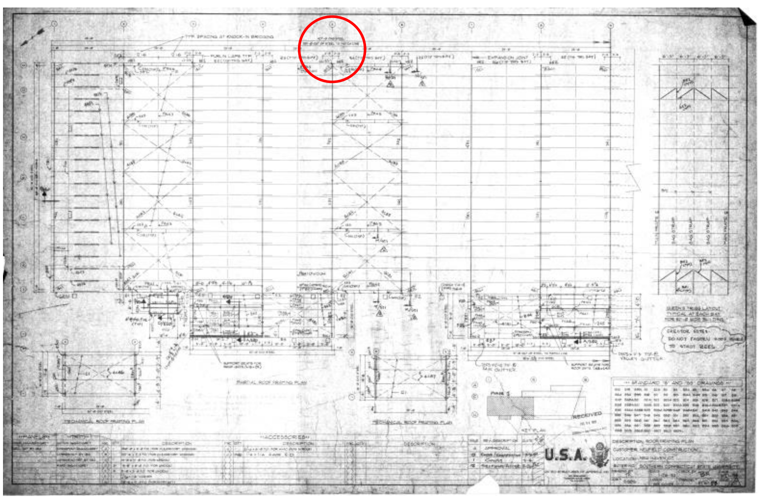
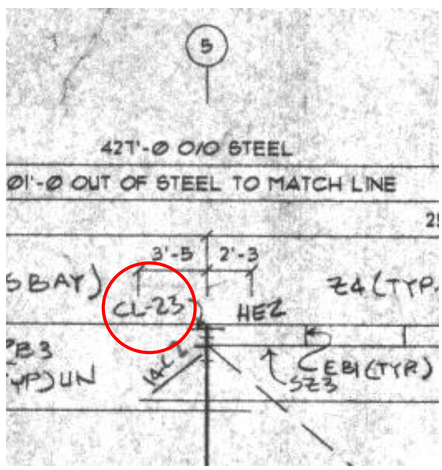
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Missing Parts***





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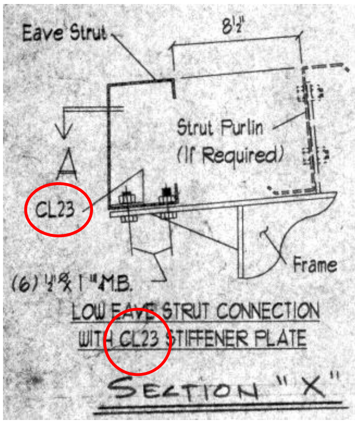
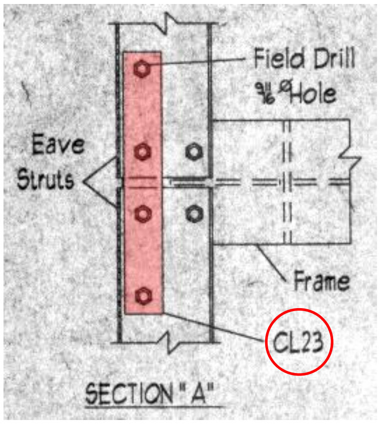
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- *Missing Connectors*





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Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- *Missing Connectors*

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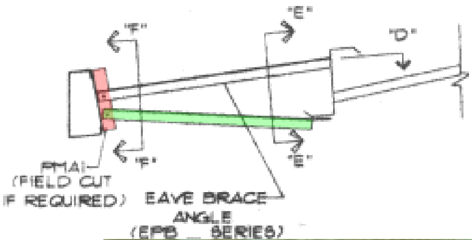
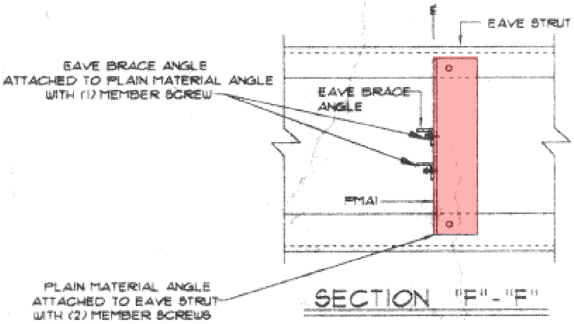
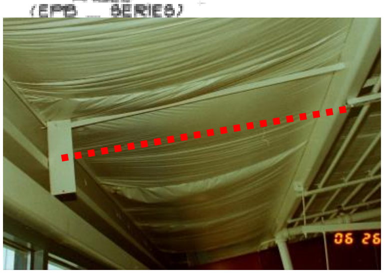
Part 2: Metal Building Systems

