

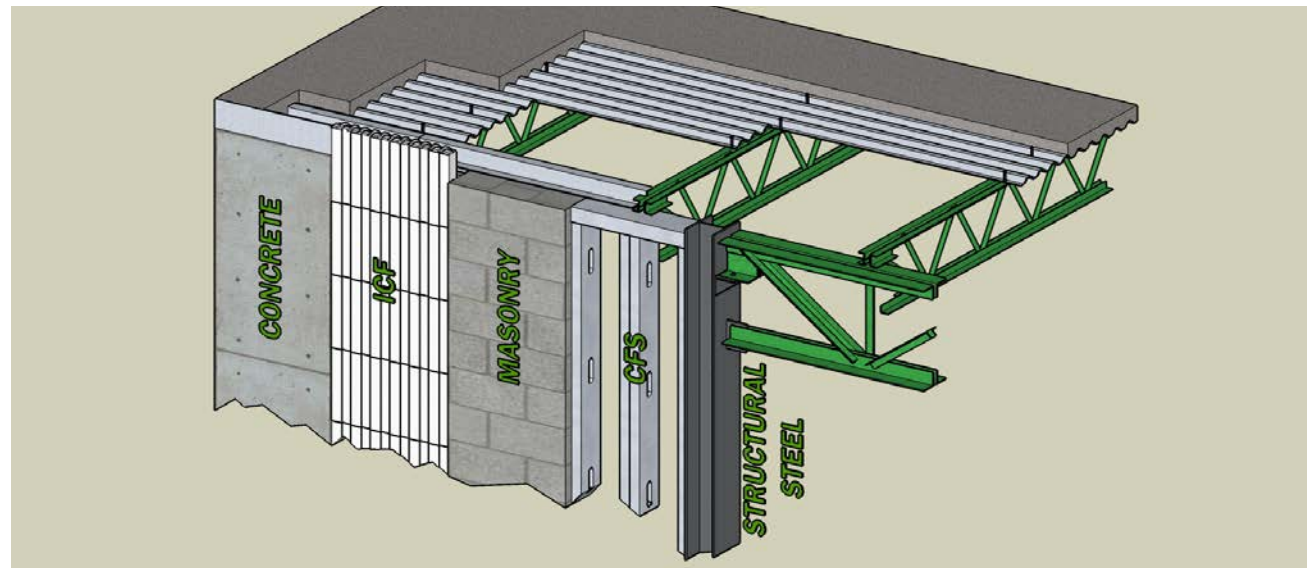
The *ECOSPAN*[®] Composite Floor System



The **ECOSPAN**[®] Composite Floor System

The **ECOSPAN**[®] Composite Floor System is an *innovative, simple, effective and economical* method of providing all steel, open web structural components for elevated floor construction while incorporating the benefits of lighter weight composite design.

ECOSPAN[®] requires only a nominal 3 inch thick, 3000 psi concrete slab.



The open web configuration and 48" o.c. joist spacing allows HVAC and electrical design flexibility. **ECOSPAN**[®] requires no stripping of formwork and no shoring.

The *ECOSPAN*[®] Composite Floor System

Consider the Advantages:

- ✓ Ecospan is an effective and economical solution for constructing residential and commercial floor systems.
- ✓ Erection is safe, easy, and cost effective. There are no short deck sheets, plywood forms or shoring; sub-trades can normally continue construction the day after the concrete is placed.
- ✓ Floor to floor heights can often be decreased due to the inherent ability to pass mechanical ducts, piping, conduit, etc. through the open web design.
- ✓ High strength to weight ratio of composite steel joists allows for greater spans and spacing with lighter members.
- ✓ Weight savings due to composite joist design reduces building weight and allows foundation and wall costs to be reduced.
- ✓ Constructed with non-combustible materials, achieving multiple UL Fire Rating listings with gypsum board, acoustical ceilings, or spray applied fire resistant materials.
- ✓ The Ecospan Composite Floor System has a Sound Transmission Classification (STC) of 57 and meets or exceeds Impact Insulation Classification (IIC) requirements of the IBC for residential and commercial construction with commonly used sound attenuation materials.

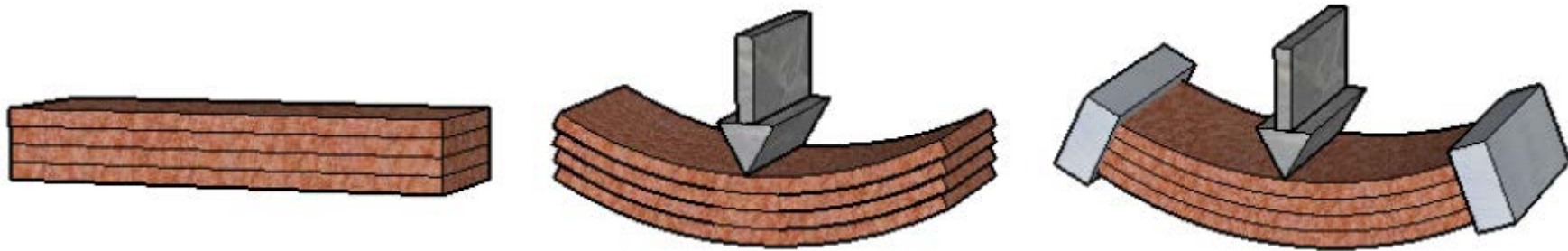
The *ECOSPAN*[®] Composite Floor System

Environmental Advantages:

- ✓ The Ecospan Composite Floor System may contain a significant portion of recycled material which may be beneficial in achieving environmental certification, such as LEED, for your project. Please contact your Ecospan representative or visit: www.Nucor.com/responsibility/sustainability/compliance/leed/ for recycled

Basic Design Philosophy

Load carrying capacity of joist and slab acting separately is less than when acting together



As a composite section, compression is carried by the concrete and tension by the bottom chord, maximizing the effective depth and increasing the capacity of the floor system.

