

### Floor Diaphragm Application (Cold-Formed Steel Framed Construction):

This document is intended to provide guidance for design of floor diaphragm systems utilizing MAXTERRA® MgO Non-Combustible Single Layer Structural Floor Panels and cold-formed steel framing. The values and design equations contained herein are based on testing of full-scale assemblies in accordance with ASTM E455 and AISI S907.

#### Design Requirements:

Diaphragm design must comply with the applicable requirements of IBC Chapter 16 and Chapter 22 for cold-formed steel light framed construction. The length to width aspect ratio must be no greater than 3:1 for simple beam diaphragms and no greater than 1:1 for cantilever diaphragm assemblies.

Diaphragm lateral load capacities are applicable when the lateral load is applied parallel to the framing members for simple beam diaphragms (Figure 1) and parallel or perpendicular to the framing members for cantilever diaphragms (Figure 2) as indicated in Table 1.

Diaphragm classification as flexible or rigid must be determined in accordance with Section 12.3.1 of ASCE 7.

Diaphragm boundary elements must be provided to transfer the design tension and compression forces. Design of the boundary elements must be performed by a Registered Design Professional and is outside of the scope of this document.

Diaphragm sheathing must not be used to splice boundary elements.

**TABLE 1 – Diaphragm Capacities**

Diaphragm Configuration	Load Direction	Max Support Framing Spacing (inches)	Required Blocking or Strapping	Max Fastener Spacing (inches)		Shear Strength (lb/ft)		
				Perimeter	Field	Ultimate Shear Strength ( $S_u$ )	LRFD Shear Strength ( $S_{LRFD}$ )	ASD Shear Strength ( $S_{ASD}$ )
Simple Beam (Figure 1)	Parallel to Framing	24	None	12	6	1607	965	574
Cantilever (Figure 2)	Parallel or Perpendicular to Framing	24	None	12	6	613	368	219

**For SI:** 1 inch = 25.4 mm, 1 lb/ft = 14.6 N/m

<sup>1</sup>  $S_{LRFD}$  utilizes a resistance factor,  $\phi$ , of 0.6 applied to the ultimate shear strength ( $S_u$ )

<sup>2</sup>  $S_{ASD}$  utilizes a safety factor,  $\Omega$ , of 2.8 applied to the ultimate shear strength ( $S_u$ )

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Simple beam diaphragm deflection must be calculated as follows:

$$\partial_{dia} = \left( \frac{0.624vL^3}{E_s A_c b} \right) + \left( \frac{0.50256vL}{Ga} \right) + 1.04986 \times 10^{-7} (v)^2$$

Where:

$\partial_{dia}$  = Total diaphragm deflection (in)

$v$  = Unit shear perpendicular to the direction of the applied load (lb/ft)

$L$  = Diaphragm length perpendicular to the direction of the applied load (feet)

$b$  = Diaphragm depth parallel to the direction of the applied load (feet)

$A_c$  = 0.3398in<sup>2</sup> (minimum gross cross-sectional area of diaphragm chord member)

$E_s$  = 29,500,000 psi (Modulus of Elasticity of diaphragm chord member)

$G_a$  = 76,809 lb/in (apparent shear modulus)

Cantilever diaphragm deflection must be calculated as follows:

$$\partial_{dia} = \left( \frac{8vL^3}{E_s A_c W} \right) + \left( \frac{vL}{Ga} \right)$$

Where:

$\partial_{dia}$  = Total diaphragm deflection (in)

$v$  = Unit shear perpendicular to the direction of the applied load (lb/ft)

$L$  = Diaphragm length perpendicular to the direction of the applied load (feet)

$W$  = Diaphragm width parallel to the direction of the applied load (feet)

$A_c$  = 0.3398in<sup>2</sup> (minimum gross cross-sectional area of diaphragm chord member)

$E_s$  = 29,500,000 psi (Modulus of Elasticity of diaphragm chord member)

$G_a$  = 25,659 (apparent shear modulus)

**Note:** unit conversions have been accounted for in the equation above

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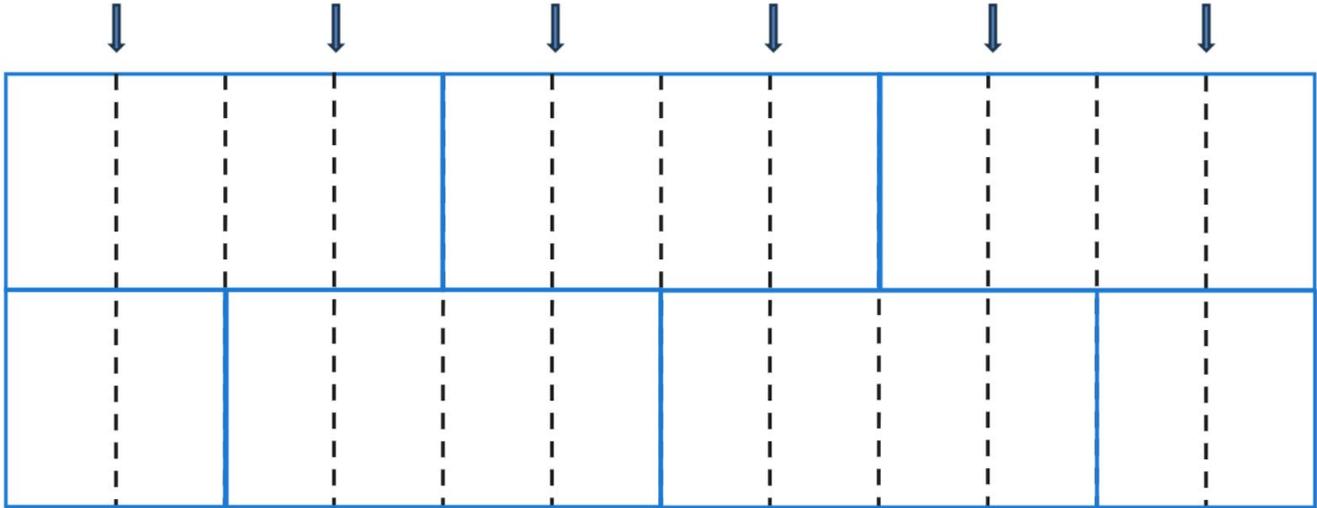