Problems: *CASE STUDIES*

- *Missing Bridging*







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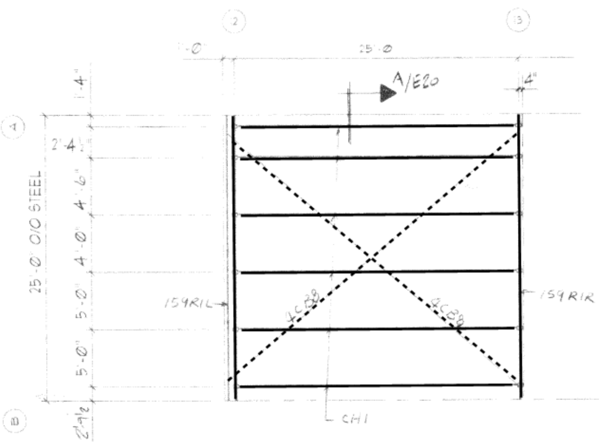
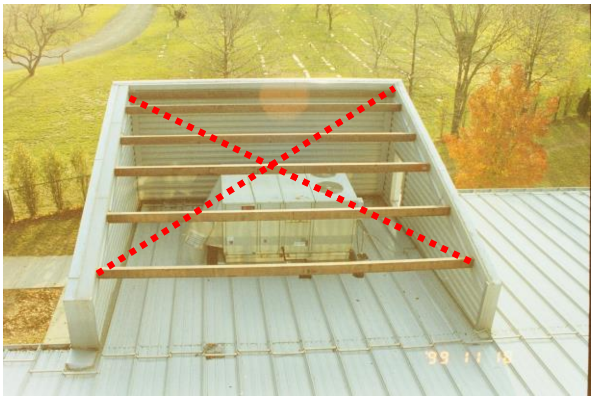
Part 2: Metal Building Systems

Problems: *CASE STUDIES*

- *Missing Bracing*





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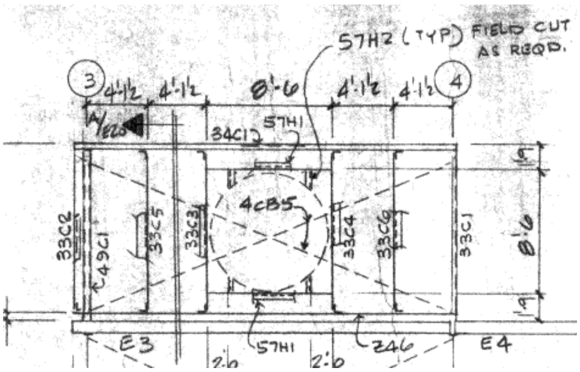
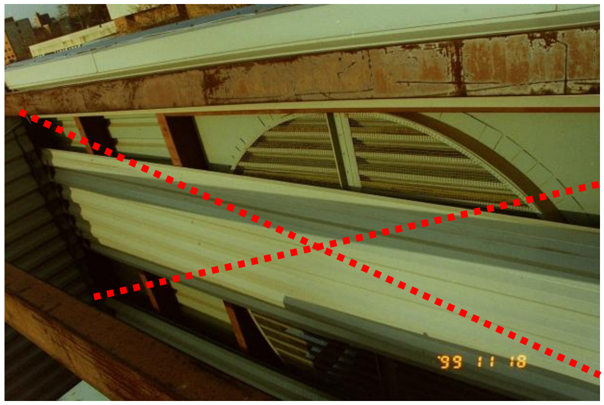
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Missing Bracing***