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Composite Joist

Steel joists and concrete used in composite construction act as a unit creating an assembly that is stronger than each of the materials acting independently. As seen in Figure 2-3, the effective depth (d_{eff}) of the composite section is larger than the non-composite section because the post composite compression forces are resisted by the concrete, not the top chord of the joist. Flexural strength of the assembly is increased proportionally with the increase in d_{eff} . This increase allows longer spans for the same total framing depth.

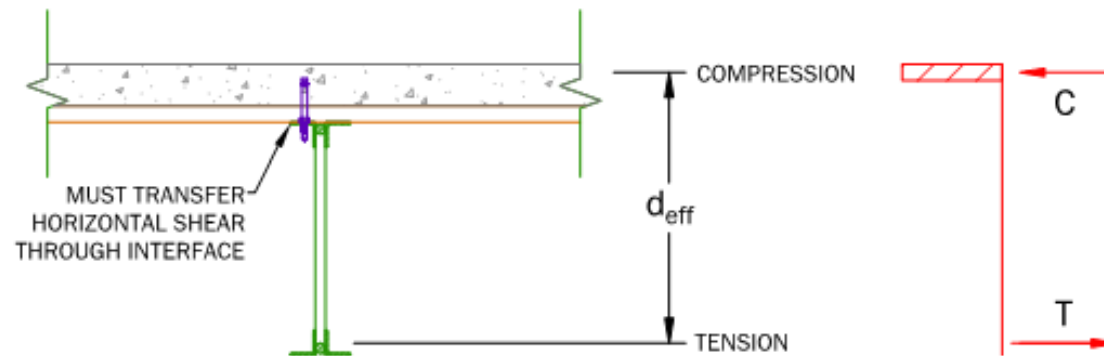


Figure 2-3: Composite Joist Effective Depth (d_{eff})

FORCE DIAGRAM

2.3.1 Development of Composite Action

The equal and opposite forces acting in the concrete and bottom chord of the joist create a couple to resist the bending moment in the section. However, there must be a mechanism to transfer this horizontal shear force between the concrete and steel sections.

The Ecospan[®] Composite Joist System utilizes the **Shearflex[®] stand-off screw** to transfer the horizontal shear forces from the joist top chord into the concrete. The Shearflex[®] screws are installed into the top chord of the joist through the steel deck and cast into the concrete slab.

The ECOSPAN[®] Composite Floor System

Joist Span Capacity

Ecospan[®] composite floor joists are designed to meet the requirements specified in the Contract Documents. Information supplied by the Design Professional via the Design Parameters Checklist for E-series Joists (see Section 2.6) will be used by Vulcraft Engineers to design E-series joists and develop placement plan.

E-series joists are capable of reaching a span-to-depth ratio of $l/d \leq 30$ and still meet the serviceability requirements of most floors.

$$\text{span to depth } (d) \leq \frac{L}{30} = \frac{\text{span (inches)}}{30}$$

E-Series Joist Maximum Span Chart (ft)						
Typical Loading	Residential Loading			Commercial Loading		
	Total Load = 112 PSF Live Load = 55 PSF NC Dead Load = 42 PSF Composite Dead Load = 15 PSF			Total Load = 158 PSF Live Load = 100 PSF NC Dead Load = 43 PSF Composite Dead Load = 15 PSF		
Depth (in)	On Center Joist Spacing					
	4'-0"	4'-6"	5'-0"	4'-0"	5'-0"	6'-0"
Typical Loading (plf)	448/220/60	505/248/68	560/275/75	632/400/60	790/500/75	948/600/90
10E	25'	25'	25'	25'	21'	17'
12E	30'	30'	30'	30'	25'	21'
14E	35'	35'	35'	35'	29'	24'
16E	40'	40'	39'	37'	33'	27'
18E	45'	44'	42'	39'	35'	31'
20E	50'	47'	44'	41'	37'	32'
22E	52'	49'	46'	43'	38'	33'
24E	54'	51'	48'	45'	40'	36'
26E	57'	53'	50'	47'	41'	38'
28E	59'	55'	52'	49'	43'	39'
30E	60'	57'	54'	50'	45'	41'

Notes:

1. Assumed 36/4 attachment pattern
2. Assumed 1.0C24 (3.5" total) for Residential
3. Assumed 1.5VL22 (4.0" total) for Commercial
4. Joists ranging from 10"-14" deep are assumed rod web joists, while joists 16"-30" may be crimped or uncrimped angle web joists

