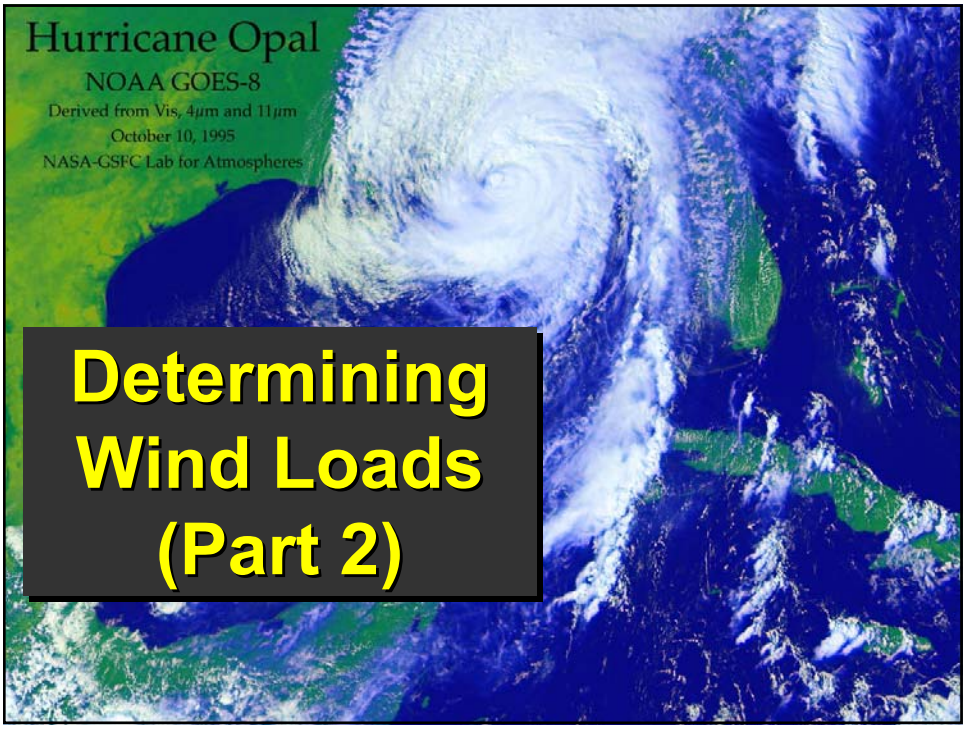


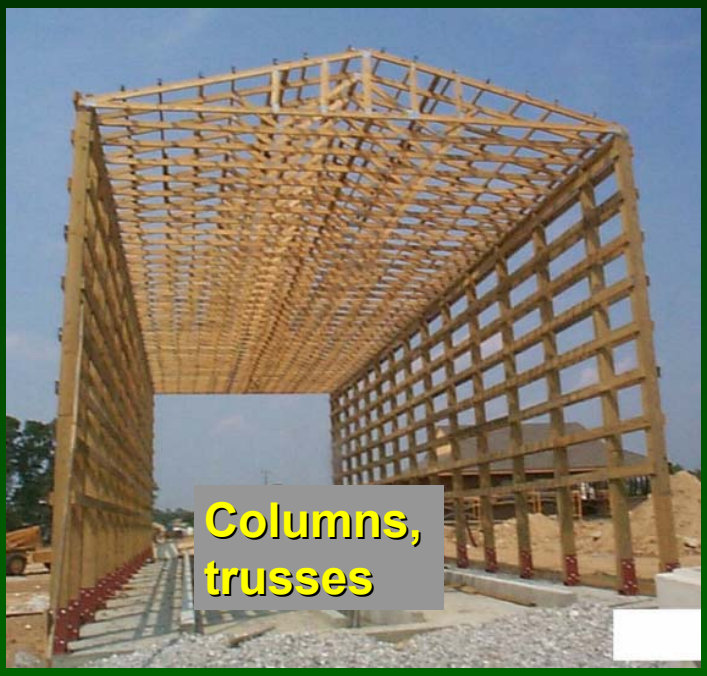
Determining Wind Loads (Part 2)

Wind Load Terms

- Main Wind Force Resisting System (MWFRS)
  - an assemblage of major structural elements assigned to provide support for secondary members and cladding, it primarily receives wind loading from more than one surface
    - Rigid and braced frames
    - trusses
    - roof and floor diaphragms
    - shear walls


