

ANNEX “C”

LOAD ASSUMPTIONS - CHARACTERISTICS AND CALCULATION DATA

• Reference document: 3185-ET-US-B0102

C.1 – Raw Material Area Building (Building B1)

1. General Considerations

1.1 - Building characteristics

It's a steel building with horizontal dimensions of approx. 131m x 103m and columns height of 4.5m.

1.2 Lateral stability system

For lateral stability system it is considered:

- for the transverse direction: rigid frames in each axis
- for the longitudinal direction: bracing frames in each column row

2. Standards

NBR 8800: 2008. Associação Brasileira de Normas Técnicas. “Projeto de Estrutura de Aço e de Estrutura Mista de Aço e Concreto de Edifícios ”

NBR 6123: 1980. Associação Brasileira de Normas Técnicas “Forças devidas ao vento em edificações”

AISC–Steel Construction Manual – 2005 - 13^a edition

American Welding Society AWS D1-1 – “Structural Welding Code”

3. Materials

Plates: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled I Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Welded Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled Angle Shapes: ASTM A-36

Cold Formed Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

High Strength Bolts: ASTM A-325

Round Bars: ASTM A-36

Anchor Bolts: ASTM A-36

Concrete: $f_{ck} \geq 30$ MPa

4. Loads Assumptions

4.1 Dead Load:

- Self weight of steel structure and roof :35 kg /m²
 - Roof : 6 kg /m²
 - Purlins: 6 kg /m²
 - Rods: 1 kg /m²
 - Roof bracing: 2 kg /m²
 - Trusses Knee Braces: 2 kg /m²

- 17 kg /m²

- Trusses 12 kg /m²

- Steel Columns 6 kg /m²

- Siding 20 kg /m²

- Gutter + spout 100 kg /m

4.2 Live Load:

- Roof Live Load (minimum for Brazil):..... 25 kg /m²

- Gutter water: 150 kg /m

4.3 Wind Load: (in accordance with Brazilian standard NBR 6123)

- Basic wind speed – V_0 (Queimados region):..... 35 m/s

- Topographical factor - S_1 (function of the terrain relief) 1,0

- Height and Terrain roughness factor – S_2 0,84
 - Roughness class – IV (Industrial Area)
 - Considered height – 15m
 - Class – C (building length or width more than 50m)

- Statistics factor – S_3 (function of use) 1,0

- Characteristic wind speed - V_k - ($V_k = V_0 S_1 S_2 S_3$) 29,4 m/s

- Dynamic wind pressure - q ($q = 0,613 V_k^2$) 530 N/m²

- Pressure Coefficient – $C_p = C_{pe} - C_{pi}$

- External pressure coefficients - C_{pe}

C_{pe} (windward) = +0,7

C_{pe} (leeward) = -0,5

- Internal pressure coefficients - C_{pi}

C_{pi} = -0,3 or +0,2

4. Ambient Temperature Variation

Considered Ambient Temperature Variation = ± 30 ° C

C.2 – Crushers Area Building (Building B2)

1. Building characteristics

It's a Roof Steel Structure with horizontal dimensions of 103,0m x 20,9m.

2. Standards

NBR 8800: 2008. Associação Brasileira de Normas Técnicas. “Projeto de Estrutura de Aço e de Estrutura Mista de Aço e Concreto de Edifícios ”

NBR 6123: 1980. Associação Brasileira de Normas Técnicas “Forças devidas ao vento em edificações”

AISC–Steel Construction Manual – 2005 - 13^a edition

American Welding Society AWS D1-1 – “Structural Welding Code”

3. Materials

Plates: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled I Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Welded Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled Angle Shapes: ASTM A-36

Cold Formed Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

High Strength Bolts: ASTM A-325

Round Bars: ASTM A-36

Anchor Bolts: ASTM A-36

Concrete: $f_{ck} \geq 30$ MPa

4. Loads Assumptions

4.1 Dead Load:

- Self weight of steel structure and roof :35 kg /m²
- Roof : 6 kg /m²
- Purlins: 6 kg /m²
- Rods: 1 kg /m²
- Roof bracing: 2 kg /m²

- Trusses Knee Braces: $\frac{2 \text{ kg /m}^2}{17 \text{ kg /m}^2}$
- Trusses 12 kg /m^2
- Siding 20 kg /m^2
- Gutter + spout 100 kg /m

4.2 Live Load:

- Roof Live Load (minimum for Brazil):..... 25 kg /m^2
- Hanging Elements (lighting elements, water pipes, etc): 40 kg /m^2
- Gutter water: 150 kg /m

4.3 Wind Load: (in accordance with Brazilian standard NBR 6123)

- Basic wind speed – V_0 (Queimados region):..... 35 m/s
- Topographical factor - S_1 (function of the terrain relief) $1,0$
- Height and Terrain roughness factor – S_2 $0,84$
 - Roughness class – IV (Industrial Area)
 - Considered height – 15m
 - Class – C (building length or width more than 50m)
- Statistics factor – S_3 (function of use) $1,0$
- Characteristic wind speed - V_k - ($V_k = V_0 S_1 S_2 S_3$) $29,4 \text{ m/s}$
- Dynamic wind pressure - q ($q = 0,613 V_k^2$) 530 N/m^2
- Pressure Coefficient – $C_p = C_{pe} - C_{pi}$
- External pressure coefficients - C_{pe}
 - C_{pe} (windward) = $+0,7$
 - C_{pe} (leeward) = $-0,5$
- Internal pressure coefficients - C_{pi}
 - $C_{pi} = -0,3$ or $+0,2$

4.4 Ambient Temperature Variation

Considered Ambient Temperature Variation = $\pm 30^{\circ}\text{C}$

C.3 – Tower Building (Building B3)

1. General Considerations

1.1 Building characteristics

It's a steel building with horizontal dimensions of 49,74m x 15,45m and columns heights of 49,7m. At elevations 5,845m and 9,695m there are concrete slabs and at the other levels (15,945m; 22,045m; 25,8m; 31,795m and 39,195m) floor plate.