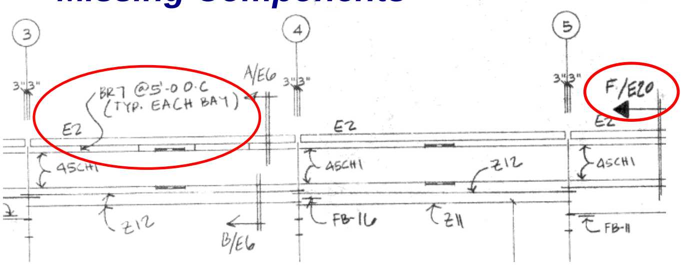


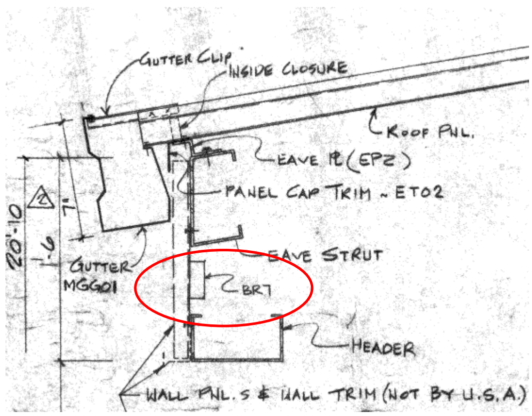
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Missing Components***





Section F

Part 2: Metal Building Systems

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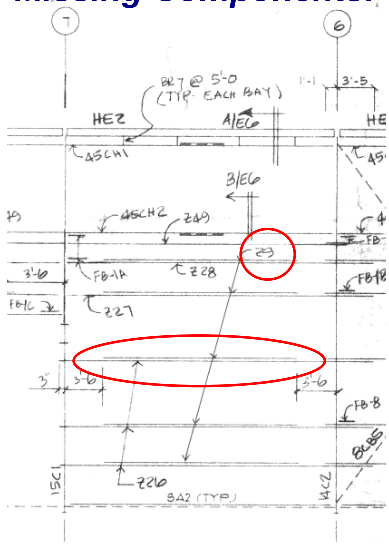
Problems: CASE STUDIES

- Missing Components: Girt Reinforcing

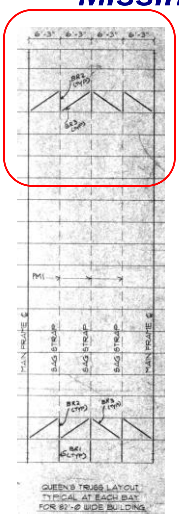


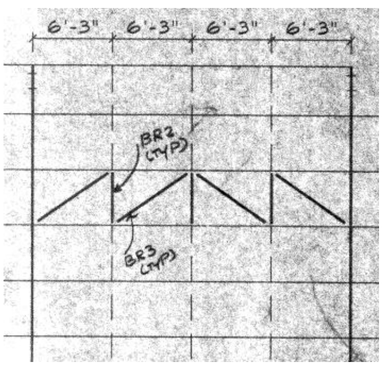
Part 2: Metal Building Systems

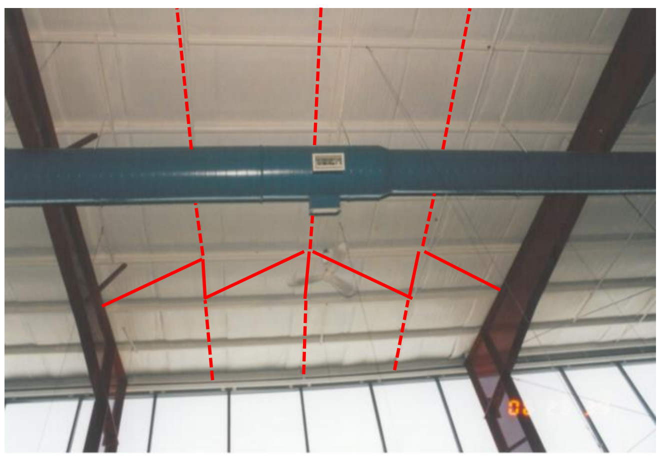
DiBlasi Associates, PC Structural Engineers