Rigid
Frames


Main
columns,
beams,
trusses, roof
diaphragm

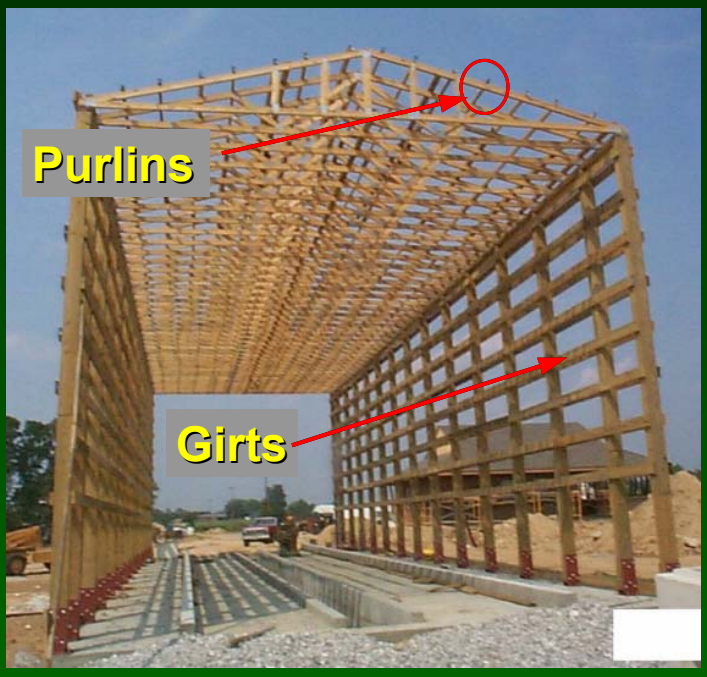

Columns,
trusses


Shear walls

Wind Load Terms

- Components and Cladding
  - structural elements that are either directly loaded by wind or receive wind loads originating at relatively close locations and that transfer these loads to the main wind force resisting system
    - curtain walls, studs
    - roof and wall sheathing
    - purlins, girts


Roof
sheathing


Purlins
Girts

- **Design Wind Pressure** calculated by (1999 Standard Building Code):

$$p = q G C_p U$$

- p = design wind pressure, psf
- q = basic velocity pressure
- GC_p = combined gust factor and pressure coefficient
- U = use factor (like importance factor)

- **Gust Factor - Pressure Coefficient**

- GC_p is a combined term that SBC uses
  - the gust factor (G) accounts for increases in pressure due to higher speed wind gusts
  - the pressure coefficient (C_p) indicates the magnitude and direction of the actual wind pressure on a given surface of the building

- **Gust Factor - Pressure Coefficient**

- GC_p terms are different for:
  - each surface of the building
  - MWFRS or C&C
    - i.e. to design different components, you will need to use different GC_p values

- **GC_p for Components and Cladding**

- for C&C - use:
  - Figures 1606. 2C, 2D, 2E, 2F, 2G
  - Note how the building is broken down into different zones
  - Note "interior" and "exterior" zones
    - corners, overhangs, etc.

- for C&C coefficients are based on Effective Wind Area:
  - Effective Wind Area (EWA)
  - EWA = tributary area

    -BUT-

  - EWA $\geq$ (span^2)/3

Tributary
Area of girt

- C&C Wall Coefficients

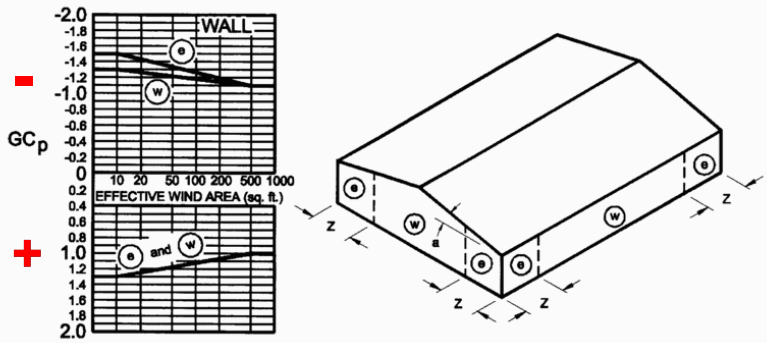


FIGURE 1606.2C
WALL COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDINGS)[3]

For **SI:** 1 degree = 0.01745 radians.