1.2 Lateral stability system

For lateral stability system it is considered:

- for the transverse direction: bracing frames in rows Ba e Bh and rigid frames in rows Bb to Bg.
- for the longitudinal direction: bracing frames in axis 31 and 33 and rigid frames in axis 32.

2. Standards

NBR 8800: 2008. Associação Brasileira de Normas Técnicas. “Projeto de Estrutura de Aço e de Estrutura Mista de Aço e Concreto de Edifícios ”

NBR 6123: 1980. Associação Brasileira de Normas Técnicas “Forças devidas ao vento em edificações”

AISC–Steel Construction Manual – 2005 - 13^a edition

American Welding Society AWS D1-1 – “Structural Welding Code”

3. Materials

Plates: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled I Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Welded Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled Angle Shapes: ASTM A-36

Cold Formed Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

High Strength Bolts: ASTM A-325

Round Bars: ASTM A-36

Anchor Bolts: ASTM A-36

- EL. 15,945m : floor plate 8mm..... 500 kg /m²
- EL. 9,695m : slab floor 20cm..... 500 kg /m²
- EL. 5,845m : slab floor 20cm..... 2000 kg /m²

4.3 Wind Load: (in accordance with Brazilian standard NBR 6123)

- Basic wind speed – V_0 (Queimados region):..... 35 m/s
- Topographical factor - S_1 (function of the terrain relief) 1,0
- Height and Terrain roughness factor – S_2 : 0,72 to 1,02 according to the level
 - Roughness class – IV (Industrial Area)
 - Considered height – 49,5m
 - Class B (building length or width less than 50m)
- Statistics factor – S_3 (function of use) 1,0
- Characteristic wind speed - V_k - ($V_k = V_0 S_1 S_2 S_3$) 29,4 m/s
- Dynamic wind pressure - q ($q = 0,613 V_k^2$)530 N/m²
- Pressure Coefficient – $C_p = C_{pe} - C_{pi}$
- External pressure coefficients - C_{pe}
 - C_{pe} (windward) = +0,7
 - C_{pe} (leeward) = -0,5
- Internal pressure coefficients - C_{pi}
 - $C_{pi} = -0,3$ or $+0,2$

4. Ambient Temperature Variation

Considered Ambient Temperature Variation = ± 30 ° C

C.4 – Presses Hall (Building B4)

1.0 General Considerations

1.1 Building characteristics

It's a steel building with horizontal dimensions of 113,8m x 19,05m and columns heights of 16,5m that supports a 20 ton crane.

1.2 Lateral stability system

For lateral stability system it is considered:

- for the transverse direction: rigid frames in each axis
- for the longitudinal direction: bracings frames in each column row

2. Standards

NBR 8800: 2008. Associação Brasileira de Normas Técnicas. “Projeto de Estrutura de Aço e de Estrutura Mista de Aço e Concreto de Edifícios ”

NBR 6123: 1980. Associação Brasileira de Normas Técnicas “Forças devidas ao vento em edificações”

AISC–Steel Construction Manual – 2005 - 13^a edition

American Welding Society AWS D1-1 – “Structural Welding Code”

3. Materials

Plates: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled I Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Welded Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

Rolled Angle Shapes: ASTM A-36

Cold Formed Shapes: ASTM A-572 Gr. 50 - $F_y \geq 345$ MPa – $F_u \geq 450$ MPa

High Strength Bolts: ASTM A-325

Round Bars: ASTM A-36

Anchor Bolts: ASTM A-36

Concrete: $f_{ck} \geq 30$ MPa

4.0 Loads Assumptions

4.1 Dead Load:

- Self weight of steel structure and roof :35 kg /m²
 - Roof : 6 kg /m²
 - Purlins: 6 kg /m²
 - Rods: 1 kg /m²
 - Roof bracing: 2 kg /m²
 - Trusses Knee Braces: 2 kg /m²
- 17 kg /m²
- Trusses 12 kg /m²
- Steel Columns 6 kg /m²
- Siding 20 kg /m²
- Gutter + spout + handrail 100 kg /m

4.2 Live Load:

- Roof Live Load (minimum for Brazil):..... 25 kg /m²
- Gutter water: 150 kg /m

4.3 Wind Load: (in accordance with Brazilian standard NBR 6123)

- Basic wind speed – V_0 (Queimados region):..... 35 m/s
- Topographical factor - S_1 (function of the terrain relief) 1,0
- Height and Terrain roughness factor – S_2 0,84
 - Roughness class – IV (Industrial Area)
 - Considered height – 20m
 - Class B (building length or width less than 50m)
- Statistics factor – S_3 (function of use) 1,0
- Characteristic wind speed - V_k - ($V_k = V_0 S_1 S_2 S_3$) 29,4 m/s
- Dynamic wind pressure - q ($q = 0,613 V_k^2$)530 N/m²

- Pressure Coefficient – $C_p = C_{pe} - C_{pi}$

- External pressure coefficients - C_{pe}

$$C_{pe} (\text{windward}) = +0,7$$

$$C_{pe} (\text{leeward}) = -0,5$$

- Internal pressure coefficients - C_{pi}

$$C_{pi} = -0,3 \text{ or } +0,2$$

4. Ambient Temperature Variation

Considered Ambient Temperature Variation = $\pm 30^\circ \text{C}$