FIGURE 1 - Simple Beam Diaphragm Configuration For Load Applied Parallel To Joists

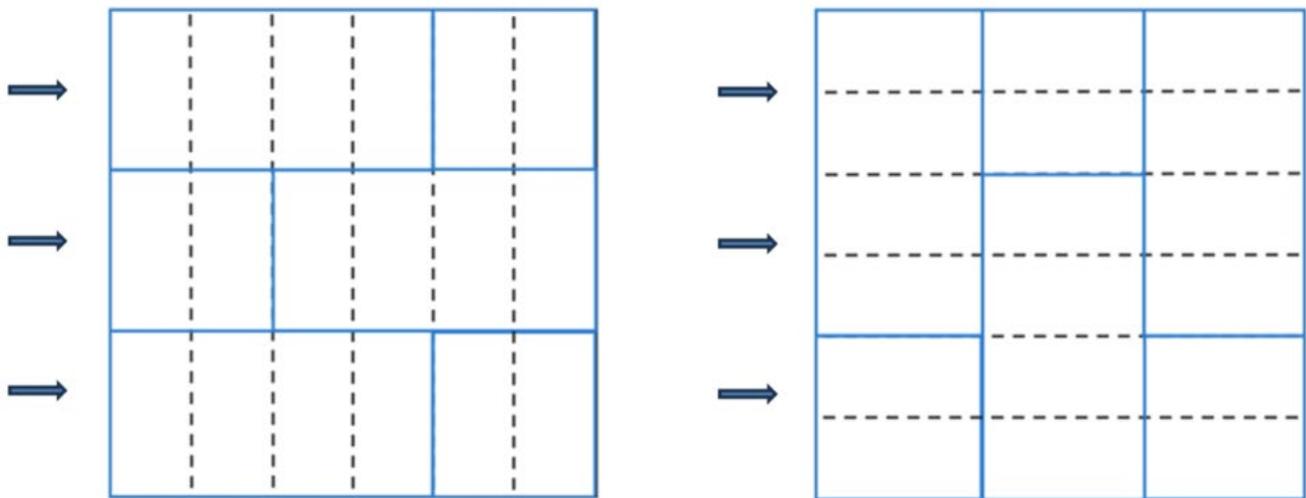


FIGURE 2 - Cantilever Diaphragm Configuration For Load Applied Perpendicular To Joists (Left) And Parallel To Joists (Right)

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### General Installation Requirements:

Floor framing must be supported on a foundation that is uniform and level. Additional framing must be provided under partitions running parallel to the framing members and around all openings that interrupt one or more framing members.

Web stiffeners must be provided at reaction points and / or at locations of concentrated loads as specified in the approved plans, if applicable. End blocking must be provided where ends of joists are not otherwise restrained from rotation.

The MAXTERRA® MgO Non-Combustible Single Layer Structural Floor Panels must be installed with the smooth side up (printed side facing down). The panels must be fitted together such that the tongue and groove features are fully interlocked with one another. The joists must be spaced no greater than 24-inches (610 mm) on center. Square edges (edges without tongue and groove) must be located over framing members. MAXTERRA® MgO Non-Combustible Single Layer Structural Floor Panels edges that are not supported by the tongue and groove profile must be supported by blocking.

When blocking is required at the abutting edges of the panels, it must be centered under the panel joints. All blocking or bridging for the framing must be installed prior to installation of the MAXTERRA® MgO Non-Combustible Single Layer Structural Floor Panels.

The sheathing must be cut as needed to the proper length and width in accordance with the installation instructions. All cut-outs located at panel ends and edges that exceed 6 inches in any direction must be supported by framing.

MAXTERRA® MgO Non-Combustible Single Layer Structural Floor Panels must be oriented with the tongue and groove edge installed perpendicular to the joists with the sheathing joints staggered 4 ft (1.22m) as shown in Figure 1 and Figure 2.

### Trusses:

The truss components must be formed from Grade 50 steel with a minimum base thickness of 43 mils [0.043 inch (1.09 mm)], a minimum depth of 3.25 inches (83 mm), and a minimum flange width of 1.625 inches (41 mm). The minimum truss depth must be 12 inches (305 mm). Trusses must be placed at a maximum spacing of 24-inches (610 mm) on center. The floor truss must be designed by a registered design professional, and the trusses must be fastened to the supporting walls or structure in accordance with the approved plans.

### Fastening:

Panels must be fastened to CFS framing with Grabber Construction Products, Inc.'s #8-18 x 1-5/8" (41 mm) long GCH8158LG fasteners (ESR-4223) fasteners. Fasteners must be spaced 6-inches (152.4 mm) on center along the perimeter and 12-inches (304.8 mm) on center in the field of the panel. A ½-inch (12.7 mm) edge distance must be maintained along the panel edges, and no fasteners may be placed within 2 inches (50.8 mm) of a panel corner.

For additional product information, please visit [www.nexgenbp.com/resources](http://www.nexgenbp.com/resources).