Table 2-2

Typical ECOSPAN[®] System

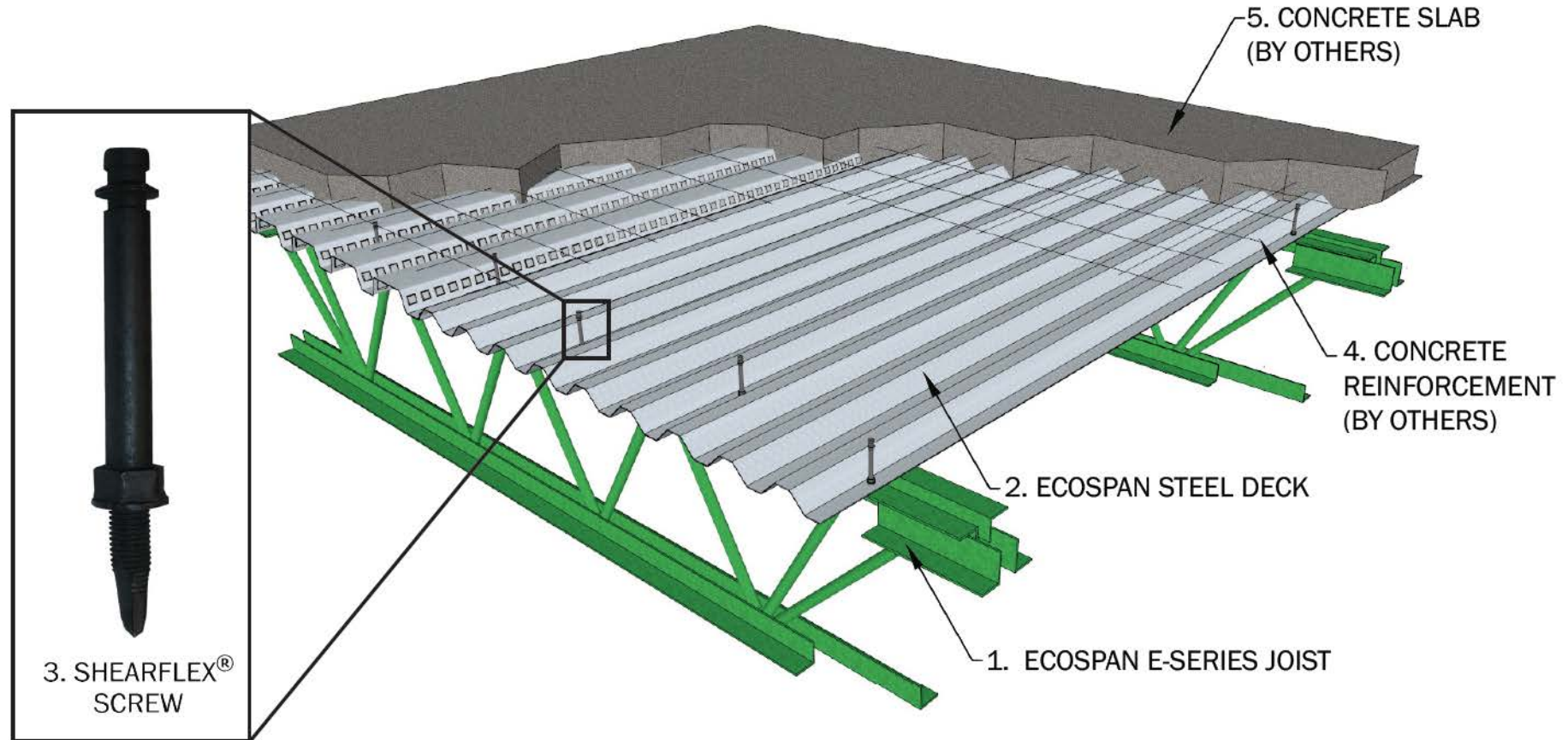


Figure 1-1: The Ecospan[®] Composite Floor System

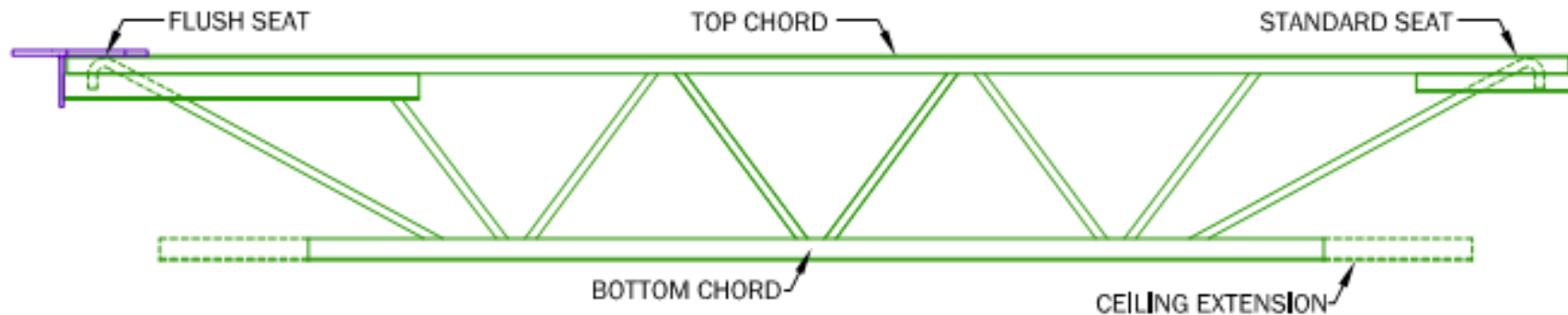
Components of *ECOSPAN*[®]

- E-series Open Web Joist
- Bridging
- Steel Deck:
 - non composite - 1.0C
 - OR
 - Composite - 1.5VL, 2VL, 3VL
- Closures:
 - ✓ Pourstop
 - ✓ Z-Closure
 - ✓ Cell Closure
 - ✓ E-Closures
- Shearflex HD Screw (self-drilling, self-tapping)
- Drill Bolt (1/4" self-drilling, self-tapping)
- TeK Screws (#10,#12, etc.)

