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BUILDING SYSTEMS

Optimized Steel Deck Design

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AIA Provider Number: 40107447
AIA Course Number: 2021

Learning Objectives

At the conclusion of this course, you will be able to:

- Explain steel deck production basics, the range of steel deck types, their profiles and features
- Explain steel deck design terminology and design criteria
- Discuss ways to optimize steel deck design to enhance architectural aesthetic goals, building performance and total project cost control
- Discuss the role of steel deck detailing, examples of the deck detailing process, meeting Factory Mutual Global (FMG) requirements, and Underwriter's Laboratory (UL) requirements.

This course will introduce steel deck production methods, review the range of steel deck types, their commonly used profiles, and their distinguishing features. We will explain the terms used for specifying steel decking and their definitions. We will also discuss the contributions steel decking can make to a building's aesthetics, structural performance, and overall project cost reduction. Lastly, we will look closely at the role of the steel deck detailer, the deck detailing process and its value to a project.

Course Outline

- **Deck Production, Types, Profiles and Features**
  - Deck production
  - Types of steel deck, profiles and features
- **Steel Deck Design Terminology and Criteria**
  - Steel deck design terminology
  - Steel deck design criteria
- **Optimizing Steel Deck Design**
  - Architectural aesthetic goals
  - Structural performance and cost
- **Steel Deck Detailing**
  - The role of steel deck detailing
  - Examples of steel deck detailing
  - Factory Mutual Global requirements
  - Underwriter's Laboratory requirements

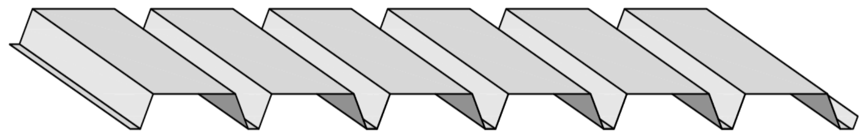

Deck Production, Types,
Profiles and Features

Deck Production

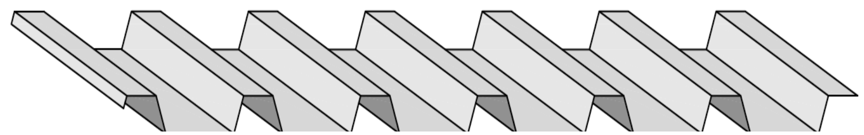
Steel deck is made by cold forming structural grade sheet steel into a repeating pattern of parallel ribs. The strength and stiffness of the panels are a result of the shape of the ribs and the material properties of the steel.

Types of Steel Deck

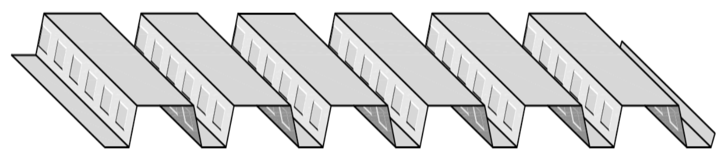
Roof Deck



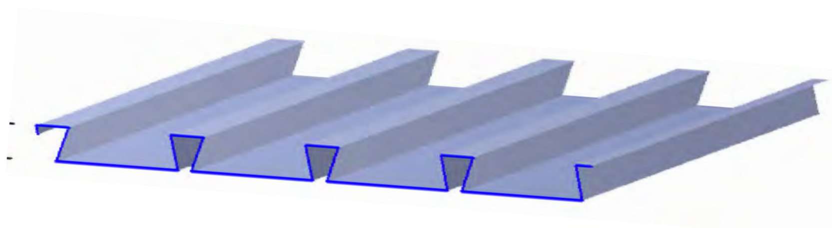
Form Deck



Composite Deck



Specialty Deck



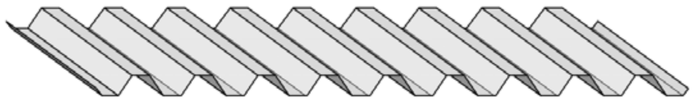
Four types of steel decking are erected widely in the non-residential steel construction market. These are roof deck, form deck, composite deck, and specialty deck.

Roof Deck

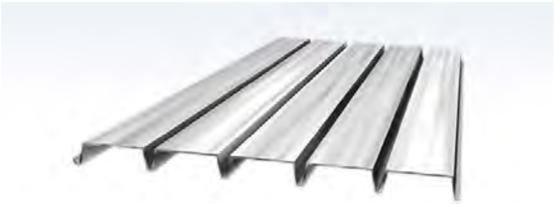
More than just a roof, a steel roof deck is the basis upon which the roofing system is dependent. The design-engineering objective is to structurally support the required loads as well as the roofing membrane system specified by the designer, while meeting the aesthetic objectives and cost control interests of the building owner and appointed architect.

Types of Roof Deck

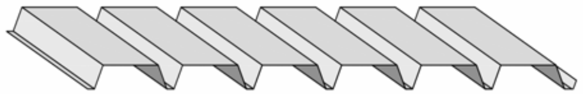
1.0 Roof Deck



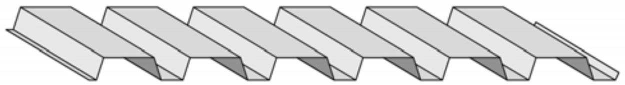
Type A Roof Deck
Narrow Rib 1.5" Deep



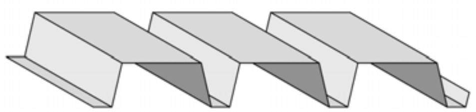
Type F Roof Deck
Intermediate Rib 1.5" Deep



Type B Roof Deck
Wide Rib 1.5" Deep



Type N Roof Deck
3" Deep Rib



To address these objectives, various types of roof deck and attachment methods have evolved – and continue to evolve.

1.0 roof deck provides a minimum of one-inch thickness to incorporate rigid roofing insulation. This profile is an economical option for applications where structural spacing is small.

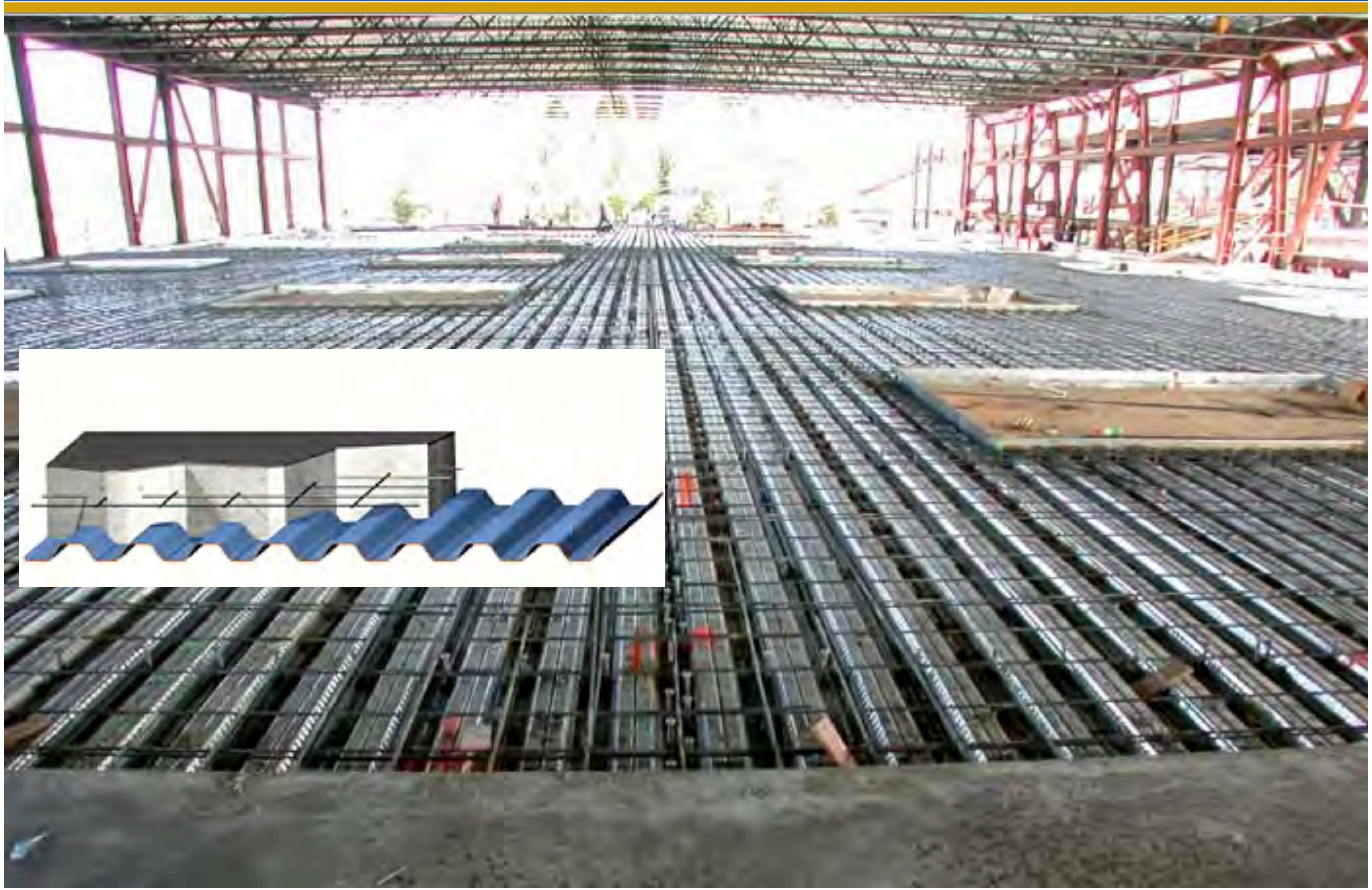
Type A roof deck features a narrow rib to accommodate the most economical, thinner insulation materials. It will provide a maximum top surface contact area for thinner, rigid insulation boards.

Type F roof deck is a cost-saving choice when the application calls for reduced insulation. When rigid insulation is used with F deck, a minimum 1" thickness is required. The flute openings permit easy attachment of the deck to the supporting structural members.

Type B roof deck with wide rib offers the best balance of strength and economy of all the 1½" deep roof decks. When rigid insulation is used with B deck, a minimum 1" thickness is required.

Type N roof deck with 3" deep rib supports the wider spacing of supporting members, so long as the spacing is within the limits of the maximum construction span.

Form Deck

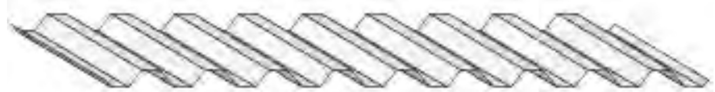


Steel form deck is used as a form to hold poured concrete. The form becomes a permanent steel base for the cured concrete floor slabs and requires no form removal costs. The installation of this type of deck is fast, easy and economical. Unlike composite deck however, it adds no strength to the concrete slab.

Types of Form Deck

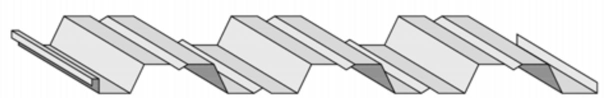
9/16” Form Deck

1” Form Deck

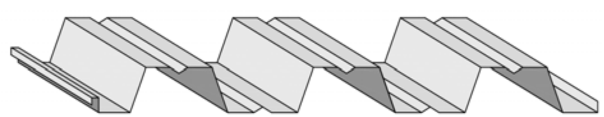


1.5” Form Deck

2.0” Form Deck



3.0” Form Deck

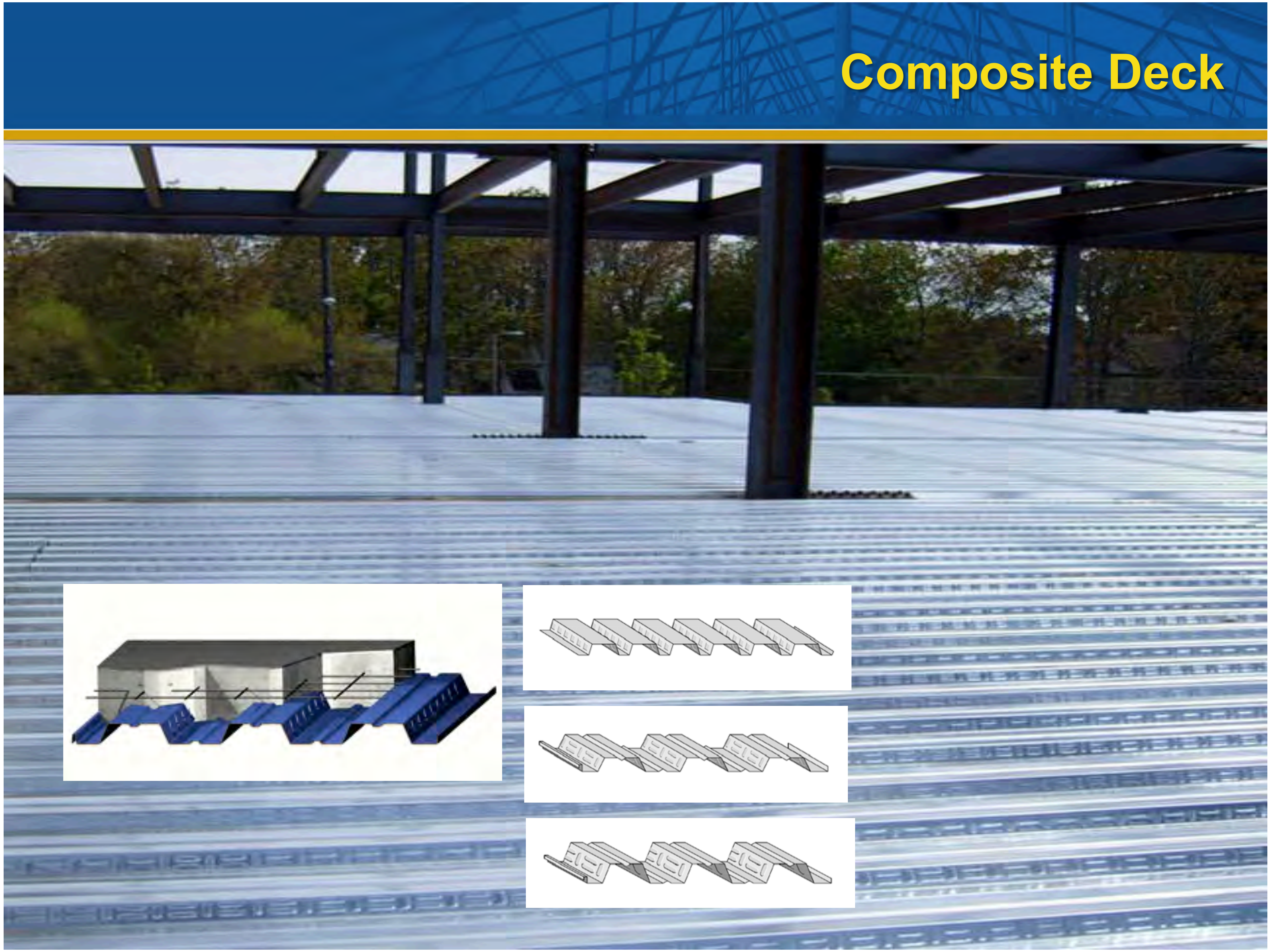


Steel form deck profiles are available in various depths. All are used extensively in floor and roof construction as an economical way to support concrete slabs during construction. Specifying form deck helps eliminate the need for expensive temporary shoring. However, a related cost consideration is the spacing of structural members: The deeper the decking, the wider the spacing of the structural members.