Notes:

1. Plus and minus signs signify pressures acting toward and away from the outside surfaces, respectively.
2. Each component shall be designed for maximum positive and negative pressures.
3. For partially enclosed buildings, positive coefficients shall be increased by 0.1 and negative coefficients shall be increased by 0.4 (in absolute sense).
4. Coefficients may be reduced 10% when $a \leq 10°$ (0.01745 rad).
5. Notation:
   a: Roof angle from horizontal (degrees).
   Z: 10% of minimum building width or 0.4H, whichever is smaller, but not less than the larger of 4% of the minimum building width or 3 ft.
   H: Mean roof height (ft), except that eave height may be used when $a \leq 10°$.

- **C&C Roof Coefficients (0°≤angle≤10°)**

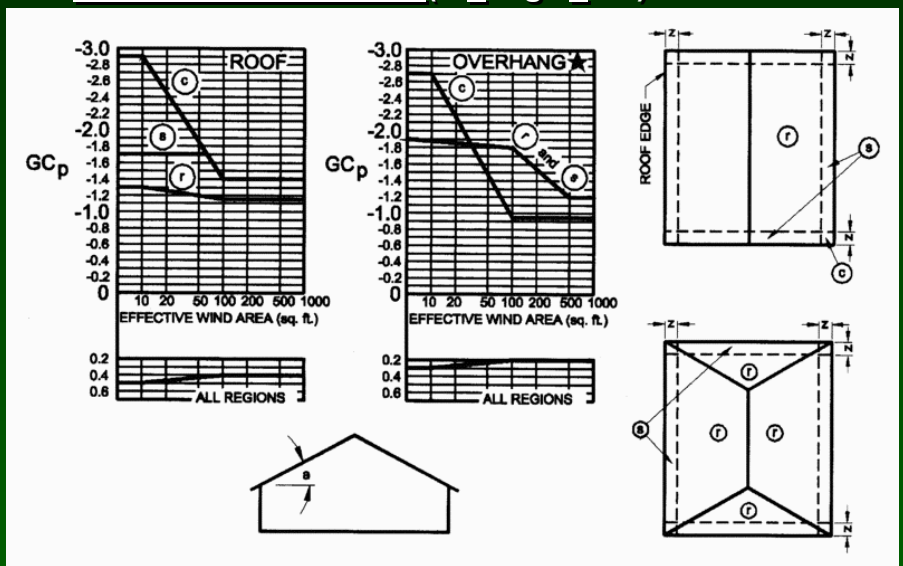


FIGURE 1606.2D
ROOF COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDINGS)[3]
$0° \le a \le 10°$

For **SI:** 1 degree = 0.01745 radians.

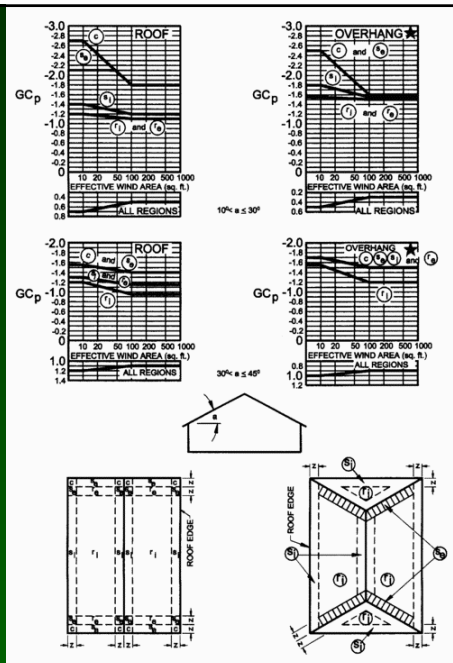


FIGURE 1606.2E
ROOF COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDING)[3]
$10° < a \le 45°$[5]