The *ECOSPAN*[®] Composite Floor System

E-series Open Web Joist:

E-Series joists are detailed and produced using the same practices and base materials that Vulcraft uses to produce K-series or CJ-series joists. The top and bottom chords are double angles and the web members are either solid rounds, crimped or uncrimped angles, or solid rectangular stock depending on the joist span, joist depth and supported loads. Figure 3-1 below illustrates the typical configuration of E-series joist utilizing a flush seat on the left end and an extended bearing seat on the right. Design Professionals should be familiar with the standard nomenclature used to specify and detail open-web joists, as the E-series permits a larger range of seat configurations and bearing conditions.



The *ECOSPAN*[®] Composite Floor System

Joist Bearing Conditions/Supporting Members:

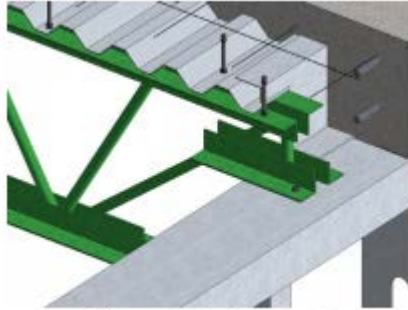


Figure 3-2: CFS Bearing

Cold-Formed Steel Studs (CFS)

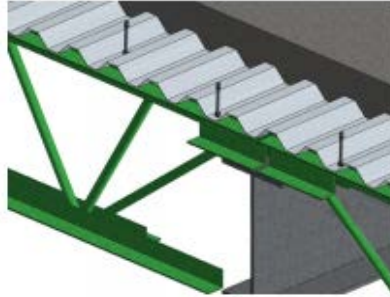


Figure 3-3: Steel Bearing

Standard Seat on Structural Steel

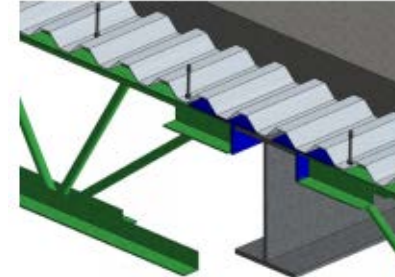


Figure 3-4: Flush Seat

Flush Seat on Structural Steel

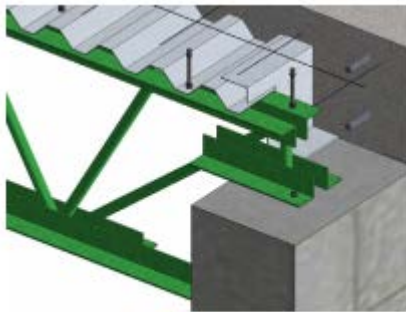


Figure 3-5: CMU/Masonry Bearing

Grouted CMU

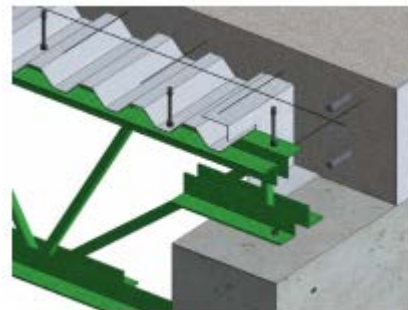


Figure 3-6: Concrete Bearing

Concrete

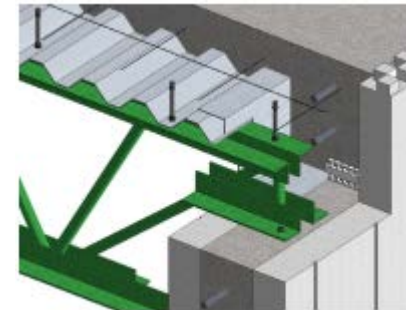


Figure 3-7: ICF Bearing

Insulated Concrete Forms (ICF)

ECOSPAN[®] Joist

E-Series Joist Bearing Seat Configurations:

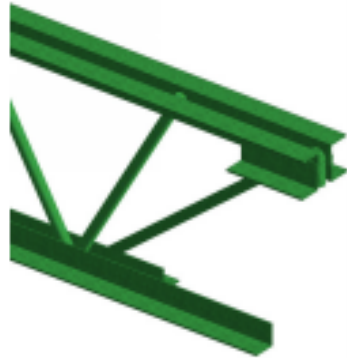


Figure 3-2: Standard Bearing Seat



Figure 3-3: Extended Bearing Seat



Figure 3-4: Gapped Bearing Seat

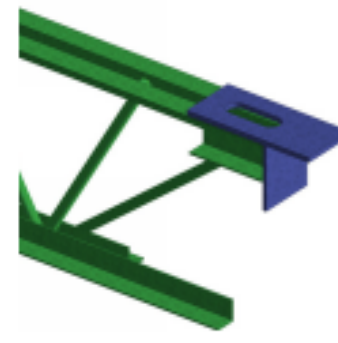


Figure 3-5: Flush Bearing Seat

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Bridging

Installation - Bridging

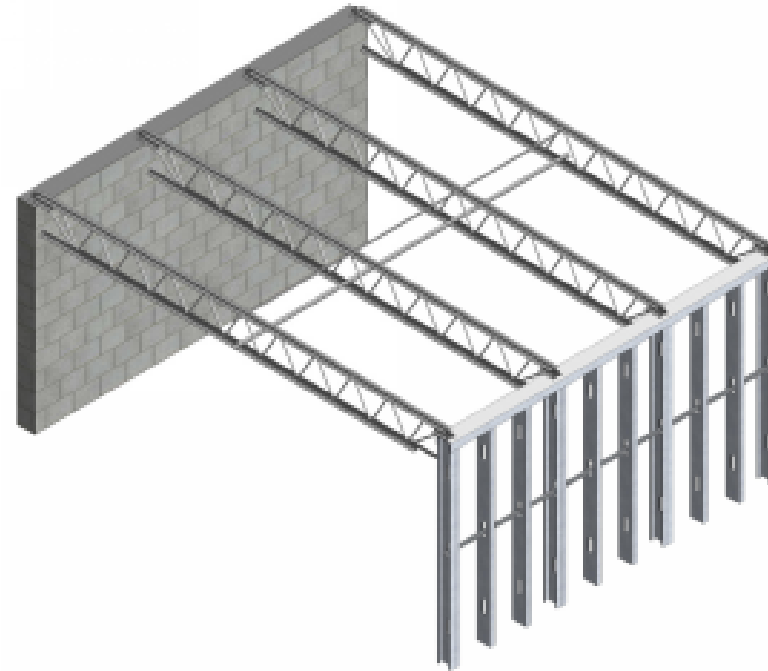
Bolted/Screwed Horizontal & Diagonal Bridging:

Snug tighten bolted/Screwed horizontal and diagonal bridging.

Welded Horizontal Bridging: Lap bridging a minimum of 3 inches. Connect bridging to joist with a minimum of 1/8 inch fillet weld 1/2 inch long. Use drops where possible.

Welded Diagonal Bridging: Weld at intersection with a minimum 1/8 inch fillet weld 1 inch long or equivalent.

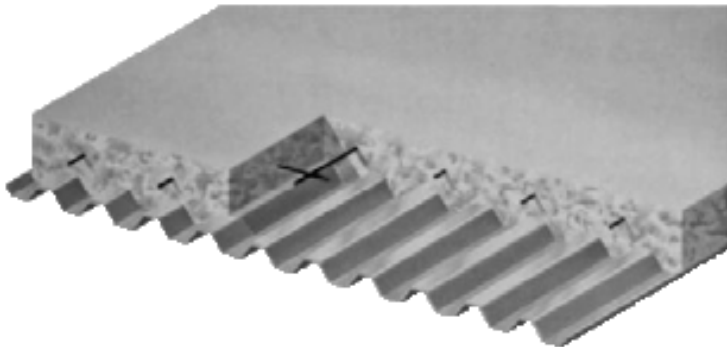
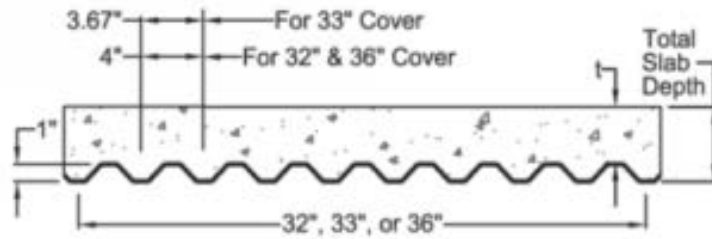
Typically (1) or (2) rows of bridging will be required per bay. Locate bridging as shown on the Field Use Erection Drawings. If more than one row is required, locate bridging equally spaced along the joist.



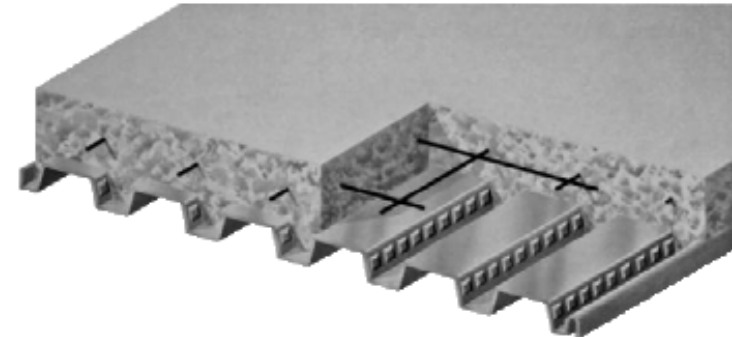
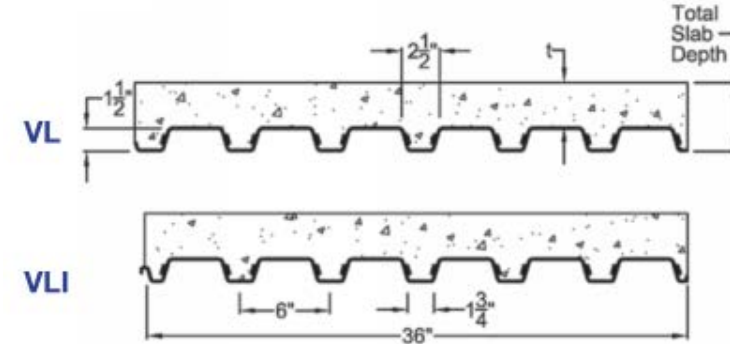
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Deck Types