For 1.5” deep form deck, the structural members can be spaced up to 10’ 2” on center.

For 2” deep form deck, the structural members can be spaced up to 14’ 4” on center.

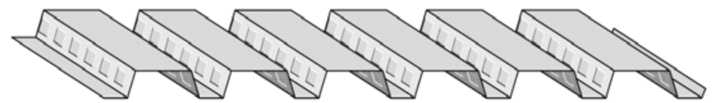
For 3” deep form deck, the structural members can be spaced up to 16’ 11” on center.



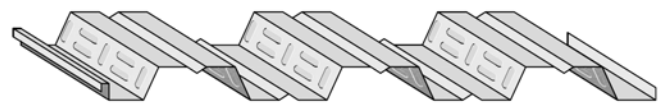
The difference between composite deck and form deck is simple. Composite deck has embossments in the vertical ribs that bond with the concrete slab to develop a composite floor system. The system also includes shear studs installed and supplied by others, to provide a composite floor system that allows for the loads to be transferred into the steel frame. Once the concrete cures, the resulting composite floor system provides superior strength and stiffness. Alternatively, form deck serves to support the poured concrete, but it does not have embossments for bonding with the cured concrete.

Types of Composite Deck

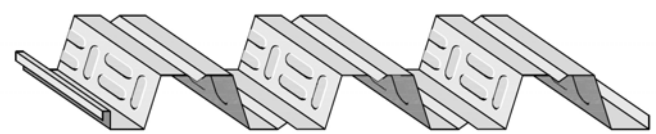
1.5” Composite Deck



2.0” Composite Deck



3.0” Composite Deck



Composite deck profiles range in depth from 1.5 inches to 2 inches, to 3 inches.

1.5” composite deck enables the designer to space the structural members to over 11’-0” on center without additional shoring.

2.0” composite deck enables the designer to space the structural members to over 14’-0” on center without additional shoring.

3.0” composite deck enables the designer to space the structural members to over 16’-0” on center without additional shoring.

Specialty Deck

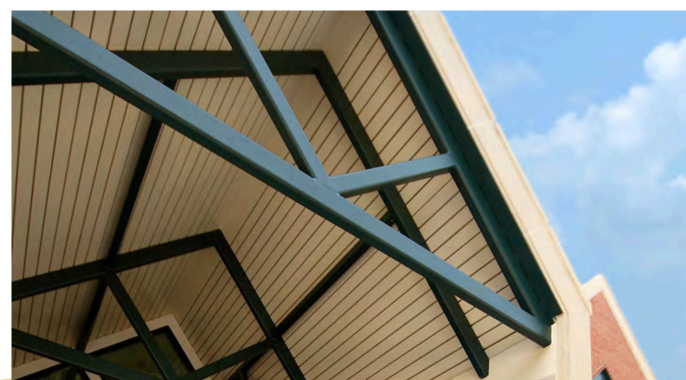
Specialty decks cover a wide variety of deck types, profiles, depths and combinations. These types of decks have been developed to provide owners and architects a broader pallete for more aesthetic, architectural roof and floor design options. So not all deck manufacturers carry these profiles and some specialize in this product line. It is best to contact your nearest deck manufacturer or supplier to see if they carry the desired type.

Types of Specialty Deck

Cellular Deck

Long Span Deck

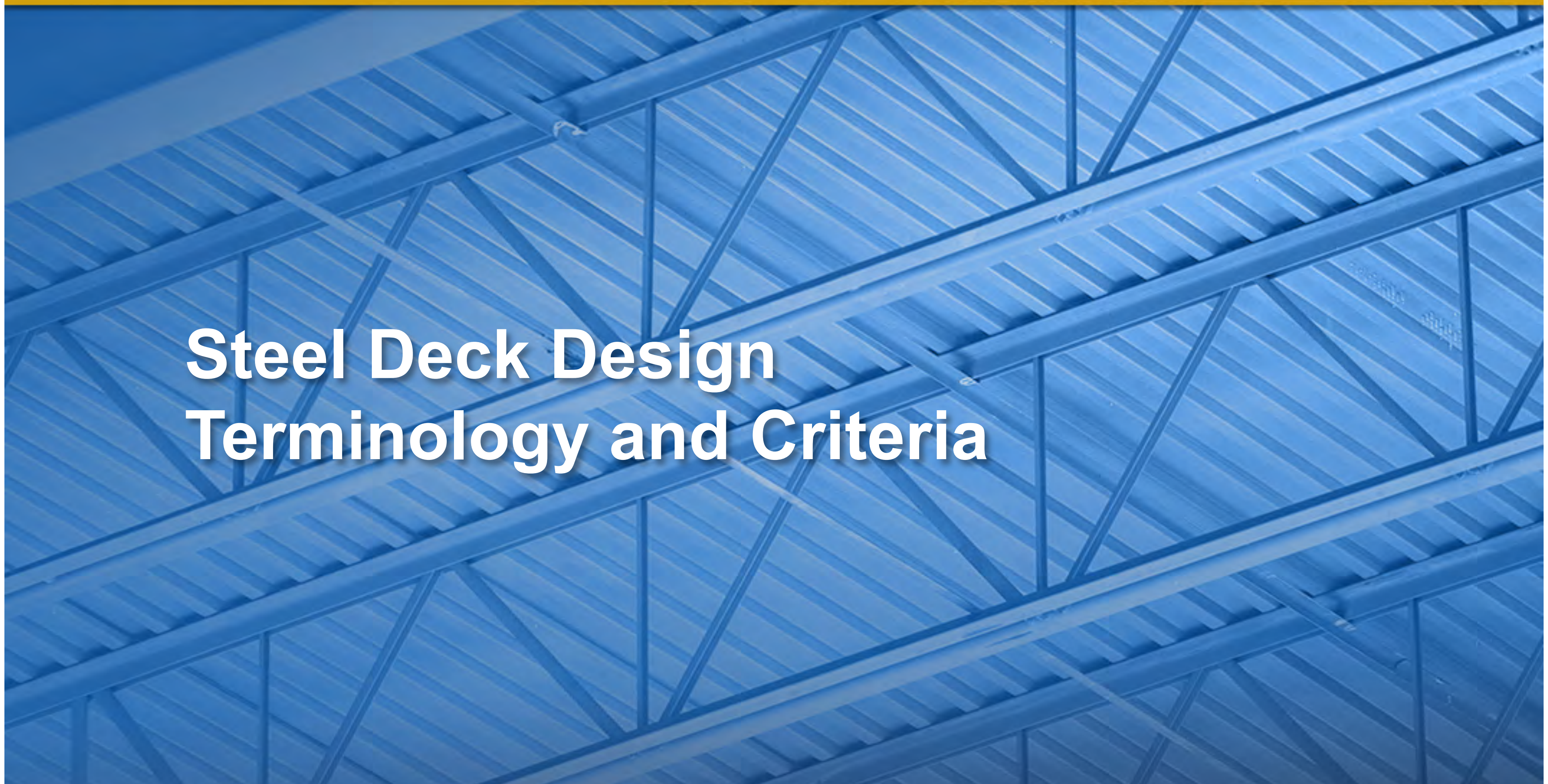
Dovetail Deck



Cellular decks are manufactured with a flat bottom plate with or without perforations for sound absorption. They are attached to a wide range of top profiles and profile depths. The bottom plate provides an aesthetically pleasing flat surface for use in finished exposed applications. These decks are used for non-composite and composite floor slab designs, as well as roof applications.

Long span decks have a deep profile for larger support spacing. These decks are available with or without perforations for sound absorption and as cellular or non-cellular profiles.

Dovetail decks are also called reentrant decks, because they provide an aesthetically pleasing surface for use in finished exposed applications. Dovetail decks can also span longer distances. These decks are available for use in composite floor slab designs, as well as roof applications. Dovetail roof decks are available with or without perforations for sound absorption.



Steel Deck Design Terminology and Criteria

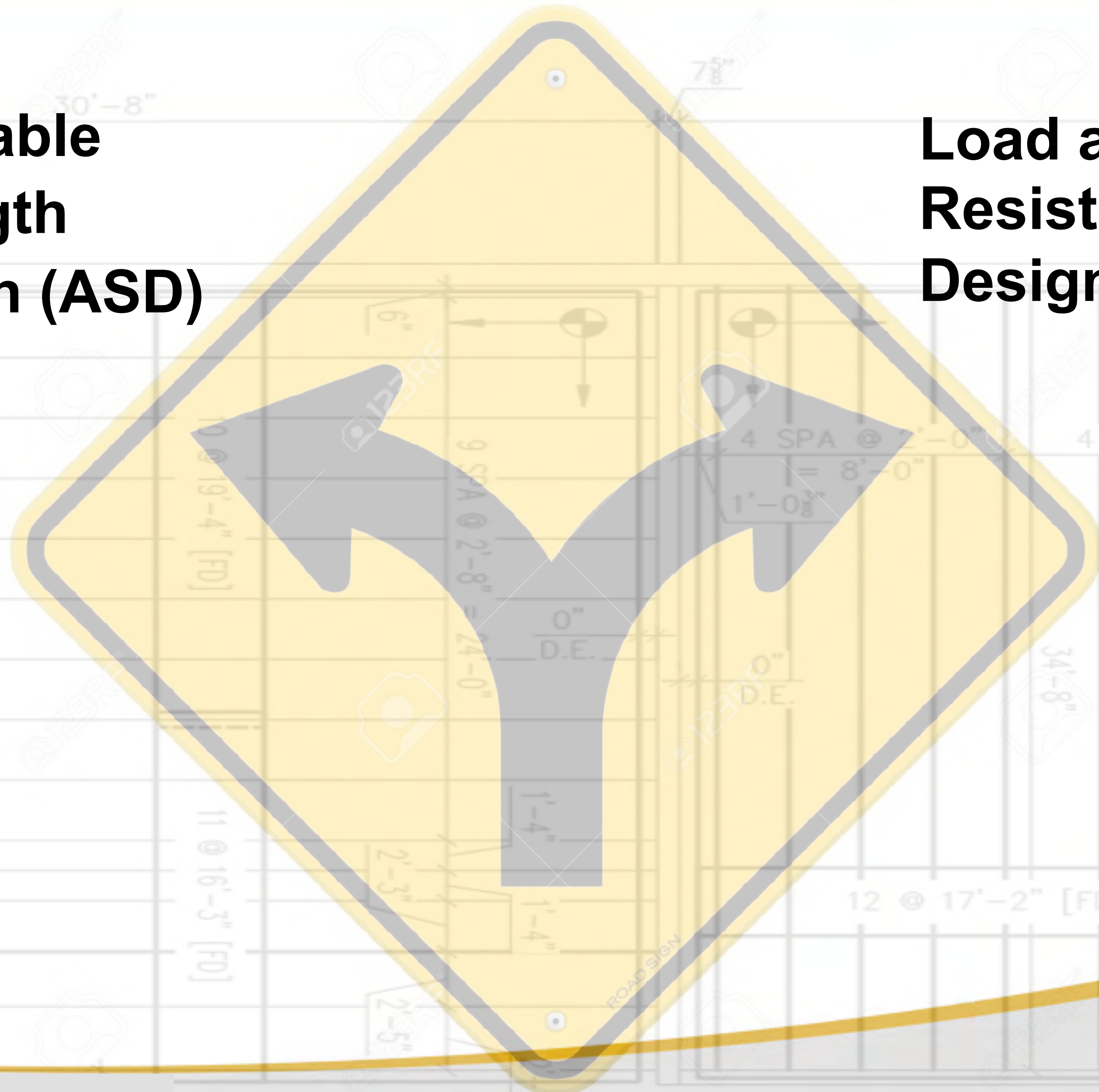
Steel Deck Terminology

- Allowable Strength Design (ASD)
- Load and Resistance Factor Design (LRFD)
- Building Codes
- Diaphragm
- Deflection
- Bending
- Design Strength
- Fastening
- Finish
- Maximum Construction Span
- Uniform Load
- Yield Strength
- Maximum Unshored Span
- Factory Mutual Span

As you would expect, many of the terms used for steel deck design relate to structural considerations. Industry codes and standards often address these terms to foster construction that is reliable and safe. An introduction to each of these terms will give the foundation for learning a range of deck design criteria.