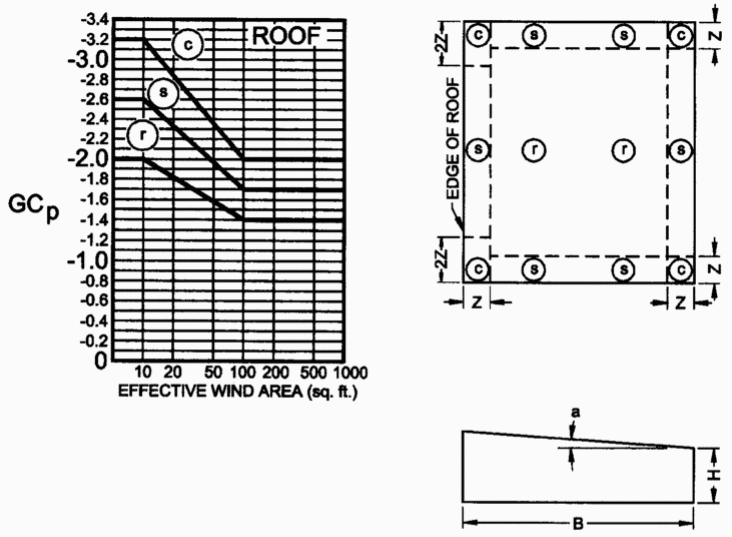


FIGURE 1606.2F
MONOSLOPE ROOF COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDING)[2]
$3° < a \leq 10°$[3,4]

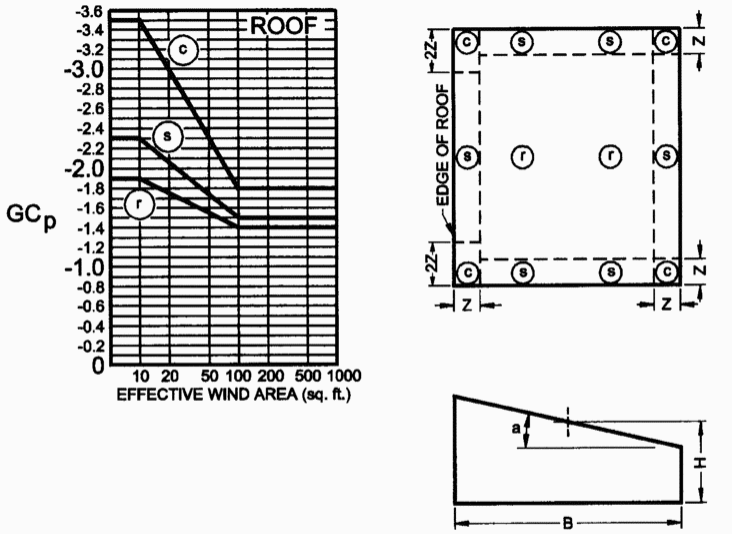


FIGURE 1606.2G
MONOSLOPE ROOF COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDING)[2]
$10° < a \leq 30°$

- **Example GC_p for C&C**
- Given:
  - commercial post-frame building in Mobile
  - wall girts are 2x6
  - girts are spaced 4 ft OC
  - posts are spaced 12 ft OC
- Find:
  - C&C GCp for girts
    - interior zone
    - end zone

- Solution:

$$\text{EWA} = \text{trib. area} \quad \text{or} \quad \frac{(\text{span})^2}{3}$$

  - span = 12 ft

$$\text{trib. area} = (4\ \text{ft})(12\ \text{ft}) = 48\ \text{ft}^2$$

$$\frac{(\text{span})^2}{3} = \frac{(12)^2}{3} = 48\ \text{ft}^2$$

  - use EWA = 48 ft^2

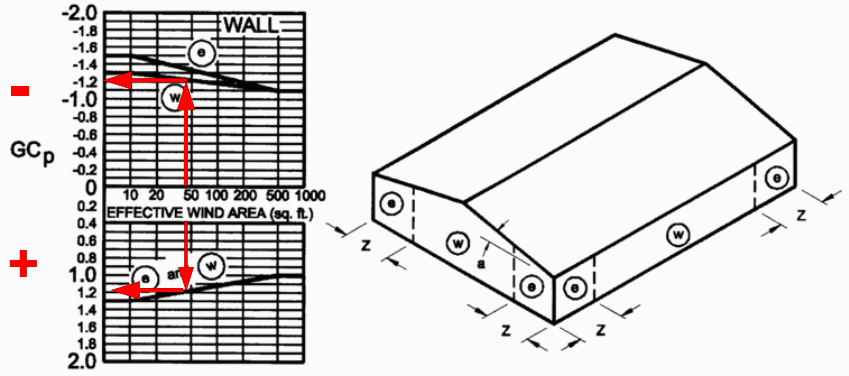


FIGURE 1606.2C
WALL COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDINGS)[3]

For **SI:** 1 degree = 0.01745 radians.