1.0C Conform Deck

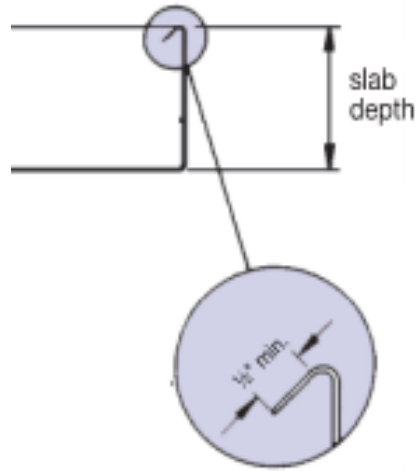


1.5 VL, VLI Composite Deck

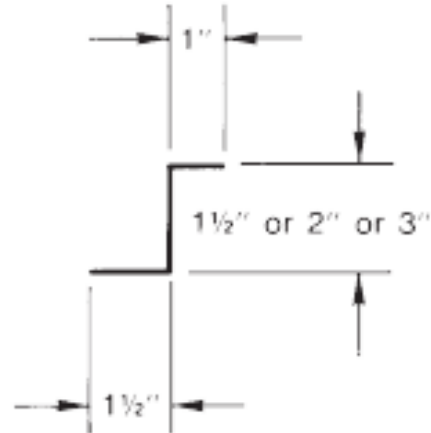


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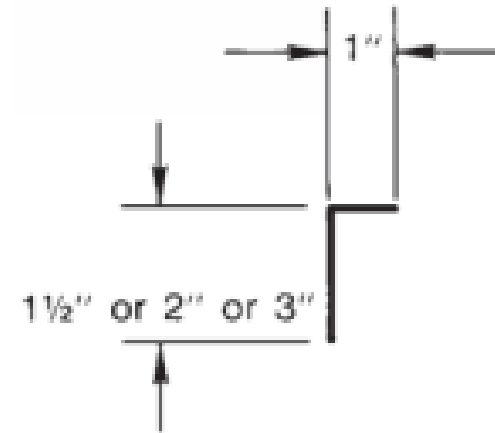
Closures



Pour Stop



Z-closure



Cell Closure

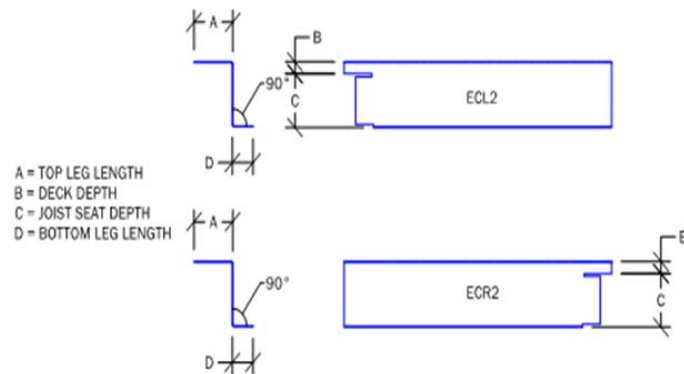


Figure 3-31: E-Closure Details

E-closure

The *ECOSPAN*[®] Composite Floor System

Shearflex[®] HD Screw

- ✓ Self-drilling and self-threading stand-off screw
- ✓ Dual process heat treated
- ✓ Installs with standard screw gun in approximately 8 seconds
- ✓ 5/16" diameter
- ✓ Capacity depends on chord thickness
- ✓ Uniform pattern typically utilized



The *ECOSPAN*[®] Composite Floor System

- ✓ Provides multiple Fire Ratings for 1, 2, & 3 hours.

UL Fire Ratings

The Ecospan[®] Composite Floor System is listed by Underwriters Laboratories Inc. with multiple Fire Ratings for Acoustical and Gypsum ceiling applications. The most common UL codes encountered in construction utilizing the Ecospan[®] Composite Floor System are listed with bold type in Table 4-1. Figures 4-1 through 4-2 illustrate examples of fire rated assemblies.

UL Fire Ratings	
UL Code	Application
*Design No. G561	Direct Applied and/or Suspended Gypsum Board Ceiling
Design No. G213	Suspended Acoustical Ceiling
Design No. G227	Suspended Acoustical Ceiling
*Design No. G229	Suspended Acoustical Ceiling
Design No. G236	Suspended Acoustical Ceiling
Design No. G243	Suspended Acoustical Ceiling
Design No. G222	Suspended Gypsum Board Ceiling
Design No. G547	Suspended Gypsum Board Ceiling
*Design No. G710	Spray-on Fire Proofing
Design No. N789	Spray-on Fire Proofing
*Design No. D902	Unprotected Comp. Deck in Corridor Areas
*Design No. D916	Unprotected Comp. Deck in Corridor Areas
Design No. D918	Unprotected Comp. Deck in Corridor Areas
Design No. D919	Unprotected Comp. Deck in Corridor Areas

*Most commonly utilized UL Ratings

Table 4-1

The *ECOSPAN*[®] Composite Floor System

- ✓ Helps form the LDM, the concrete Load Distribution Member.