Terminology

Allowable Strength Design (ASD)



Load and Resistance Factor Design (LRFD)

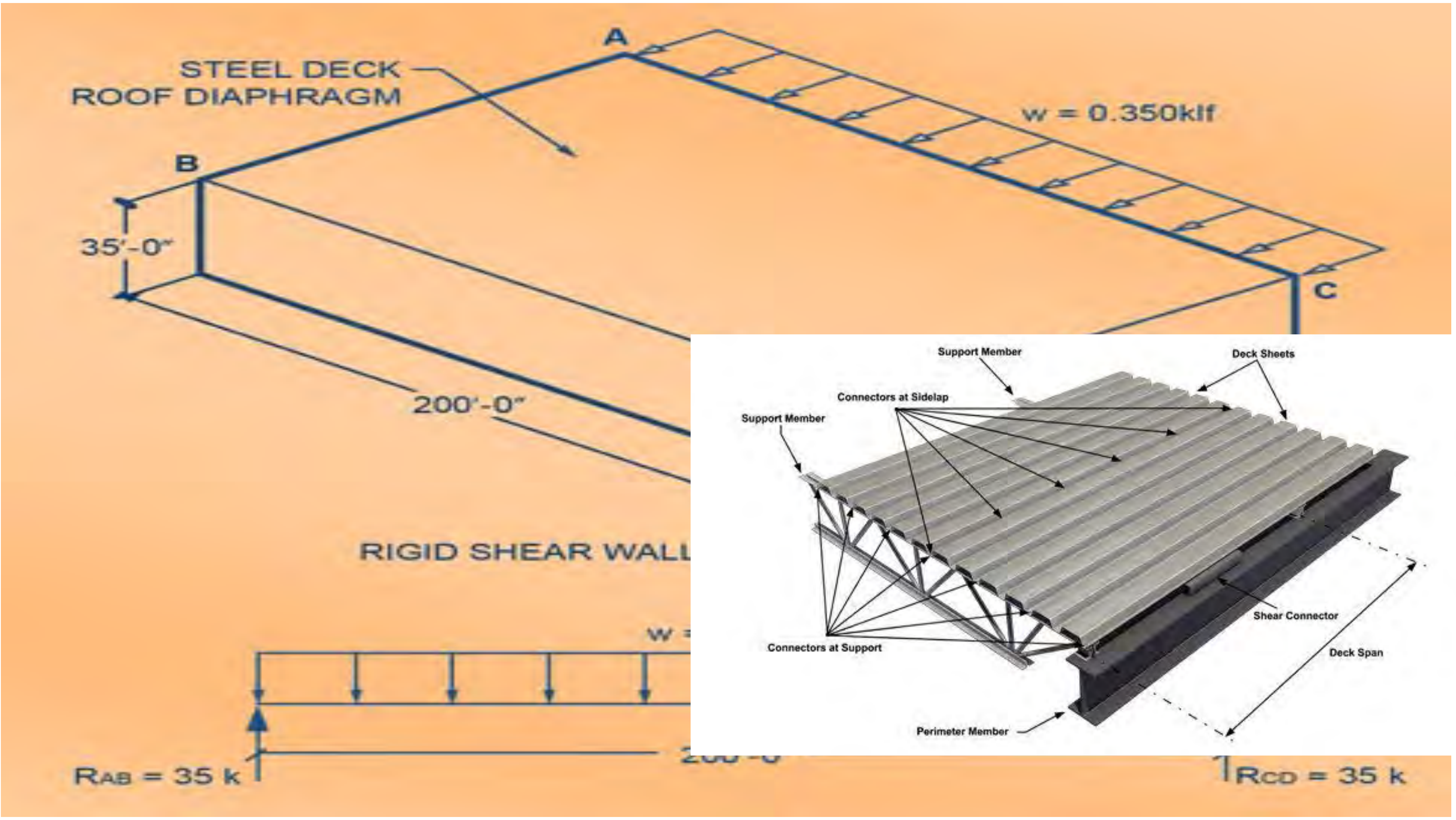
There are two optional methods for factoring steel deck design. The traditional Allowable Strength Design (ASD) method is based on using an allowable design strength, calculated by dividing the component nominal strength by a safety factor. Alternatively, the Load and Resistance Factor Design (LRFD) method is based on the combined factoring of applied loads up as a function of loading predictability and factoring the component resistance (nominal strength) down as a function of reliability and importance. While these are similar methods, they are not the same. ASD uses a constant factor of safety for all designs, no matter what the load type, while LRFD requires a higher factor of safety for loads with higher variability (less predictability). The LRFD method requires the use of higher load factors for loads with higher variance, such as live or snow loads. For more information on the distinction between ASD and LRFD structural steel design, see the AISC Steel Construction Manual available on the AISC web site.

Building Codes

- International Building Code
- ICC/ANSI A-117.1 Accessible and Usable Buildings and Facilities
- International Plumbing Code
- International Mechanical Code
- National Electrical Code
- International Fire Code
- Life Safety Code (NFPA 101)

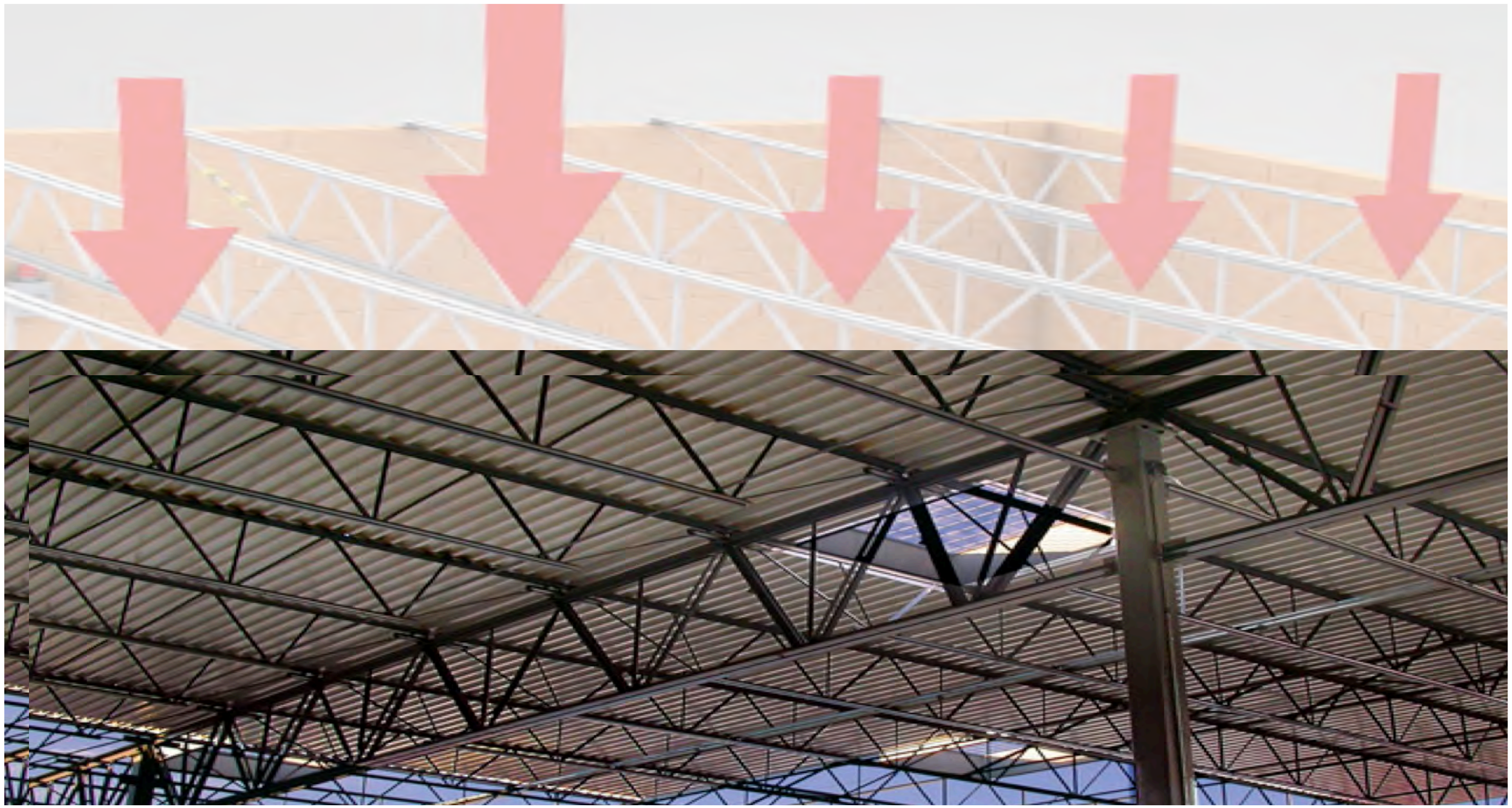
Since building codes are different from city-to-city and state-to-state, it is best to check with your local building official for the building codes that pertain to your area. Shown here is a sample list of building codes that are often referenced by each city. Very often, the city having jurisdiction will dictate which code year is to be referenced and will add code amendments that are unique to that city.

Diaphragm



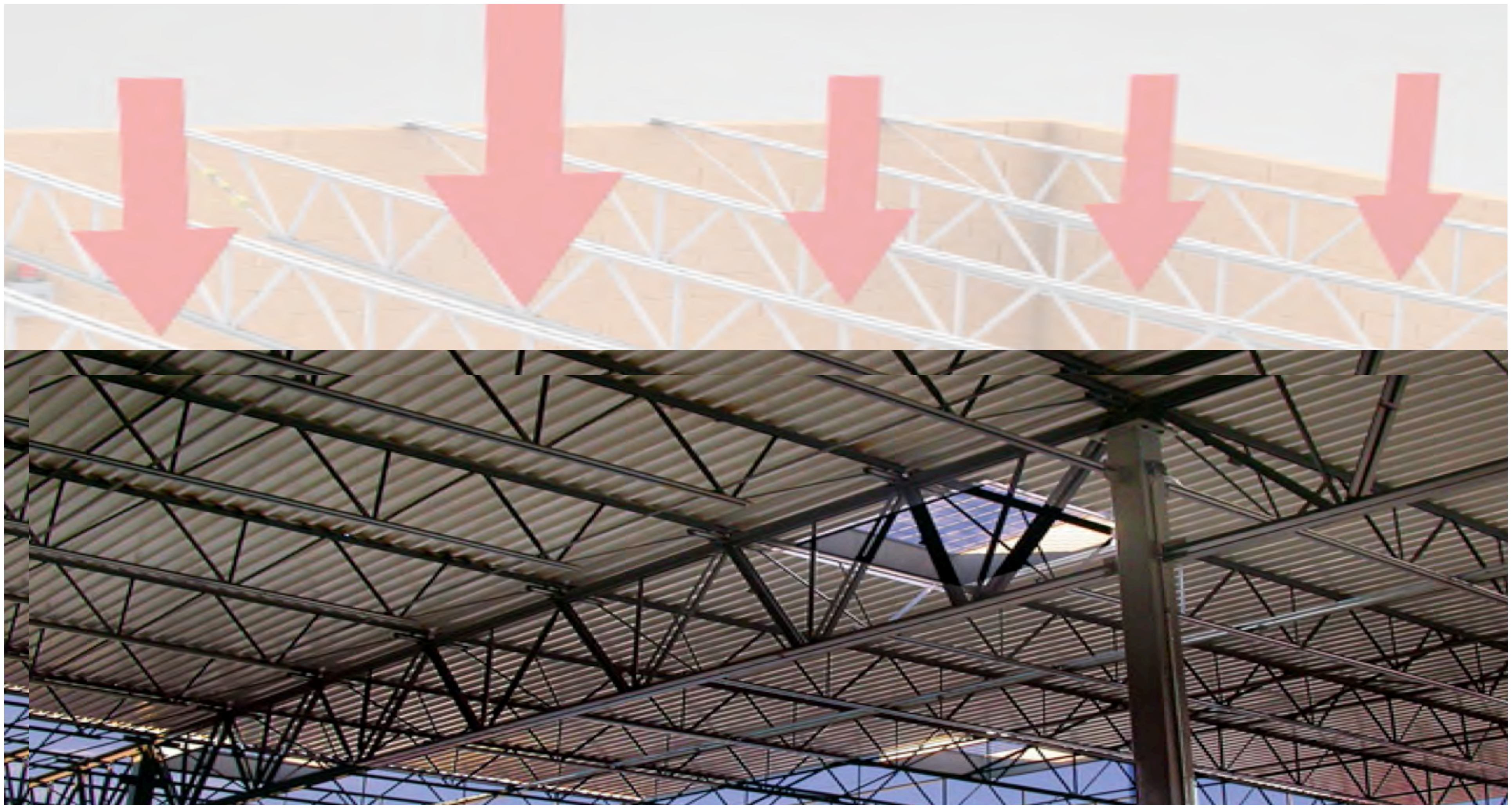
A steel deck diaphragm is a steel roof or floor that acts as a membrane within the structure, spanning between the support members to create a structurally stable covering. The metal deck must be fastened down and the minimum required fastening inherently provides a diaphragm system capable of resisting lateral forces. Effective diaphragm design takes into account these lateral forces.

Deflection



Deflection defines the displacement of a structural member or system under a load. Deflection can be likened to a book shelf that deflects over time under the load of your books. It would hardly be noticeable until or unless you try to fit a book in that should fit but now it is tight because the shelf above has deflected by some increment. It would not normally fail, but it could affect other building performance objectives such as the closing of a door or smooth movement of a window, or even result in ponding on the roof. A roof may not lose its structural integrity, but the amount of deflection may be unacceptable.

Bending



Bending, also called bending moment, is M=wl2/8 for simple and two span conditions; or M=wl2/10 for three span conditions. Bending is different than deflection. The moment calculation or limit state relates to when the deck twists or bends to the point that the flutes buckle and thereby the deck loses it's structural properties and is unable to return to its original shape without some external mechanical means. This would constitute a failure, even though it may be without breakage. Another limit state called "shear" would take the situation beyond failure to breakage.

Design Strength

ASD Design Strength Formula

$$R_a \leq \frac{R_n}{\Omega}$$

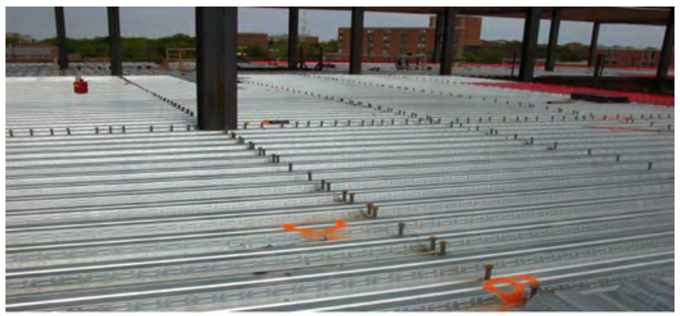
LRFD Design Strength Formula

$$R_u \leq \phi * R_n$$

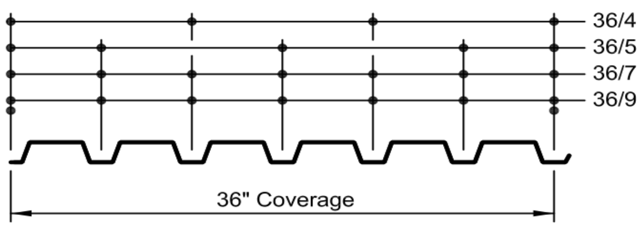
Design strength is determined using either of these equations, either according to the ASD method or the LRFD method. In both equations, the "R" stands for strength. In the ASD equation, the engineer uses ASD load combinations to determine the required strength of a member and arranges for the allowable strength to satisfy the equation. In the LRFD equation, the engineer uses Load and Resistance Factor Design (LRFD) load combinations to determine the required strength of a member and arranges for the allowable strength to satisfy the equation.

