TRICEL HONEYCOMB

Exhibit and Museum

SPECIFICATIONS

Design Data for Honeycomb Sandwich Panels

This section presents design criteria for structural sandwich panel constructions under various types of loading. Detailed design procedures are presented for determining deflections of sandwich panels or beams and buckling of sandwich columns and simply supported panels under edge loadings. Also included are formulas for calculating facing stresses and core shear stresses.

A structural sandwich is a layered construction formed by bonding two thin facings to a thicker core. The basic design concept is to space strong thin facings far enough apart with a thick core to assure the combination will be stiff, to provide a core that is stiff and strong enough to hold the facings flat with an adhesive layer, and to provide a core material of sufficient shearing resistance. The structural sandwich panel is analogous to an I-beam, with the facings carrying compression and tension loads, as do I-beam flanges, and the core material carrying shear loads, as does the I-beam web.

The American society for Testing Materials under their classification ASTM C274-53 defines a structural sandwich as follows: “A laminar construction comprising a combination of alternating dissimilar simple or composite materials assembled and intimately fixed in relation to each other so as to use the properties of each to attain specific structural advantages for the whole assembly.”

In conventional beam formulas for maximum deflection the product of the moment of inertia **I** and the modulus of elasticity **E** is the measure of stiffness and is expressed as the composite term **EI**. Honeycomb type core contributes nothing to the stiffness of a sandwich construction other than to make the two faces function as a unit. The stiffness, **EI**, of a given construction is therefore based entirely upon the physical properties and dimensions of the two faces.

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Design Example

In order to illustrate a design procedure, consider a floor panel f sandwich construction. The panel will be simply supported on both ends with a span of 8 feet and a width of 4 feet. Design load to be 40 pounds per square foot and a maximum deflection of 1/360, or .267". The facings are to be 3/8" plywood having a modulus of elasticity of 1,500,000 psi and a compressive design stress of 1,200 psi. The core will be Tricel Honeycomb, 3/8-60-60-15%, 2½" thick having a maximum longitudinal shear of 68.2 psi and a shear modulus of 6940 psi.

Consulting Table 1 (page 3), the conditions of the example are met by using the corresponding value for Kb and Ks in formula (3):

DEFLECTION:

$$y = \frac{5Pa^3}{384D} + \frac{Pa}{8N}$$

$$D = \frac{E_b f(c+f)^2 b}{2}$$

$$D = \frac{1.5 \times 10^6 (.375)(2.5 + .375)^2 48}{2} = 111.59 \times 10^6$$

$$N = G_c(C + f)b$$

y = .132" + .017" = .149"
allowable = .267"

$$y = \frac{5(1280)96^3}{384(111.59 \times 10^6)} + \frac{1280(96)}{8(9.57 \times 10^5)}$$

y = .132" + .017" = .149"
allowable = .267"

FACING STRESS:

$$F = \frac{2M}{f(h+c)b}$$

Where: $M = \frac{Pa}{8} = \frac{1280(96)}{8} = 15{,}360$

$$F = \frac{2(15{,}360)}{.375(3.25 + 2.5)48} = 297 \text{ psi}$$

allowable = 1200 psi

CORE SHEAR STRESS:

$$S = \frac{2V}{(h+c)b}$$

Where: $V = \frac{P}{2} = \frac{1280}{2} = 640$

$$S = \frac{2(640)}{(3.25 + 2.5)48} = 4.64 \text{ psi}$$

allowable = 68.2
Safety factor = 18

The above example is typical for a sandwich panel produced by Tricel under the tradename of Trideck. Trideck is specifically designed for use in trade show exhibits as flooring for a double deck or raised platform. In accordance with the design, structural members to support the Trideck system need only be located for a full 8 foot span thus saving many dollars for materials, erection and dismantling labor. The Trideck system of sandwich panels have been proven to be successful and cost effective for more than 200 custom designed exhibits by several different exhibit builders. For more information on Trideck contact Tricel Corporation.

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Table 1 – Sandwich Beam Loading

LOADING	BEAM ENDS	DEFLECTION AT	K_B	K_S
Uniformly distributed	Both simply supported	mid-span	5/384	1/8
Uniformly distributed	Both clamped	do	1/384	1/8
Concentrated at mid-span	Both simply supported	do	1/48	1/4
Concentrated at mid-span	Both clamped	do	1/192	1/4
Concentrated at Outer quarter points	Both simply supported	do	11/768	1/8
Concentrated at Outer quarter points	Both simply supported	load point	1/96	1/8
Uniformly distributed	Cantilever, 1 free, 1 clamped	free end	1/8	1/2
Concentrated at free end	do	do	1/3	1