Notes:

1. Plus and minus signs signify pressures acting toward and away from the outside surfaces, respectively.
2. Each component shall be designed for maximum positive and negative pressures.
3. For partially enclosed buildings, positive coefficients shall be increased by 0.1 and negative coefficients shall be increased by 0.4 (in absolute sense).
4. Coefficients may be reduced 10% when $a \leq 10°$ (0.01745 rad).
5. Notation:
   a: Roof angle from horizontal (degrees).
   Z: 10% of minimum building width or 0.4H, whichever is smaller, but not less than the larger of 4% of the minimum building width or 3 ft.
   H: Mean roof height (ft), except that eave height may be used when $a \leq 10°$.

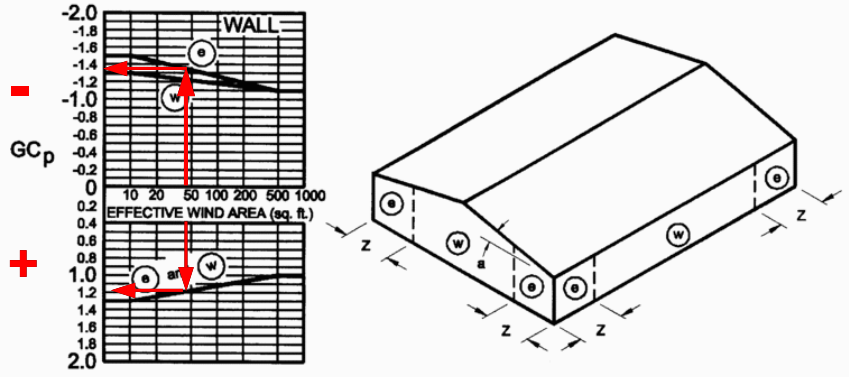


FIGURE 1606.2C
WALL COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDINGS)[3]

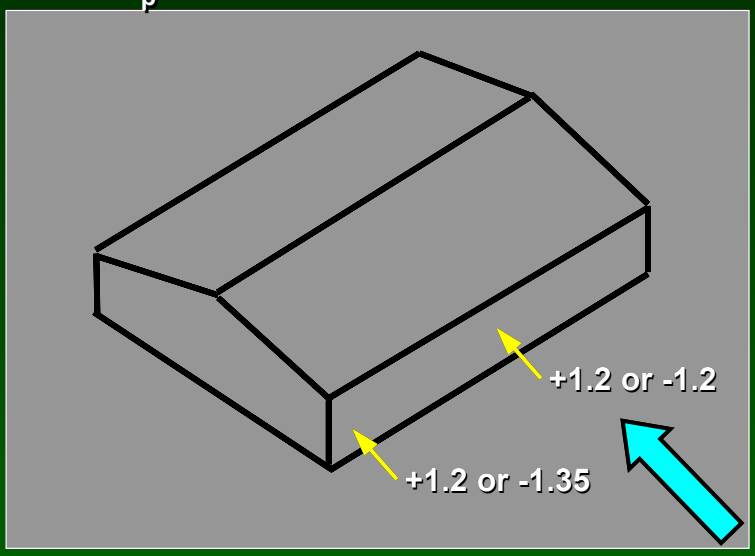
For **SI:** 1 degree = 0.01745 radians.

Notes:

1. Plus and minus signs signify pressures acting toward and away from the outside surfaces, respectively.
2. Each component shall be designed for maximum positive and negative pressures.
3. For partially enclosed buildings, positive coefficients shall be increased by 0.1 and negative coefficients shall be increased by 0.4 (in absolute sense).
4. Coefficients may be reduced 10% when $a \leq 10°$ (0.01745 rad).
5. Notation:
   a: Roof angle from horizontal (degrees).
   Z: 10% of minimum building width or 0.4H, whichever is smaller, but not less than the larger of 4% of the minimum building width or 3 ft.
   H: Mean roof height (ft), except that eave height may be used when $a \leq 10°$.