Fastening

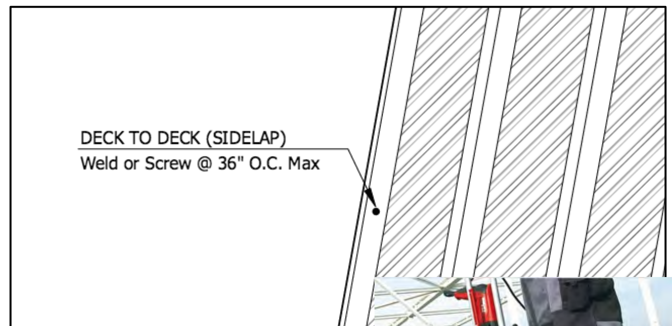
Mechanical Fastening



Fastening Layout



Sidelap Fastening



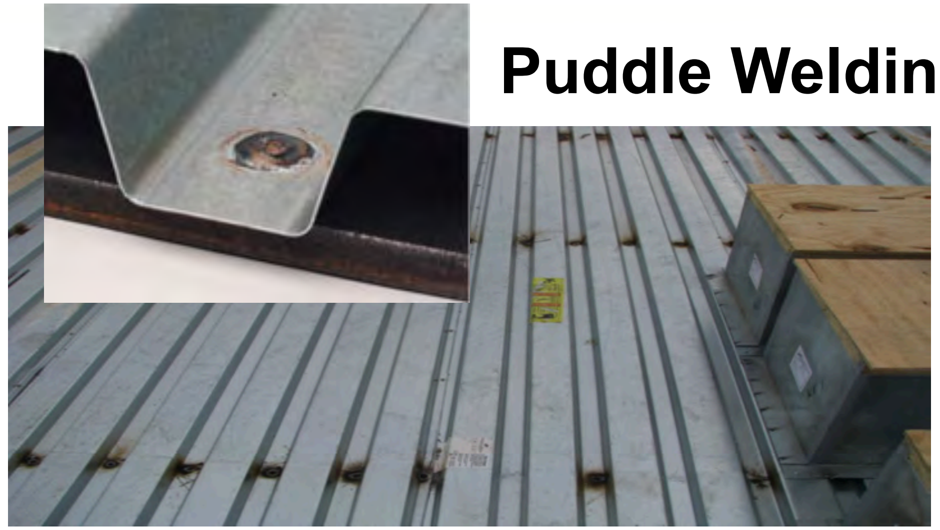
As you have begun to see in the context of diaphragm design, fastening is a design function, and the type and number of fasteners should be selected by the design professional. Deck attachment can be made either by welding or using mechanical fasteners. Fastening points are to be spaced an average of 12” on center, not to exceed 18” on center. The specifying professional will determine the fastening points or pattern based on the prescribed decking.

Terminology

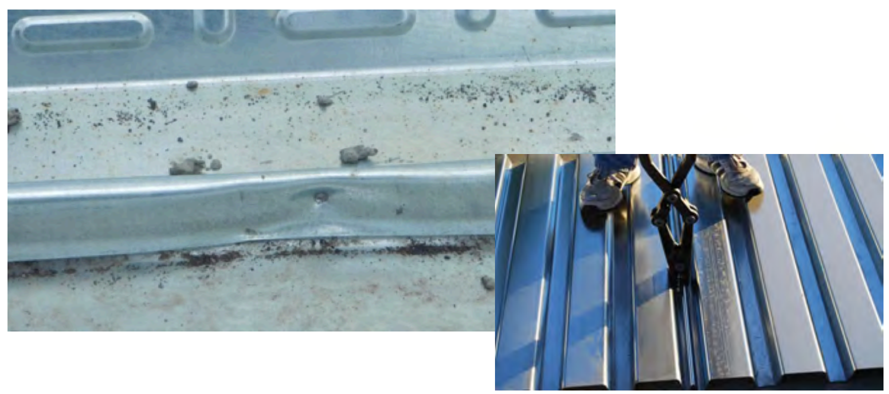
Fastening

Weld Washers

Puddle Welding



Button Punching

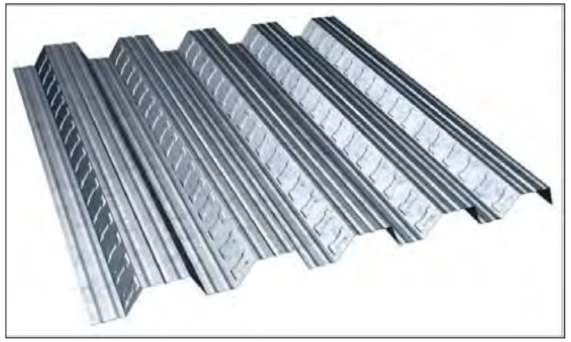


Welding, also called puddle welding, calls for a minimum visible 5/8” diameter puddle weld. For decking that is 22 gauge (0.0295”) or thinner, weld washers must also be used to create a stronger connection and prevent burn-through.

Side lap attachments are intended to make adjacent deck units share resisting horizontal and vertical loads. With concrete slabs, one of the objectives of side lap fastening is to prevent differential sheet deflection during concrete loading, therefore preventing side joints from opening. Side laps are to be fastened together between supports at a maximum spacing of 36” on center whenever the deck span exceeds 5’-0”. Fastening here can be done using puddle welds that are ¾ inch or mechanical fasteners.

Finish

Galvanized Deck



Prime Painted Deck

Painted Deck

Steel decking can be manufactured using different finishes to meet different design and performance goals, including surface protection and improved appearance.

Galvanized steel can be used to make the steel deck. Galvanized steel deck features a rust-resistant zinc, zinc-iron or zinc-aluminum alloy coating that usually meets requirements for fire resistance as defined by Underwriters Laboratories.

Primer-painted finish protects the deck surface for a reasonable installation period while the deck is exposed to ordinary atmospheric conditions. Painted deck, such as the white painted deck shown here, can add an aesthetic appeal, while also extending surface protection beyond the erection phase into the ownership phase of the building. Remember however, that this is still a primer and not a finish coat.

Composite deck finishes are either galvanized or phosphatized/painted having a primer coated bottom side and a bare top surface, which is the side to be in contact with the concrete. This bare top surface can be expected to develop rust before concrete is placed. To inhibit this process, a rust inhibitor or cleaning chemical is applied to remove zinc and solvents from the top side to allow for a uniform oxidation of the steel which increases the bond of the concrete. The word "phosphatized" is generally no longer used as the cleaning agent may not contain phosphorus, but rather chrome/silica. Check with the individual manufacturer for the chemical used. A cleaned and painted deck can be a cost savings in lieu of galvanizing and also reduce surface slip potential to workers. Whichever type of finished deck is used, care should be taken during the delivery, handling and erection of the material, such as storing off the ground with one end elevated and protected from the elements using weatherproof material that is ventilated to avoid condensation.

Maximum Construction Span

ALLOWABLE UNIFORM LOADS AND MAXIMUM CONSTRUCTION SPANS - ASD

Span Condition	Gage	Allowable Uniform Total Load (psf) / Load that Produces Span/240 Deflection (psf)										Max. Constr. Span (Ctr. to Ctr.)
		Center to Center Span (ft. - in.)										
		5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	8 - 0	9 - 0	10 - 0	11 - 0	12 - 0	
Single	22	97 / 85	80 / 64	67 / 49	-	-	-	-	-	-	-	6 - 0
	20	120 / 108	99 / 81	83 / 62	71 / 49	61 / 39	47 / 26	-	-	-	-	7 - 5
	18	162 / 147	134 / 111	112 / 85	96 / 67	83 / 54	63 / 36	50 / 25	40 / 18	33 / 14	-	10 - 1
	16	207 / 186	171 / 140	144 / 108	122 / 85	106 / 68	81 / 45	64 / 32	52 / 23	43 / 17	36 / 13	12 - 11
Double	22	98 / 213	81 / 160	68 / 123	58 / 97	50 / 78	39 / 52	-	-	-	-	7 - 3
	20	124 / 264	102 / 199	86 / 153	74 / 120	64 / 96	49 / 65	39 / 45	-	-	-	9 - 0
	18	163 / 356	136 / 267	114 / 206	97 / 162	84 / 130	65 / 87	51 / 61	41 / 44	34 / 33	29 / 26	12 - 2
	16	205 / 448	170 / 337	143 / 260	122 / 204	105 / 163	81 / 109	64 / 77	52 / 56	43 / 42	36 / 32	15 - 6
Triple	22	122 / 167	101 / 125	85 / 96	73 / 76	63 / 61	48 / 41	-	-	-	-	7 - 4
	20	153 / 207	127 / 155	107 / 120	92 / 94	79 / 75	61 / 50	48 / 35	39 / 26	-	-	9 - 1
	18	203 / 278	168 / 209	142 / 161	121 / 127	105 / 101	80 / 68	64 / 48	52 / 35	43 / 26	36 / 20	12 - 4
	16	254 / 351	210 / 264	177 / 203	152 / 160	131 / 128	101 / 86	80 / 60	65 / 44	53 / 33	45 / 25	15 - 9

Maximum construction span for slabs is edge-to-edge of supports; for roof decks it is the centerline-to-centerline distance between structural steel supports such as a beam, column or joist. In the load tables for steel deck design, maximum construction span is shown as a single, double or triple span dimension.

Uniform Load

ALLOWABLE UNIFORM LOADS AND MAXIMU CONSTRUCTION SPANS - ASD

Span Condition	Gage	Allowable Uniform Total Load (psf) / Load that Produces Span/240 Deflect							
		Center to Center Span (ft. - in.)							
		5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	8 - 0	9 - 0	10 - 0
Single	22	97 / 85	80 / 64	67 / 49	-	-	-	-	-
	20	120 / 108	99 / 81	83 / 62	71 / 49	61 / 39	47 / 26	-	-
	18	162 / 147	134 / 111	112 / 85	96 / 67	83 / 54	63 / 36	50 / 25	40 / 18
	16	207 / 186	171 / 140	144 / 108	122 / 85	106 / 68	81 / 45	64 / 32	52 / 23
Double	22	98 / 213	81 / 160	68 / 123	58 / 97	50 / 78	39 / 52	-	-
	20	124 / 264	102 / 199	86 / 153	74 / 120	64 / 96	49 / 65	39 / 45	-
	18	163 / 356	136 / 267	114 / 206	97 / 162	84 / 130	65 / 87	51 / 61	41 / 44
	16	205 / 448	170 / 337	143 / 260	122 / 204	105 / 163	81 / 109	64 / 77	52 / 56
Triple	22	122 / 167	101 / 125	85 / 96	73 / 76	63 / 61	48 / 41	-	-
	20	153 / 207	127 / 155	107 / 120	92 / 94	79 / 75	61 / 50	48 / 35	39 / 26
	18	203 / 278	168 / 209	142 / 161	121 / 127	105 / 101	80 / 68	64 / 48	52 / 35

Uniform load is the load or force that is considered constant over the entire length or partial length of a deck. This includes dead load, which consists of the permanent part of the structure, and live load, which includes non-permanent components, such as rain, snow or people.

Yield Strength

40 KSI

CONSTRUCTION CLEAR SPANS - ASD

Total Slab Depth (in.)	Gage	F_y (ksi)		Concrete Weight (psf)	Maximum Construction Clear Span (ft. - in.)		
					Single	Double	Triple
4	22	40	Normal Weight Concrete (145 pcf)	36	7 - 2	8 - 4	8 - 5
	20				8 - 8	9 - 9	10 - 1
	18				10 - 9	11 - 9	12 - 2
	16				11 - 6	13 - 3	13 - 6
4 1/2	22	40		42	6 - 10	7 - 9	8 - 0
	20				8 - 2	9 - 3	9 - 7
	18				10 - 3	11 - 2	11 - 7
	16				11 - 0	12 - 7	13 - 0
5	22	40		48	6 - 6	7 - 1	7 - 8
	20				7 - 10	8 - 10	9 - 2
	18				9 - 10	10 - 8	11 - 1
	16				10 - 7	12 - 1	12 - 6
5 1/2	22	40		54	6 - 1	6 - 6	7 - 4
	20				7 - 6	8 - 6	8 - 9
	18				9 - 5	10 - 3	10 - 7
	16				10 - 2	11 - 7	12 - 0
6	22	40		60	5 - 6	6 - 0	6 - 10
	20				7 - 3	8 - 2	8 - 5
	18				9 - 2	9 - 10	10 - 2
	16				9 - 10	11 - 2	11 - 6
6 1/2	22	40		66	5 - 0	5 - 6	6 - 3
	20				7 - 0	7 - 10	8 - 1
	18				8 - 10	9 - 6	9 - 10
	16				9 - 7	10 - 9	11 - 1

50 KSI

PROPERTIES / SECTION PROPERTIES / DESIGN STRENGTHS (No Concrete Fill)

Gage	F_y (ksi)	Coverage (in.)	Thickness (in.)	Weight (psf)	A_s (in.²/ft.)	I_p (in.⁴/ft.)	I_n (in.⁴/ft.)	S_p (in.³/ft.)	S_n (in.³/ft.)	Mn,p/Ω (in.-lb./ft.)	Mn,n/Ω (in.-lb./ft.)	Vn/Ω (lb./ft.)	Rbe/Ω (lb./ft.)	Rbi/Ω (lb./ft.)
22	50	36	0.0295	1.57	0.460	0.330	0.323	0.243	0.249	7274	7470	1832	401	771
20	50	36	0.0358	1.90	0.558	0.413	0.406	0.324	0.330	9701	9883	2698	574	1102
18	50	36	0.0474	2.51	0.738	0.554	0.552	0.483	0.489	14446	14639	3599	961	1846
16	50	36	0.0598	3.17	0.931	0.698	0.702	0.638	0.650	19099	19454	4523	1470	2825