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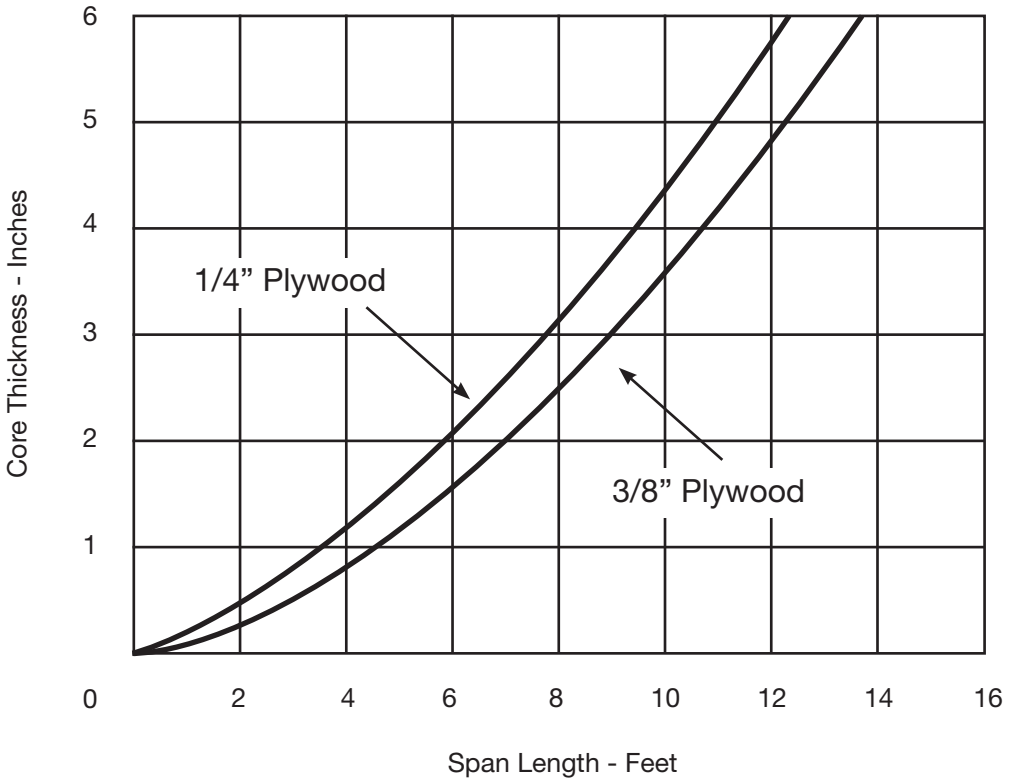
Graph 1 – Plywood Facings



CORE THICKNESS VERSUS SPAN - PLYWOOD FACINGS

Core Material: 3/8”–60–60–15%

Uniform Load: 40 lbs./sq.ft.

Panel Width: 4 ft.

Panel Deflection: L/360th Span

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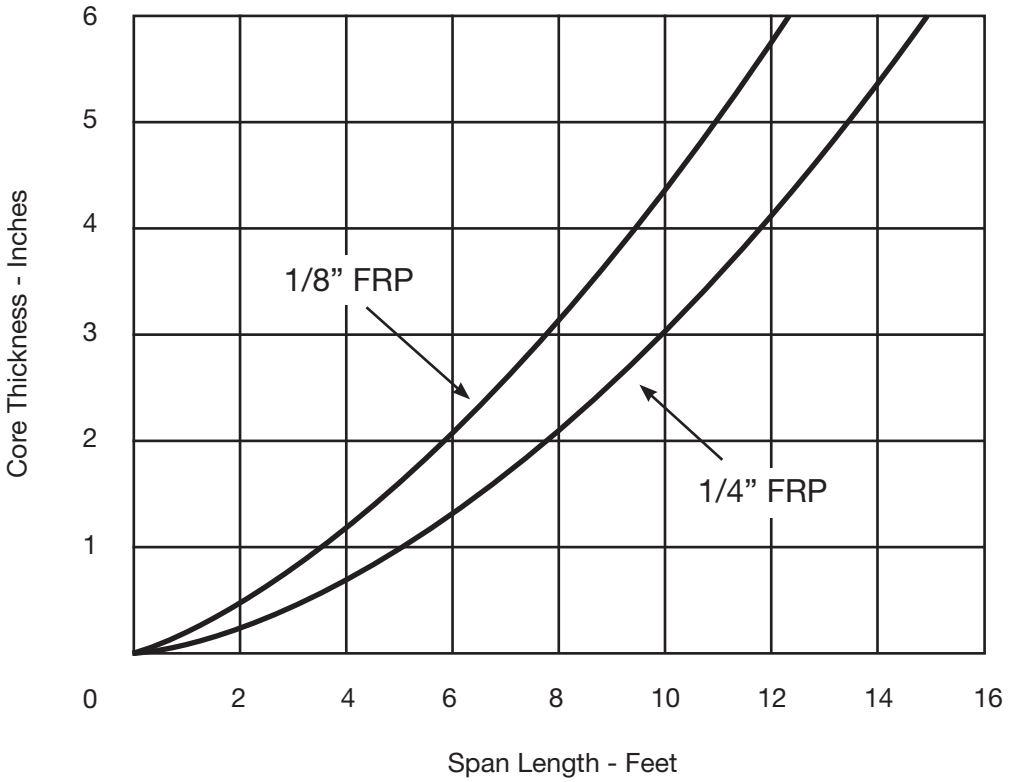
Graph 1 – FRP FACINGS



CORE THICKNESS VERSUS SPAN - FRP FACINGS

Core Material: 3/8-60-60-15%

Uniform Load: 401lbs. / sq. ft.

Panel Width: 4 ft.

Panel Deflection: 1/360th Span