Problems: CASE STUDIES

- Missing Bracing





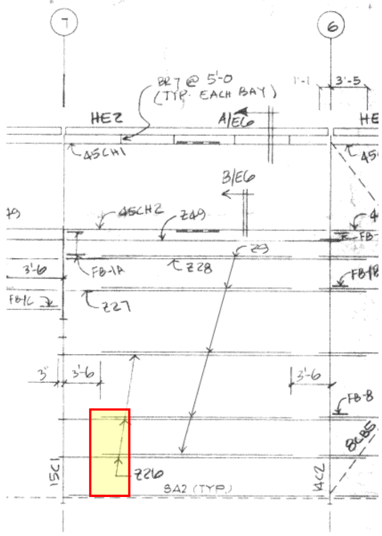


Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Framing Alterations: Cut Girts***



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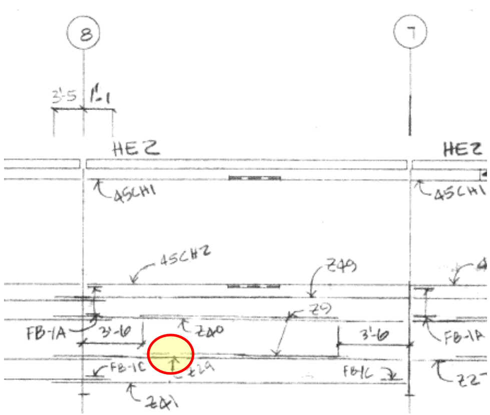
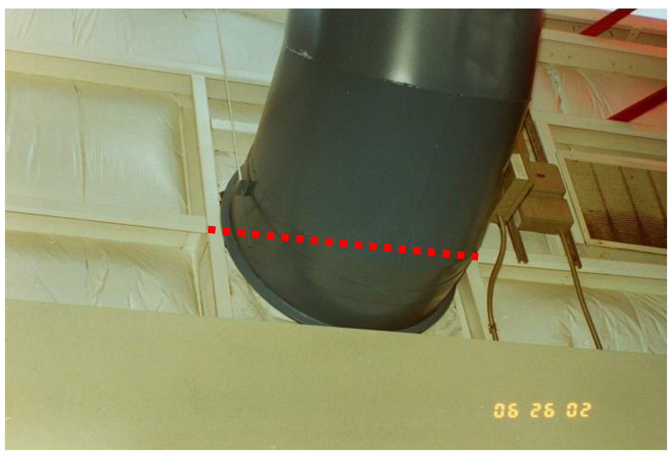
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *CASE STUDIES*

- ***Framing Alterations: Cut Girts***





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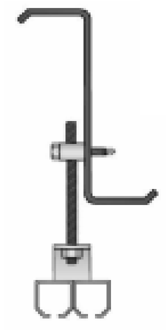
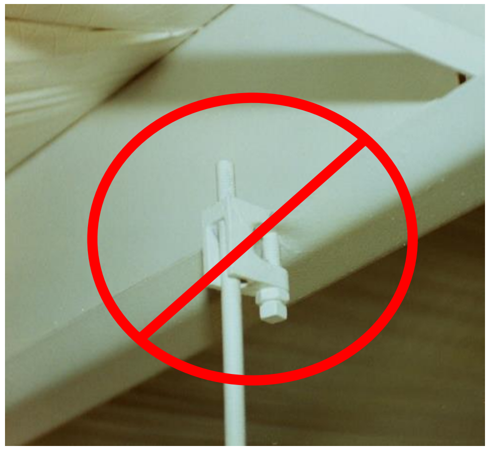
Part 2: Metal Building Systems

DiBlasi Associates, PC Structural Engineers

Problems: *HANGER ATTACHMENTS*

- ***Loads of any significance must be attached to purlin web, not purlin flange lip***
- ***Purlins must be designed to support suspended loads (collateral load allowance)***





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