CONSTRUCTION SPANS AND COMPOSITE SLAB DESIGN

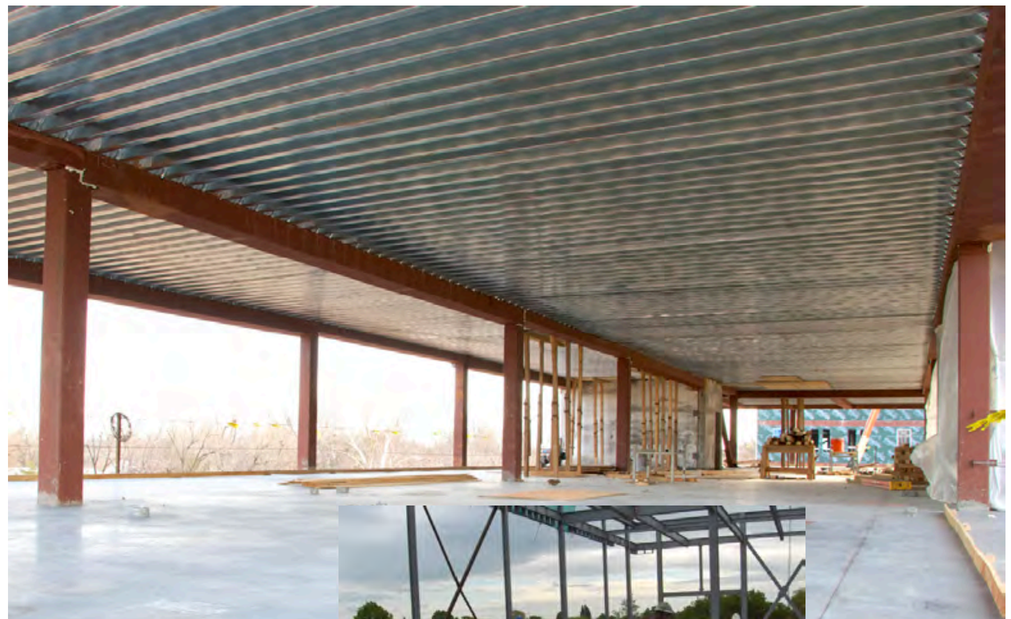
Total Slab Depth (in.)	Gage		Concrete Weight (psf)	Maximum Construction Clear Span (ft. - in.)			Allowable Superimposed Uniform Load (psf) Clear Span (ft. - in.)										
				Single	Double	Triple	5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	7 - 6	8 - 0	8 - 6	9 - 0	9 - 6	10 - 0
4	22	Normal Weight Concrete (γc = 145 pcf, f'c = 3000 psi, n = 9)	36	8 - 0	9 - 3	9 - 5	400	400	400	385	327	280	241	210	183	160	141
	20		36	9 - 8	10 - 7	11 - 0	400	400	400	400	395	339	294	256	224	197	174
	18		36	10 - 9	12 - 11	12 - 9	400	400	400	400	400	400	386	338	293	249	213
	16		36	11 - 6	14 - 4	13 - 6	400	400	400	400	400	400	369	323	284	251	222
4 1/2	22		42	7 - 7	8 - 9	8 - 11	400	400	400	400	395	339	292	254	222	195	171
	20		42	9 - 2	10 - 1	10 - 5	400	400	400	400	400	400	356	310	272	240	212
	18		42	10 - 3	12 - 3	12 - 3	400	400	400	400	400	400	400	400	361	319	284
	16		42	11 - 0	13 - 10	13 - 0	400	400	400	400	400	400	400	400	400	359	320
5	22		48	7 - 3	8 - 4	8 - 6	400	400	400	400	400	400	346	300	263	231	203
	20		48	8 - 9	9 - 8	10 - 0	400	400	400	400	400	400	400	367	322	284	251
	18		48	9 - 10	11 - 8	11 - 11	400	400	400	400	400	400	400	400	400	379	337
	16		48	10 - 7	13 - 5	12 - 7	400	400	400	400	400	400	400	400	400	400	380
5 1/2	22		54	7 - 0	8 - 0	8 - 2	400	400	400	400	400	400	400	349	305	268	237
	20		54	8 - 4	9 - 3	9 - 7	400	400	400	400	400	400	400	400	374	330	292
	18		54	9 - 5	11 - 3	11 - 7	400	400	400	400	400	400	400	400	400	400	392
	16		54	10 - 2	12 - 11	12 - 3	400	400	400	400	400	400	400	400	400	400	400
6	22		60	6 - 9	7 - 6	7 - 11	400	400	400	400	400	400	400	398	348	306	271
	20		60	8 - 0	8 - 11	9 - 2	400	400	400	400	400	400	400	400	400	377	335
	18		60	9 - 2	10 - 10	11 - 2	400	400	400	400	400	400	400	400	400	400	400
	16		60	9 - 10	12 - 5	11 - 11	400	400	400	400	400	400	400	400	400	400	400
6 1/2	22		66	6 - 6	7 - 0	7 - 7	400	400	400	400	400	400	400	400	393	346	305
	20		66	7 - 9	8 - 7	8 - 10	400	400	400	400	400	400	400	400	400	400	378
	18		66	8 - 10	10 - 5	10 - 10	400	400	400	400	400	400	400	400	400	400	400
	16		66	9 - 7	12 - 0	11 - 8	400	400	400	400	400	400	400	400	400	400	400

Notes: 1. Section properties are calculated in accordance with the AISI Cold-Formed Steel Design Specifications, 2007 Edition.

INTERNATIONAL
Standards Worldwide

Yield strength is the point at which the steel deck exhibits a deviation from the predetermined stress-to-strain level, as defined by the American Society for Testing and Materials (ASTM). Roof deck, form deck and composite decks are manufactured from steel with a yield strength of up to 80 ksi, conforming to ASTM A1008/A1008M for uncoated and painted deck, and A653/A653M for galvanized deck. You can refer to any deck manufacturer's catalog for tables that will give you the minimum yield strength used for each deck type.

Maximum Un-shored Span



Maximum un-shored span is the distance from edge of beam flange to edge of beam flange for floor decks, when the cement is wet, and with no shoring in place. This measure is the result of the crushing ability of the concrete pushing down on the deck, creating a shear zone beyond the actual support. This is a temporary condition until the concrete hardens.

Factory Mutual Span

Type F Deck

Type F - Factory Mutual Maximum Ctr. to Ctr. Spans (ft. - in.)												
FM Class	1 - 60				1 - 75				1 - 90			
Deck Gage	22	20	18	16	22	20	18	16	22	20	18	16
Single Span	4 - 4	5 - 5	6 - 5	7 - 3	4 - 4	5 - 5	6 - 5	7 - 3	4 - 4	5 - 5	6 - 5	7 - 3
Double Span	5 - 3	6 - 6	7 - 7	8 - 6	5 - 3	6 - 6	7 - 7	8 - 6	5 - 3	6 - 6	7 - 7	8 - 4
Triple Span	5 - 4	6 - 7	7 - 7	8 - 6	5 - 4	6 - 7	7 - 7	8 - 6	5 - 4	6 - 7	7 - 7	8 - 6

Type B Deck

Type B - Factory Mutual Maximum Ctr. to Ctr. Spans (ft. - in.)																		
FM Class	1 - 60						1 - 75						1 - 90					
Deck Gage	22	21	20	19	18	16	22	21	20	19	18	16	22	21	20	19	18	16
Single Span	5 - 11	6 - 3	6 - 7	7 - 1	7 - 7	8 - 6	5 - 11	6 - 3	6 - 7	7 - 1	7 - 7	8 - 6	5 - 11	6 - 3	6 - 7	7 - 1	7 - 7	8 - 6
Double Span	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0
Triple Span	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0	7 - 0	7 - 5	7 - 9	8 - 4	8 - 11	10 - 0

Type N Deck

Type N - Factory Mutual Maximum Ctr. to Ctr. Spans (ft. - in.)																		
FM Class	1 - 60						1 - 75						1 - 90					
Deck Gage	22	21	20	19	18	16	22	21	20	19	18	16	22	21	20	19	18	16
Single Span	12 - 8	14 - 3	14 - 11	16 - 1	17 - 2	19 - 3	12 - 4	13 - 3	14 - 0	15 - 3	16 - 3	18 - 3	11 - 3	12 - 1	12 - 9	13 - 11	14 - 10	16 - 8
Double Span	13 - 0	14 - 0	14 - 11	16 - 3	17 - 5	19 - 10	11 - 7	12 - 6	13 - 4	14 - 7	15 - 7	17 - 9	10 - 7	11 - 5	12 - 2	13 - 3	14 - 3	16 - 3
Triple Span	14 - 6	15 - 8	16 - 8	18 - 2	19 - 6	22 - 3	13 - 0	14 - 0	14 - 11	16 - 3	17 - 5	19 - 10	11 - 10	12 - 10	13 - 7	14 - 10	15 - 11	18 - 2

Factory Mutual span is the maximum spacing that FMG has determined for fire safety. FMG has tested certain spans to be acceptable for a particular length of burn, 1hr., 2 hr., or 3 hr. The greater the space, the more air gets in to fuel a fire. Shown here are span charts for different types of steel deck, based on Factory Mutual guidelines.

Steel Deck Design Criteria

- Roof Deck
- Form Deck
- Composite Deck
- Specialty Deck

The criteria for steel deck design often relates to the type of decking being used.

Roof Deck Design Criteria

- Does not act as composite material
- Transfers horizontal and vertical loads to frame
- Typically narrower ribs than floor deck ribs
- Supports rigid thermal insulation board
- 2-inch over-lapping of joints
- Diaphragm function requires proper fastening
- Welding or mechanical fasteners

Steel roof deck is not designed to act as a composite material with other materials. Roof deck acts alone in transferring horizontal and vertical loads into the building frame. Roof deck rib openings are usually narrower than floor deck rib openings. This provides adequate support of rigid thermal insulation board. Roof deck is typically installed to end-lap approximately 2” over supports. The use of roof deck for horizontal bracing requires that the deck act as a diaphragm, so any fastening substitute or change should be approved by the design professional. Continuous perimeter support of the deck is necessary to limit edge deflection in the finished roof and may be required for diaphragm shear transfer.

Text Source: Steel Deck Institute

Form Deck Design Criteria

- Used as a concrete form for floors and roofs
- Welding or mechanical fasteners
- Use weld washers for 22 gauge and thinner
- Galvanized required for roofs using concrete fill
- Patented dry-installed systems for primary roof load-carrying

Steel form deck can be any floor or roof deck product used as a concrete form. Connections to the frame are by the same methods used to attach floor or roof deck. Welding washers are recommended when welding metal thickness is less than 0.0280 inches. Galvanized G90 deck must be used for those roof deck systems where form deck is used to carry a lightweight insulating concrete fill. In a patented, dry installed roof deck assembly, form deck is utilized as the primary load-carrying element. This assembly functions as a structural roof deck diaphragm. The assembly may include dry installed thermal insulation placed above either prime painted, field painted galvanized or galvanized and painted steel sections.

In order to hasten the drying time of concrete that is cast on it, some decks can be supplied with elongated perforations (vents) in their bottom flutes. This facilitates the draining of excess mix water (added to allow for pumping and placement of the mix) from the cementious slurry component of lightweight insulating concrete systems (LWIC) of floors or roofs. In addition, the venting allows for the reduction of vapor pressure that will develop in the LWIC when covered with an impermeable roofing membrane.

Text Source: Steel Deck Institute

Composite Deck Design Criteria

- Functions as working platform once installed
- Stabilizes the building frame
- Serves as forms for the concrete
- Shear devices lock together with the concrete
- Devices mechanically reinforce the concrete

Steel composite deck, after installation and adequate fastening, serves several purposes. It acts as a working platform, stabilizes the building frame, serves as concrete form for the slab and reinforces the slab to carry the design loads applied during the life of the building. Composite decks are distinguished by the presence of shear connector devices as part of the deck. These devices are designed to mechanically lock the concrete and deck together so that the concrete and the deck work together to carry subsequent floor loads. The shear connector devices can be manufactured into the decking as rolled-in embossments, lugs, holes or wires welded to the panels. The deck profile configuration can also be used to interlock concrete and steel.

Text Source: Steel Deck Institute

Steel Deck Design Criteria

Specialty Deck Design Criteria

- Dovetail Deck
- Long Span Deck
- Cellular Deck
- Electrified Deck
- Acoustical Deck
- Stainless Steel Deck

In response to market needs and wants, steel decking formats continue to develop, often flowing from preceding deck designs. Dovetail deck, long span deck, and cellular deck are ideas inspired by roof, form and composite decking. For example, cellular deck borrows from the composite deck design approach to add sound dampening and a smooth, flat underside appearance.

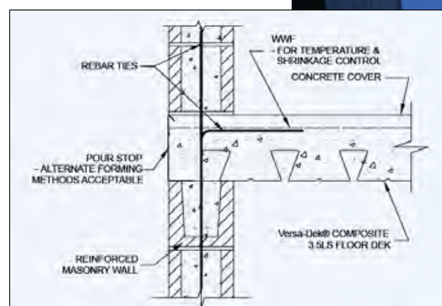
Similarly, electrified decking took the cellular deck concept and integrated wire-ways, data units and other voice-data-video elements to answer the growing need for more integrated structured cabling in building design. These methods of deck design and construction bring a new range of functionality and architectural aesthetics.

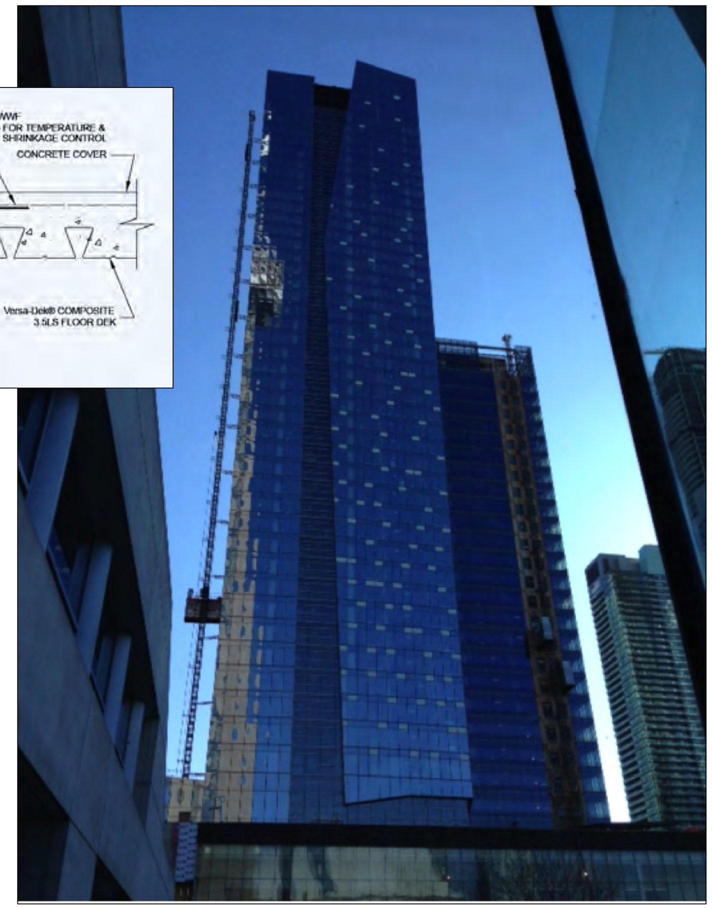
Acoustical deck focuses on the sound-dampening objective. Acoustical deck is manufactured to have perforated holes in the vertical ribs. Once the deck is installed, insulation batts supplied by the deck manufacturer are placed in the ribs. This achieves the “Noise Reduction Coefficient” or NRC rating planned by the architect and structural engineer of record for the design of the space. Stainless steel deck addresses the need for corrosion resistance. Decking made of stainless steel is resistant to salts, acids and alkaline solutions, especially in applications having elevated temperatures and pressures. Frequently, long-term deck maintenance cost reduction is a criteria for specifying stainless steel decking.