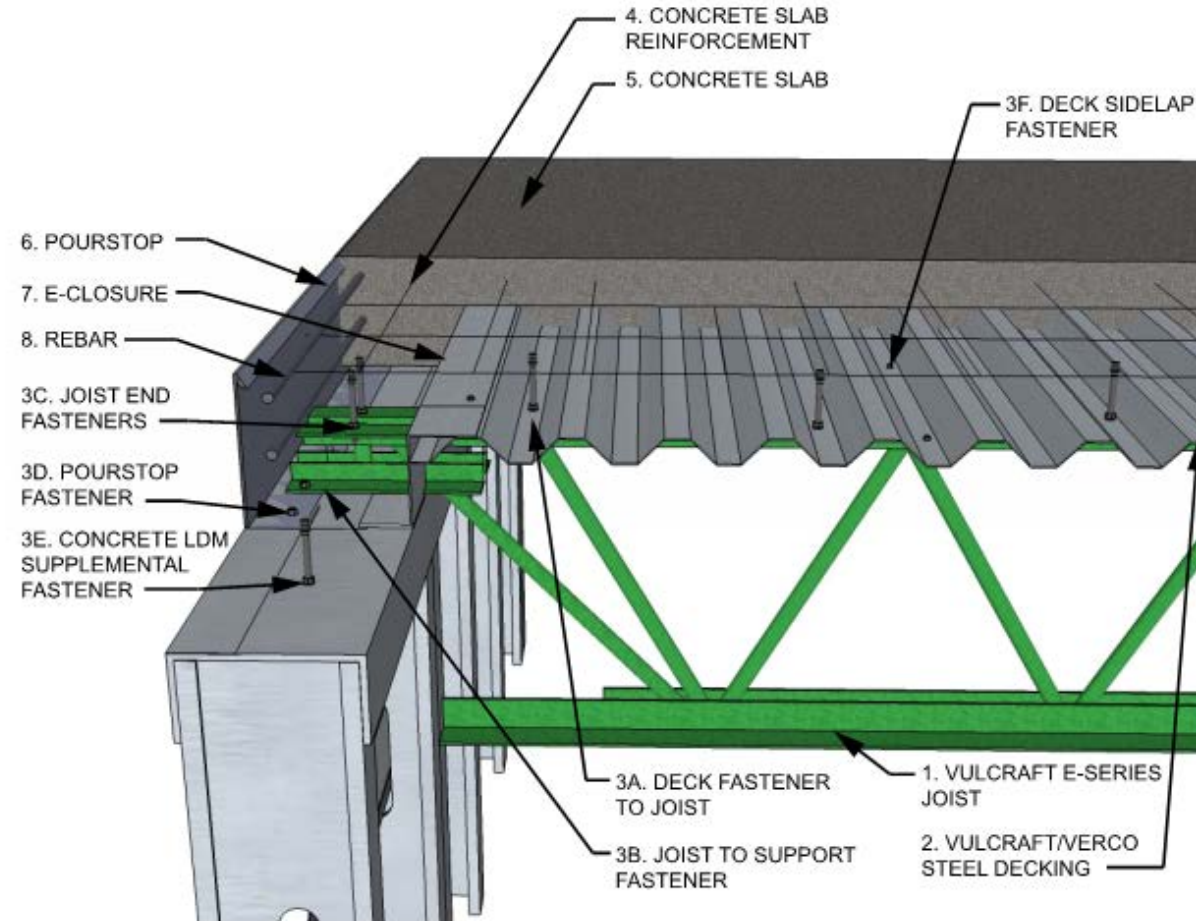
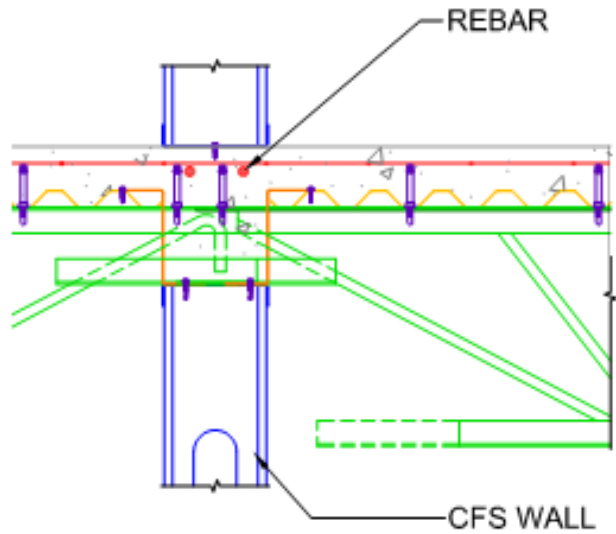


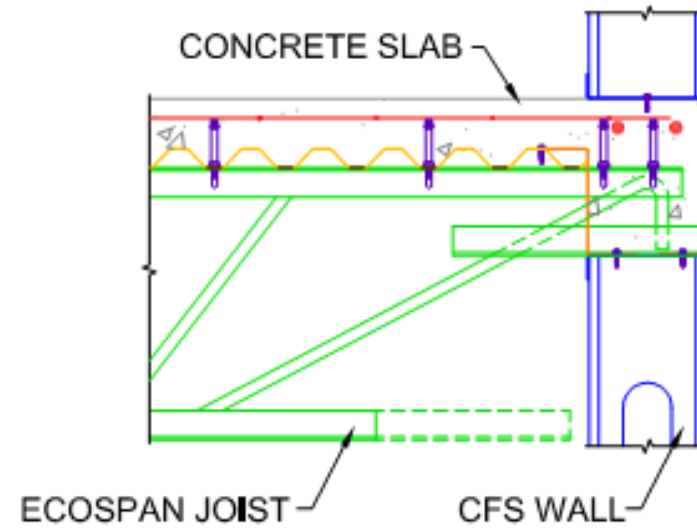
Figure 1-1 Ecospan[®] System Components and LDM Components

The *ECOSPAN*[®] Composite Floor System

The LDM can be used:



Here at the interior...



Or here at the exterior.