- **Solution:**
  - For interior zones (w)
    - GC_p = -1.2 or GC_p = + 1.2
  - For end zones (e)
    - GC_p = -1.35 or GC_p = + 1.2

- GC_p for C&C walls



- **Design Wind Pressure** :

$$p = q G C_p U$$

- p = design wind pressure, psf
- q = basic velocity pressure
- GC_p = combined gust factor and pressure coefficient
- U = use factor

- **Example GC_p for C&C**
- **Given:**
  - commercial post-frame building in Mobile
  - no overhang on roof
  - purlins are 2x4
  - purlins are spaced 2 ft OC
  - trusses are spaced 12 ft OC
- **Find:**
  - C&C GCp for purlins
    - interior zone
    - end zone

- **Solution:**

$$\text{EWA} = \text{trib. area} \quad \text{or} \quad \frac{(\text{span})^2}{3}$$

- span = 12 ft

$$\text{trib. area} = (2\ \text{ft})(12\ \text{ft}) = 24\ \text{ft}^2$$

$$\frac{(\text{span})^2}{3} = \frac{(12)^2}{3} = 48\ \text{ft}^2$$

- use EWA = 48 ft^2

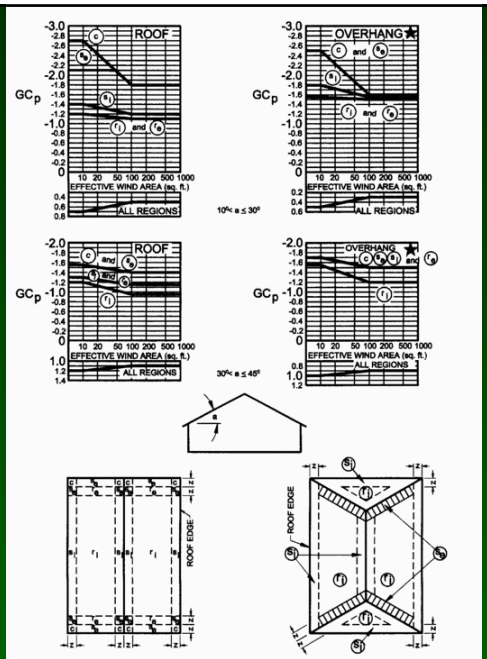
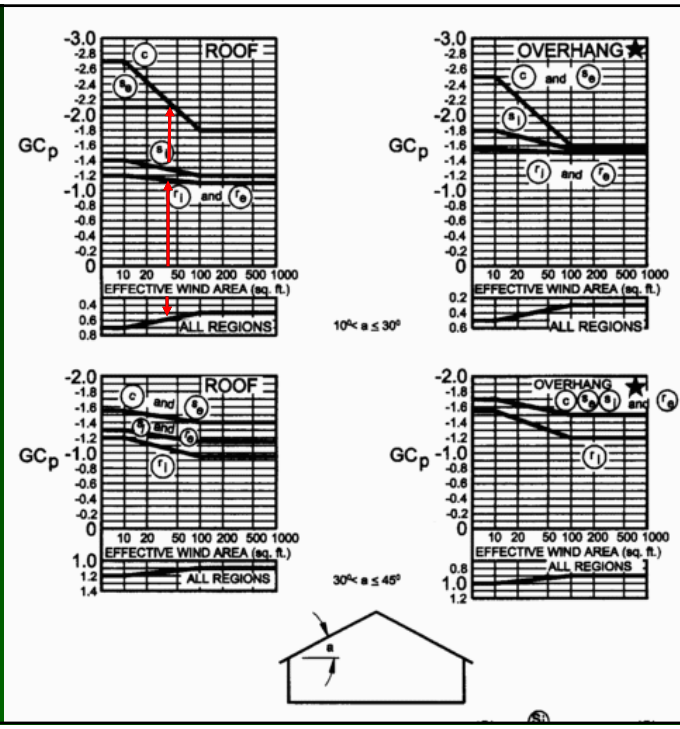


FIGURE 1606.2E
ROOF COEFFICIENTS, GC_p, COMPONENTS AND CLADDING
(ENCLOSED BUILDING)[3]
$10° < a \leq 45°$[5]



- **Solution:**
  - For interior zones (r_i, s_i)
    - r_i: GC_p = -1.1 or GC_p = + 0.6
    - s_i: GC_p = -1.3 or GC_p = + 0.6
  - For end zones (c, s_e,r_e)
    - c: GC_p = -2.1 or GC_p = + 0.6
    - s_e: GC_p = -2.1 or GC_p = + 0.6
    - r_e: GC_p = -1.1 or GC_p = + 0.6