Optimizing Steel Deck Design

Optimizing Steel Deck Design

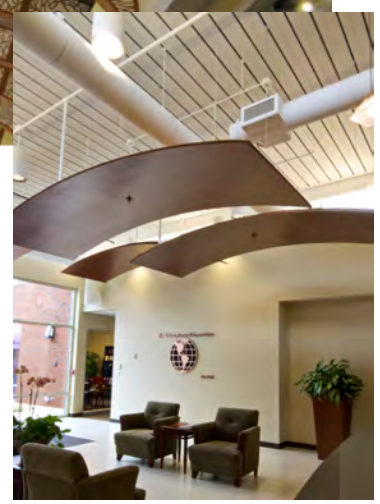
- **Architectural Aesthetics**
- **Structural Performance and Cost**





Architectural aesthetics and total project cost management are design objectives to be defined and agreed upon during the early design phase of a building. This is especially true of projects whose steel joist and decking elements represent a substantial percentage of the overall structural steel, and therefore the overall building design.

Architectural Aesthetics

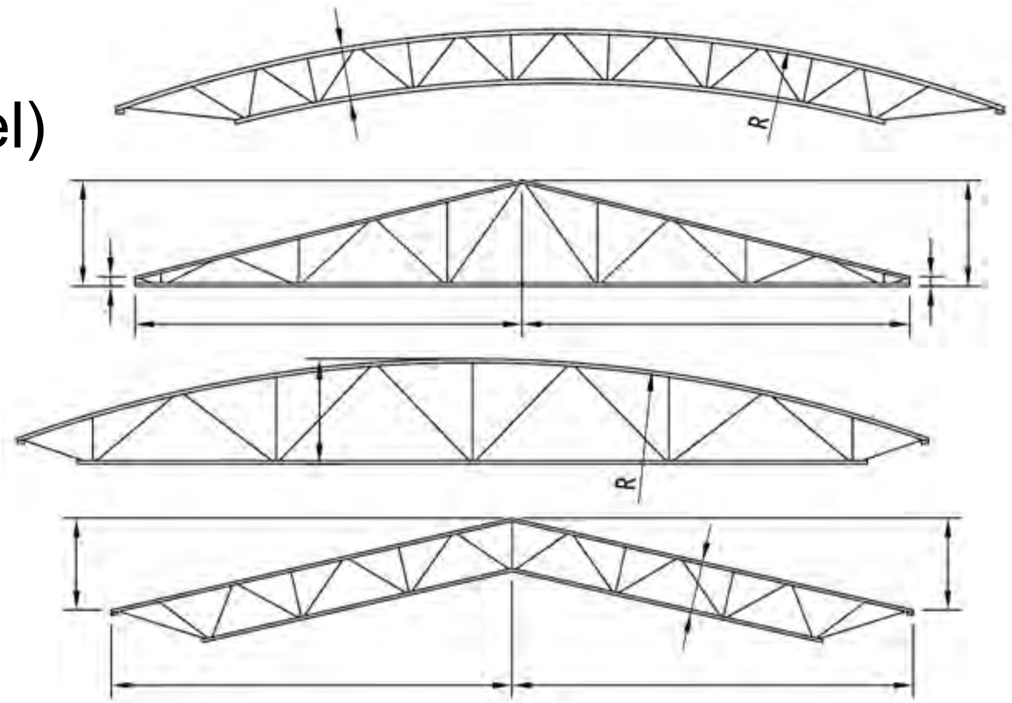


Aesthetic architectural design objectives always come down to engineering decisions. The engineering challenge is to determine how these design aspirations can be achieved in ways that are structurally sound and cost-effective. Very often, the steel joist and deck company can contribute to this effort, if involved early in the design process.

Architectural Aesthetics

Steel joists frame the design idea…

- Arch (barrel)
- Gable
- Scissor
- Bowstring
- Hybrid



Building designs using steel are uplifted by today's broad range of steel joist design options. Unusual rooflines can be shaped using special profile steel joists. The joists support the steel decking as companion elements within the structural steel system.

Architectural Aesthetics




Steel decking design decisions are integral to steel joist design decisions. In this case, the steel joist and deck company was involved early enough in the project design to engineer an integrated steel joist and deck solution. The lobby design for Nashville's Music City Center features a curved ceiling framed using steel open web barrel joists.

Structural Performance and Cost

- Maximize deck capacity
- Specify the deck gauge
- Design for wide spans
- Perimeter deck design

There are many well-proven ways to optimize the structural performance of steel decking. Maximizing deck capacity and specifying deck gauge are universal strategies that go hand-in-hand. Wide span deck design and careful perimeter deck design are especially important on multi-story building projects.

Optimizing Steel Deck Design

Structural Performance and Cost

Maximize deck capacity

ALLOWABLE UNIFORM LOADS

Span Condition	Gage	Allowable Total (Dead + Live) Uniform Load (psf) Center to Center Span (ft. - in.)										Max. Constr. Span (ctr. to ctr.)
		5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	7 - 6	8 - 0	8 - 6	9 - 0	9 - 6	
Single	22	91	71	57	47	40	34	30	27	24	22	5 - 8
	20	111	86	69	56	47	40	35	31	27	25	6 - 7
	18	156	119	94	76	63	53	46	40	35	31	8 - 2
Double	22	107	88	74	63	54	47	42	37	33	30	6 - 8
	20	133	110	92	79	68	59	52	46	41	37	7 - 10
	18	170	140	118	101	87	76	66	59	53	47	9 - 6
Triple	22	133	110	93	79	68	59	50	44	38	34	6 - 9
	20	166	137	115	98	84	70	59	51	45	39	7 - 11
	18	213	176	146	125	107	93	78	67	58	51	9 - 8

6 - 9
7 - 11
9 - 8

FACTORY MUTUAL SPANS

Gage	Max. Ctr. to Ctr. Span (ft.-in.)
22	6 - 0
20	6 - 6
18	7 - 5

A fundamental way to reduce total project cost on most any steel building project is to maximize deck capacity. The goal is to space deck support members to meet actual loads, rather than use “standard” load table specifications. This design approach holistically evaluates the structural relationships between the support structure, often built using steel joists, and the steel decking to accurately engineer a design that is both performance and cost optimized.

Optimizing Steel Deck Design

Structural Performance and Cost

Maximize deck capacity

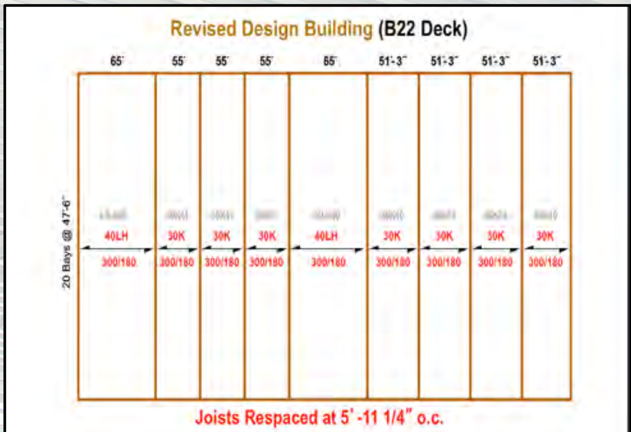
ALLOWABLE UNIFORM LOADS

Span Condition	Gage	Allowable Total (Dead + Live) Uniform Load (psf) — Center to Center Span (ft. - in.) 5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	7 - 6	8 - 0	8 - 6	9 - 0	9 - 6	Max. Constr. Span (ctr. to ctr.)
Single	22	91	71	57	47	40	34	30	27	24	22	5 - 8
	20	111	86	69	56	47	40	35	31	27	25	6 - 7
	18	156	119	94	76	63	53	46	40	35	31	8 - 2
Double	22	107	88	74	63	54	47	42	37	33	30	6 - 8
	20	133	110	92	79	68	59	52	46	41	37	7 - 10
	18	170	140	118	101	87	76	66	59	53	47	9 - 6
Triple	22	133	110	93	79	68	59	50	44	38	34	6 - 9
	20	166	137	115	98	84	70	59	51	45	39	7 - 11
	18	213	176	146	125	107	93	78	67	58	51	9 - 8

6 - 9
7 - 11
9 - 8

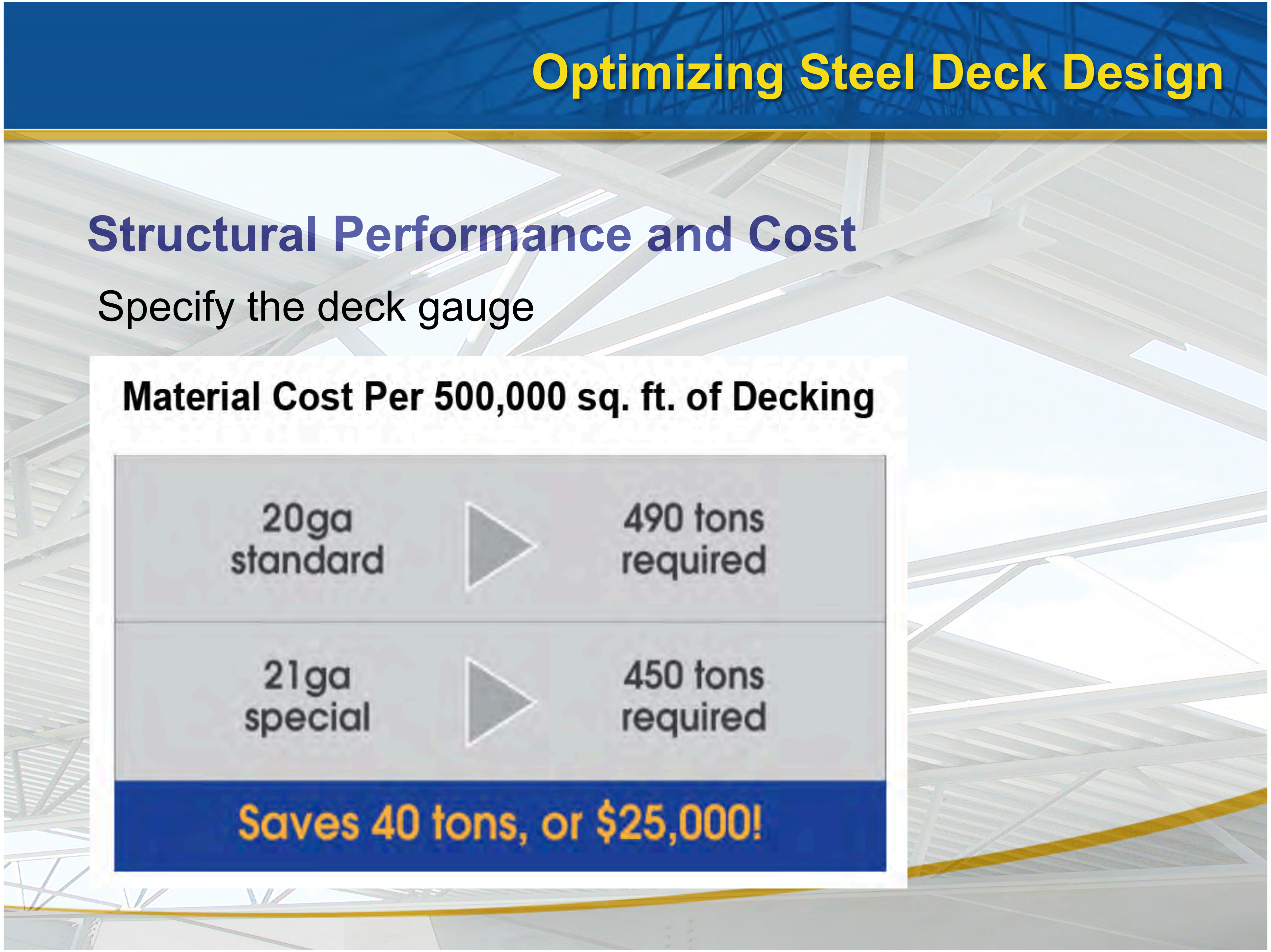
FACTORY MUTUAL SPANS

Gage	Max. Ctr. to Ctr. Span (ft.-in.)
22	6 - 0
20	6 - 6
18	7 - 5



	Standard Design	Revised Design	SAVINGS
Total Tons	926.77	848.23 tons	78.54 tons 8.47%
Total Pieces	1841	1571 Pieces	270 pieces 14.66%
Total Cost	$1,282,000	$1,157,117	$124,883 9.74%

For example, by spacing the steel joists further apart in this bay design, the structural needs of the building were fully met while reducing the steel package cost substantially. This savings did not include the related savings for steel joist shipping, handling, storage and erection.



A companion goal to maximizing deck capacity is to specify the thickness of the steel decking, rather than default to a standard gauge of steel decking. This more proactive steel joist and deck design approach not only saves steel, it saves on piece count. A smaller piece count means less fabrication and erection time, so the cost savings to the project are compounded.