The concrete load distribution member is formed through the use of the two E-closures or Z-closures at the interior bearing walls or the E-closure and the pour stop at the exterior bearing wall. The standard assembly of Ecospan[®] components creates a 6 inch x 8 inch continuous concrete form which when properly detailed, reinforced and filled with concrete creates the concrete load distribution member.

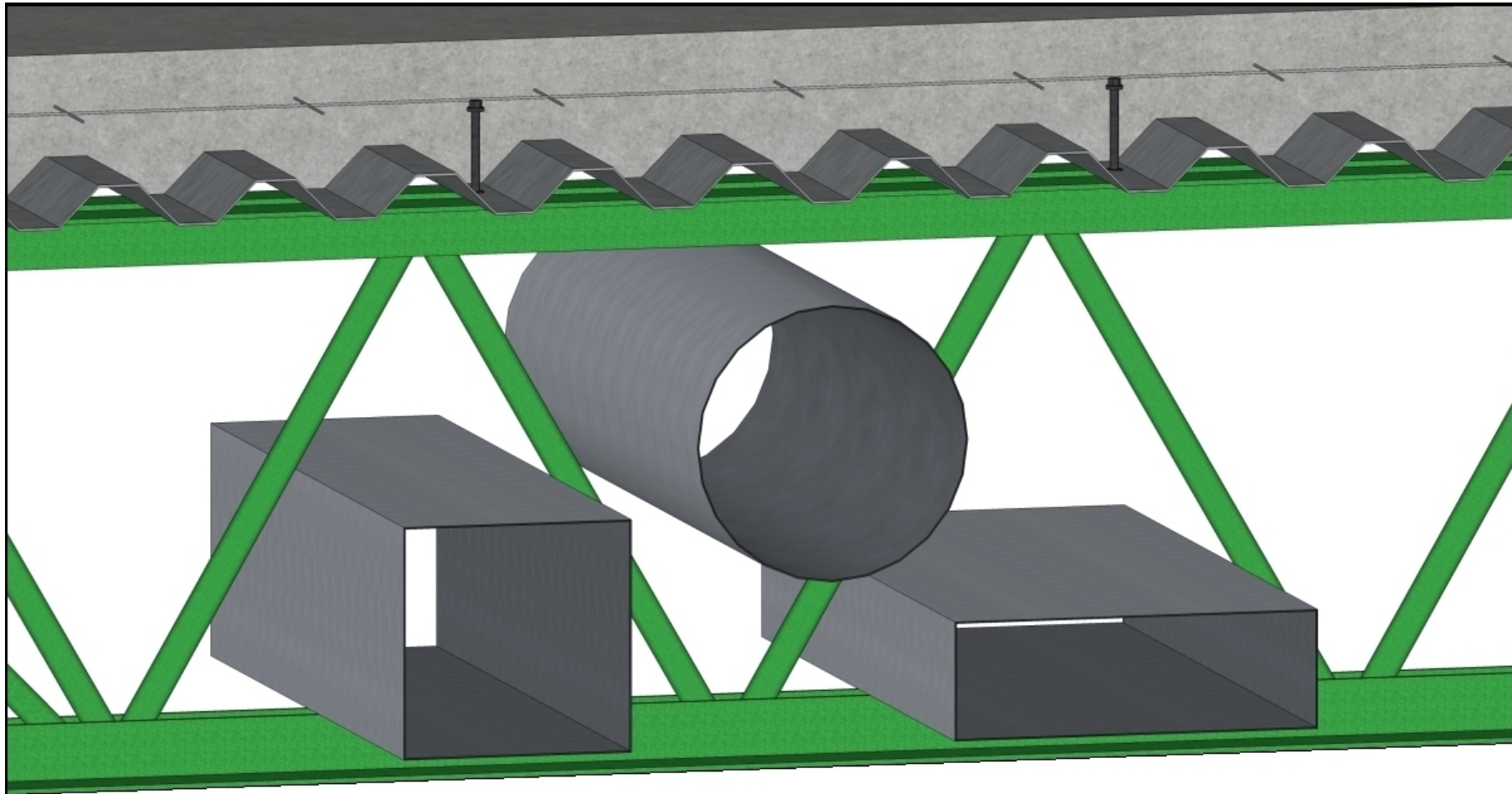
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The Concrete LDM Structural Benefits:

- ✓ A concrete load distribution member is a structural element that doles out vertical floor or roof loads. LDMs deliver these gravity loads to supporting load bearing CFS studs without requiring alignment of the bearing wall framing components. This saves time and coordination efforts for panelized or field framed structures.
- ✓ The LDM provides redundancy and structural robustness not available in standard CFS bearing wall construction. By engaging additional load paths, the LDM provides maximum structural benefits resulting in the framing economies for CFS bearing walls. Design and construction professionals will have greater flexibility in the placement of joist and wall stud framing from level to level.
- ✓ The slab and concrete LDM are poured monolithically and provide a seamless transition for gravity and lateral forces.
- ✓ The LDM also provides a solid barrier to help with sound attenuation and serves as a fire wall.

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Open Plenum for MEP



The *ECOSPAN*[®] Composite Floor System

Ideal for MEP Placement Within Plenum Space



The *ECOSPAN*[®] Composite Floor System

TYPICAL USAGE:

- ✓ Apartments & Condominiums
- ✓ Senior Living & Eldercare Facilities
- ✓ Student Housing & Schools
- ✓ Hotels & Resort Buildings
- ✓ Military Housing & Facilities
- ✓ Office Buildings
- ✓ Medical Facilities
- ✓ Mezzanines



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Design Manuals