Structural Performance and Cost

Specify the deck gauge

Deck Gauge and Cost Calculation

Example: Roof project in Shephherdsville, KY
6,056 squares of deck, specified painted 22ga
Total weight: 488 tons

Potential cost and ton savings of 23ga vs. 22ga
Gravity load capacity: 25 psf total
23ga allowable for 3-span @ 5' -6 5/8"

Diaphragm strength required		Pattern:
22ga	Interior: 325 p/f	36/5 - 5 sidelaps
	Edges: 464 p/f	36/7 - 7 sidelaps
23ga	Interior: 330 p/f	36/5 - 8 sidelaps
	Edges: 465 p/f	36/7 - 10 sidelaps

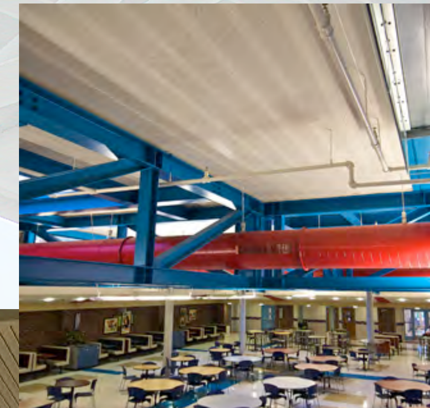
Total weight and cost savings for 23ga:
Deck: *8%*
Joist/deck package: *2%*

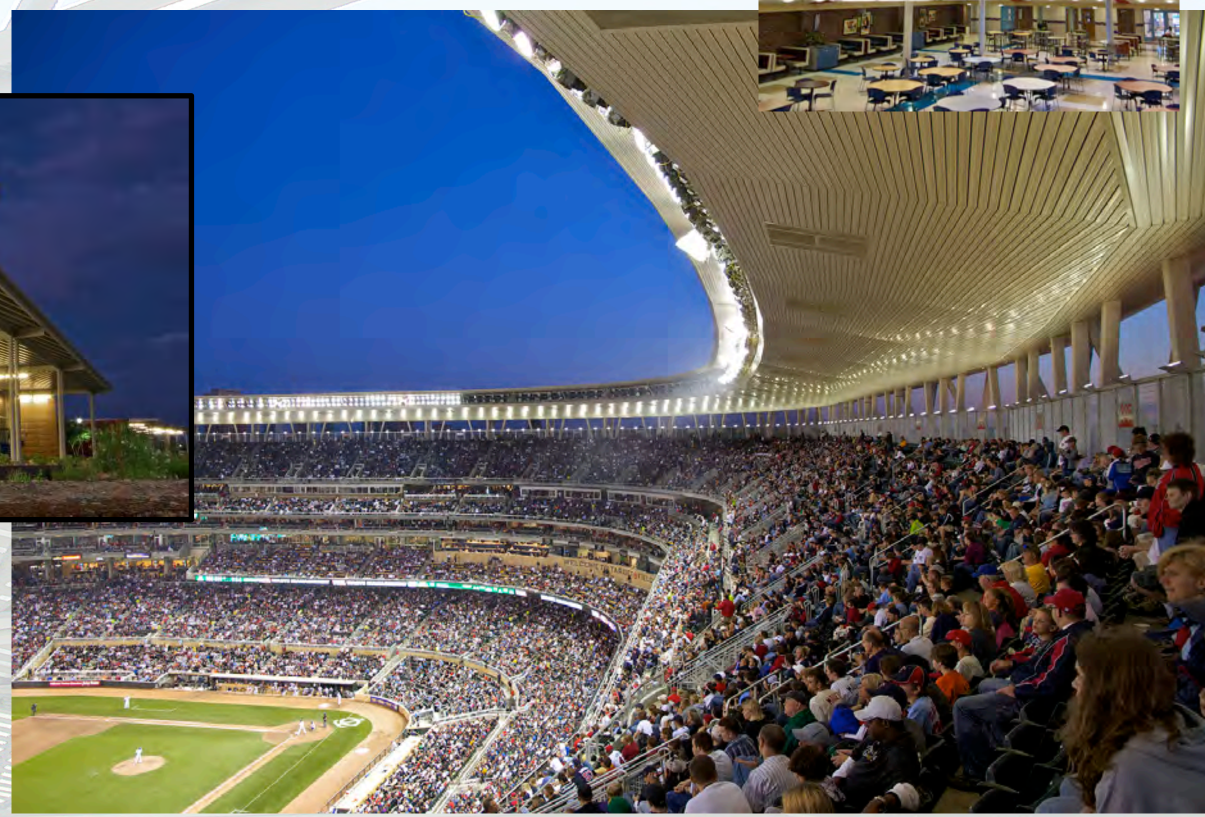
Here is an actual project example that illustrates the cost advantage of specifying the deck gauge. This project originally called for over 6,000 squares of 22-gauge steel roof deck, which would have amounted to a total of 488 tons. By going to a 23 gauge deck, the project experienced an 8% reduction in decking costs and a 2% overall reduction in the joist and deck package.

Optimizing Steel Deck Design

Structural Performance and Cost

Wide span deck design



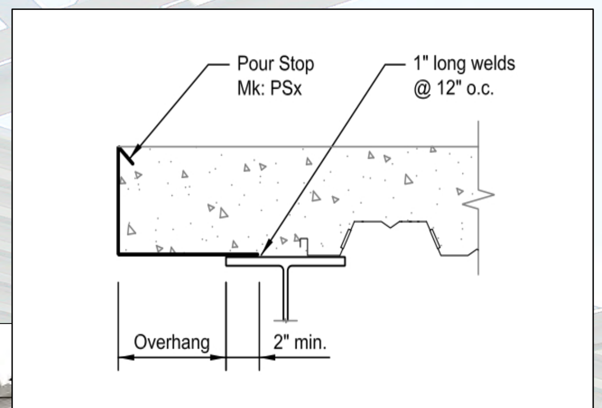


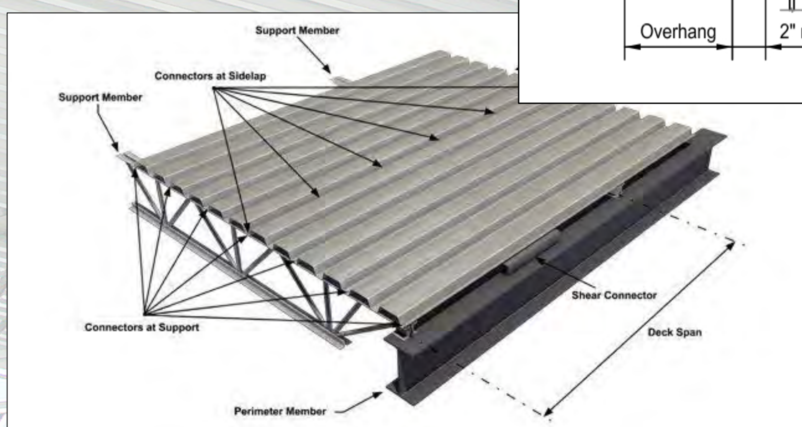
Stadiums, auditoriums, convention centers, and similar open-air facilities are continually looking for ways to avoid space-robbing structural elements such as support columns and footings. Long-span roof and floor decking using deeper profiles is often a design strategy; and decking sections can be custom manufactured to over 55ft lengths to help reduce on-site erection hours and costs.

Optimizing Steel Deck Design

Structural Performance and Cost

Perimeter deck design





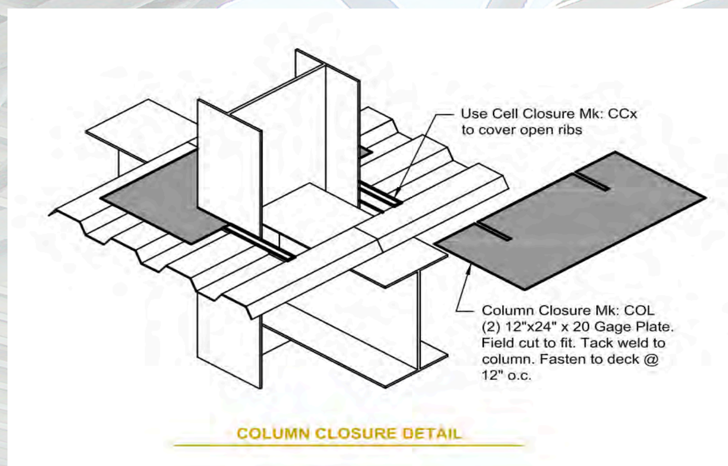
Multi-story building construction has been the answer to increasing population density and scarce real estate. Multi-story construction now also addresses such growing trends as the consolidation of residential and retail services, the demand for multi-family dwellings, and an aging population's need for multi-story health care, rehabilitation, retirement and advanced residential care.

Proactive steel deck design plays an important role in the performance and cost efficiency of these multi-story projects. A key consideration is perimeter steel deck design. Proactive perimeter steel deck design includes the provision of deck pour stop elements to support and contain the poured concrete throughout the perimeter of a deck diaphragm.

Optimizing Steel Deck Design

Structural Performance and Cost

Perimeter deck design



Proactive deck design will also address such perimeter functions as the connection of glass curtain walls. The pour stops can be manufactured with laser cut openings to receive glass curtain wall inserts, as well as reinforced bracings. These provisions will remove significant time and labor costs during the steel deck finishing erection and the glass curtain wall erection phases of a multi-story project.

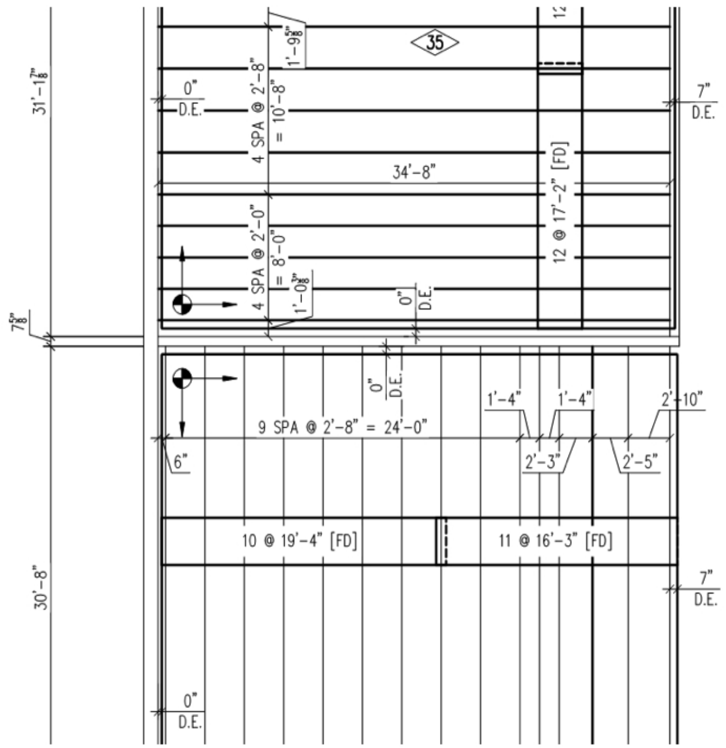
In addition, proactive steel deck design will account for all pour stop enclosure details, such as the provision of manufactured column closures to seal off around columns, and the provision of manufactured hanger tabs in the decking for rapid suspended ceiling installation – all with an eye on reducing on-site labor costs and the total project timeline.

Steel Deck Detailing

Steel deck detailing

- The role of steel deck detailing
- Examples of deck detailing
- Factory Mutual requirements
- Underwriter's Laboratory requirements

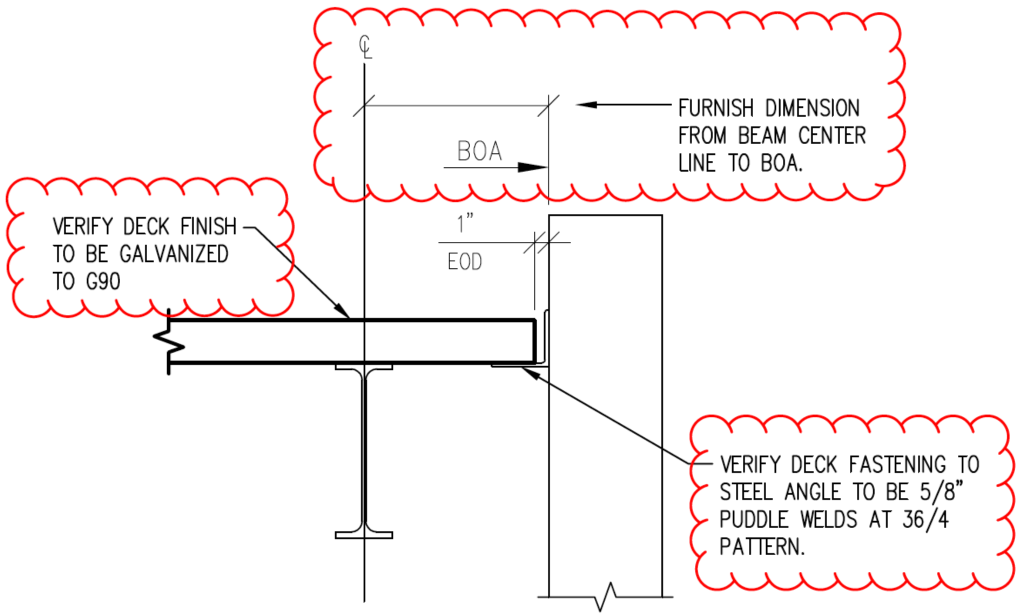
The role of steel deck detailing



Steel deck detailing is a service typically provided by the steel deck manufacturing company. As you have learned, steel decking is a highly engineered structural system. In addition, it is a system that requires proactively detailed directions for safe, proper and efficient installation. To assure project success, the detailer on any given project is relied upon to review the contract drawings, manage the Request for Information (RFI) process, and provide all essential detailed directions in the plan.

The role of steel deck detailing

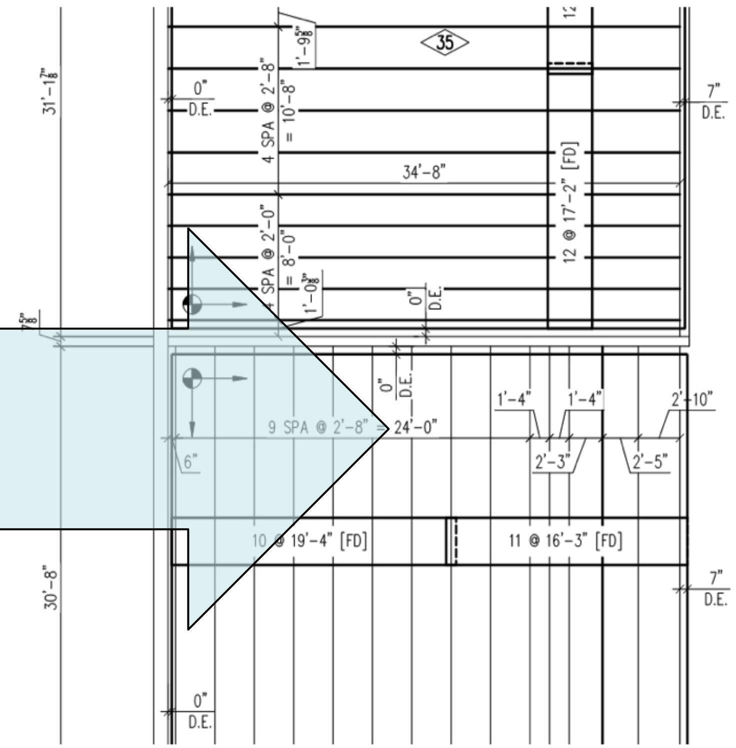
Requests for information (RFI)



Studies have confirmed that the structural engineering drawings for steel joists and decking are often incomplete when handed down by the structural engineer of record (EOR). As a result, the engineers and detailers employed by the steel joist and deck manufacturer must proactively pursue plan resolution before a project can effectively progress. A mission-critical role of the steel deck detailer is to coordinate with the steel fabricator and the EOR to manage and accelerate the Request for Information (RFI) process, to expediently resolve any deck detailing questions on behalf of the project.

The role of steel deck detailing

- ✓ Deck attachment
- ✓ Deck perimeter
- ✓ Enclosures
- ✓ Expansion joints
- ✓ Ridge and valley
- ✓ Change of deck direction



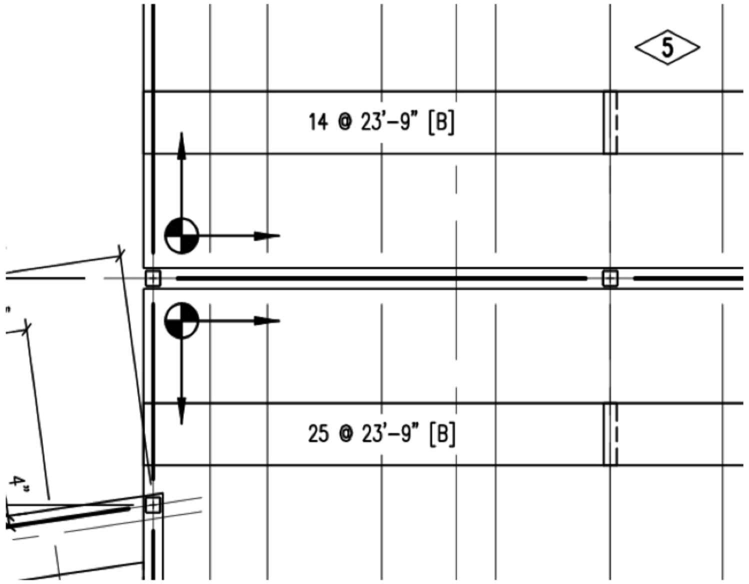
During the steel deck detailing process, a primary objective is to meet structural load requirements. Other design objectives include planning for easier deck installation, addressing the need for complete deck diaphragm enclosure, and proactively addressing perimeter considerations such as built-in connections for glass curtain wall installation.

Shown here is a range of detailing considerations. Detailed directions encompass how the deck is to be attached to its support (i.e. puddle weld, screws, pin, etc.), side lap attachment, and the pattern of attachment. Detailing provides the limits of the deck, or edge of deck (EOD) around the perimeter of the building. Detailing provides for the enclosure of interior openings. Detailing will also account for expansion joints, ridge and valley locations, finishing components, and change of deck direction.

We will next walk through some of these details to better illustrate the scope and importance of the detailing process to any steel building project, especially multi-story, high-rise steel building construction.

Examples of steel deck detailing

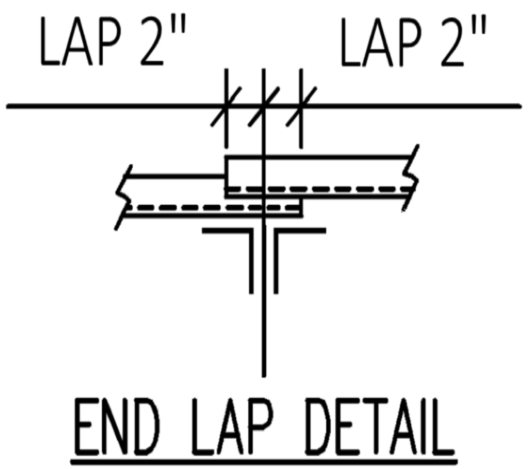
Deck starting point

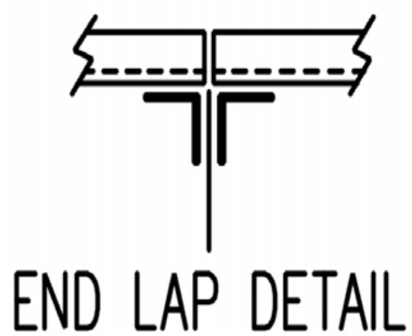


The detailer will find out where the erector intends to start deck erection or determine where the erector needs to start erection for proper installation. The detailer will then show this deck starting point on the drawing, along with noted guidelines accounting for building shape, the orientation of the floor or roof, the slope of the roof, and the deck sequence order. The detailer will note, for example, that on sloped areas the deck should start at the low end.

Examples of steel deck detailing

Roof deck & form deck end lap condition
Composite deck end lap condition



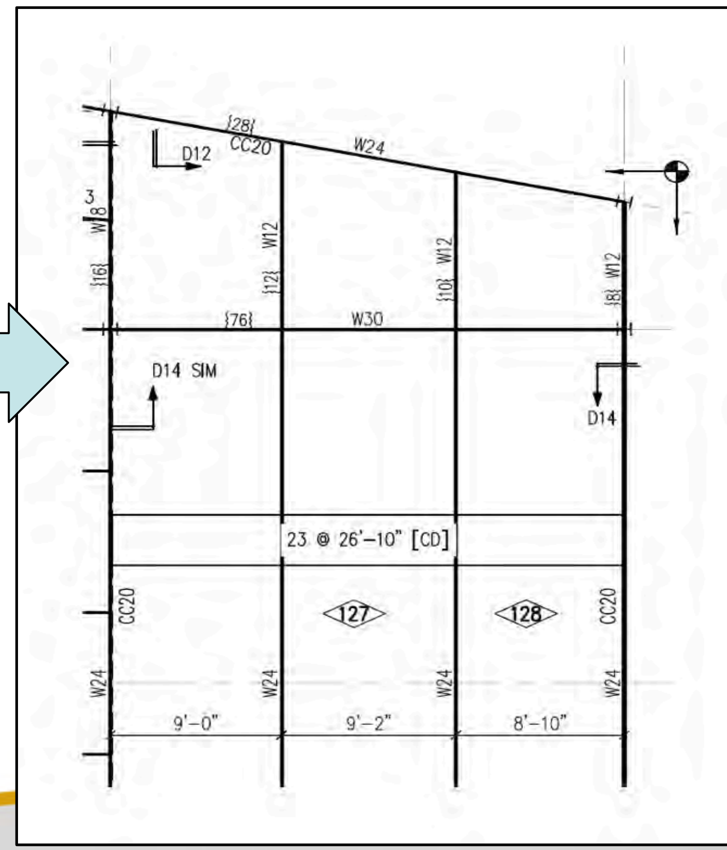


When determining deck length, the detailer will review the contract drawings and the specifications to determine how many deck spans are required. Deck is normally designed for three span conditions. The number of plan dimensions and section cuts will depend on the different limits of the deck, any change in the deck direction, and any need for decking accessories. For example, the detailer will call out that roof and form deck are to be lapped 3” over a solid support and 4” over a gapped support such as a joist support to insure a positive welded connection and a 1½” minimum bearing over the support. For composite floor deck, the detailer will show the deck ends with a ¼” less tolerance from the centerline of the support, keeping in mind the gap between deck ends and /or distance from the pour stop cannot exceed ¾” without requiring cell closure.

Examples of steel deck detailing

Deck perimeter – edge of deck (EOD)

Deck Sections

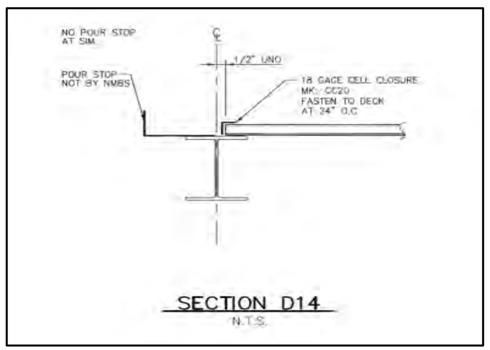


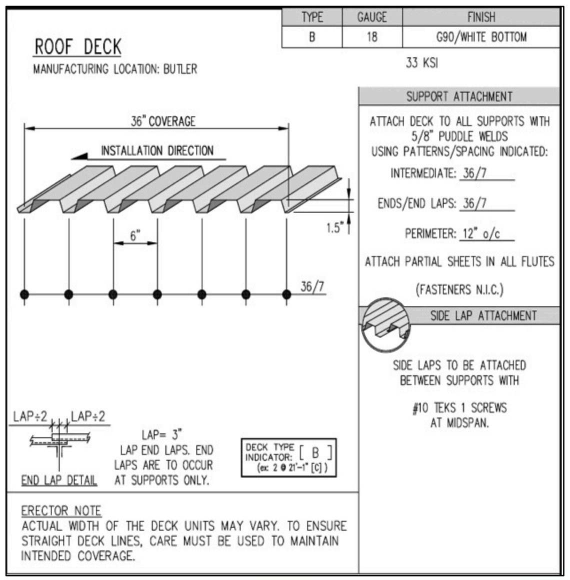
The detailer will show the basic "typical" edge of deck sections (not to be confused with the edge of slab EOS) with a "See Plan" note for these edges. The detailer will also identify any accessories to be installed, along with any openings to be enclosed. Deck sections are best combined whenever possible to denote all deck limits, so long as the deck profile is the same for each section. Sections should show the profile and edge limits of the deck by referencing these from a column line or clear reference point.

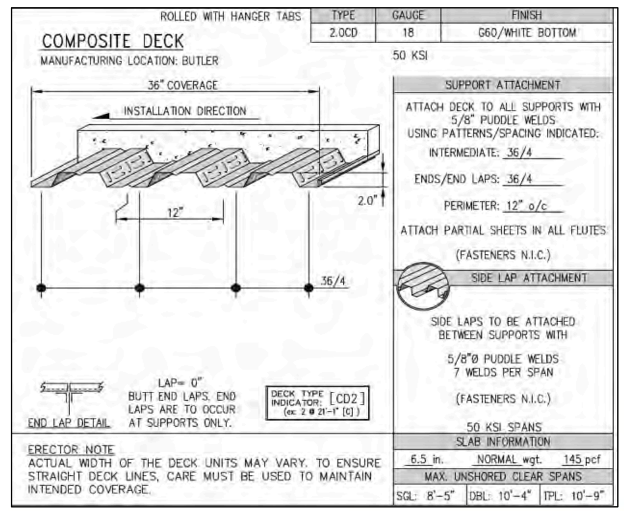
Examples of steel deck detailing

Deck perimeter – edge of deck (EOD)

Deck Attachment



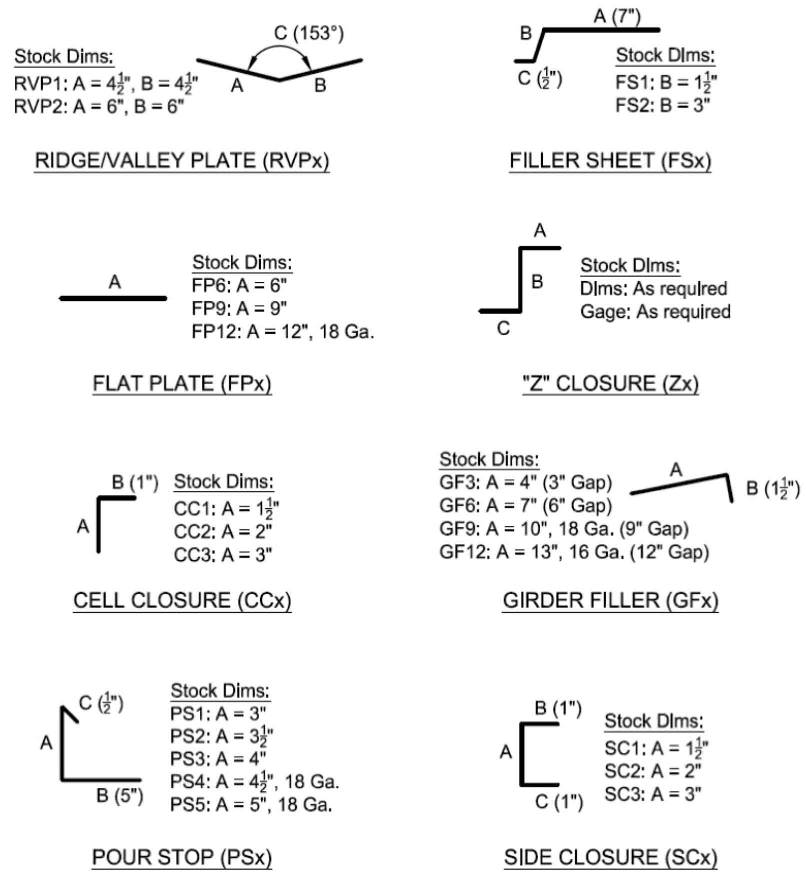




As you learned earlier, there are two kinds of deck attachments: mechanical and welded. Mechanical fasteners are installed by mechanical means. They are self-tapping screws, powder actuated pins, and pneumatic pins. The second type of attachment is welded. An important detailing task is to show how the decking is to be attached using either of these methods to the supporting members, whether joists, beams, or other. The type, quantity and pattern of attachment are specified by the engineer of record (EOR). His or her design is based on the depth of the deck, type of deck, thickness of deck, and the deck cover, such that when fastened the decking will as planned resist the lateral and uplift loads acting on the building. A deck attachment pattern is also included on the plan to show the various types of attachments.

Examples of steel deck detailing

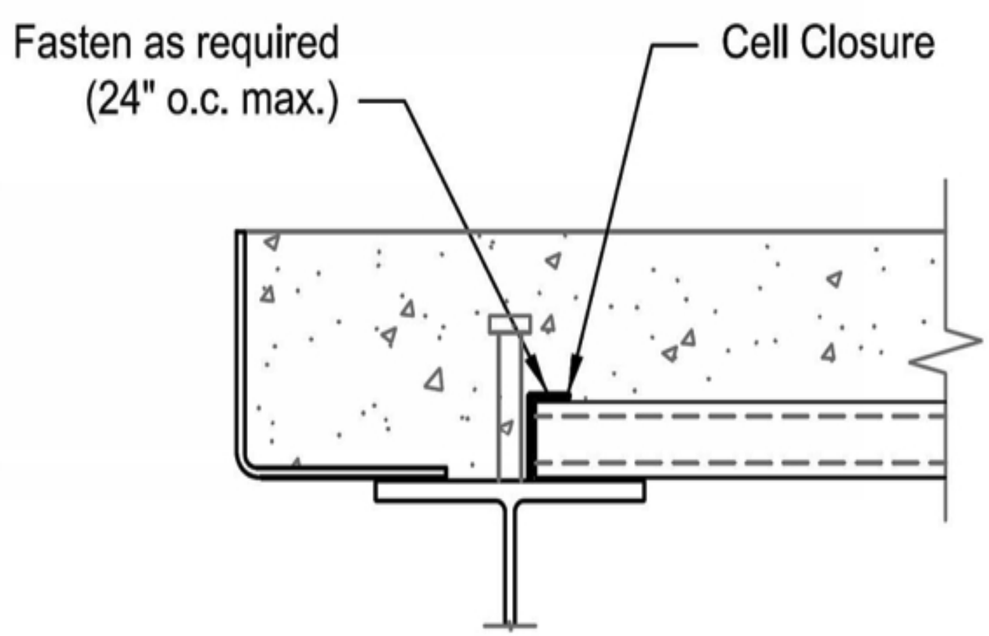
Deck finishing components



Deck finishing components include cell closures, pour stops, finish strips, z-closures, and column closures. Each accessory needs to be shown using section cuts, which are inset illustrations that show the erector the exact orientation, location and attachment points for each accessory. To give you a better knowledge of the detailing process around deck finishing components, we will next review some examples.

Examples of steel deck detailing

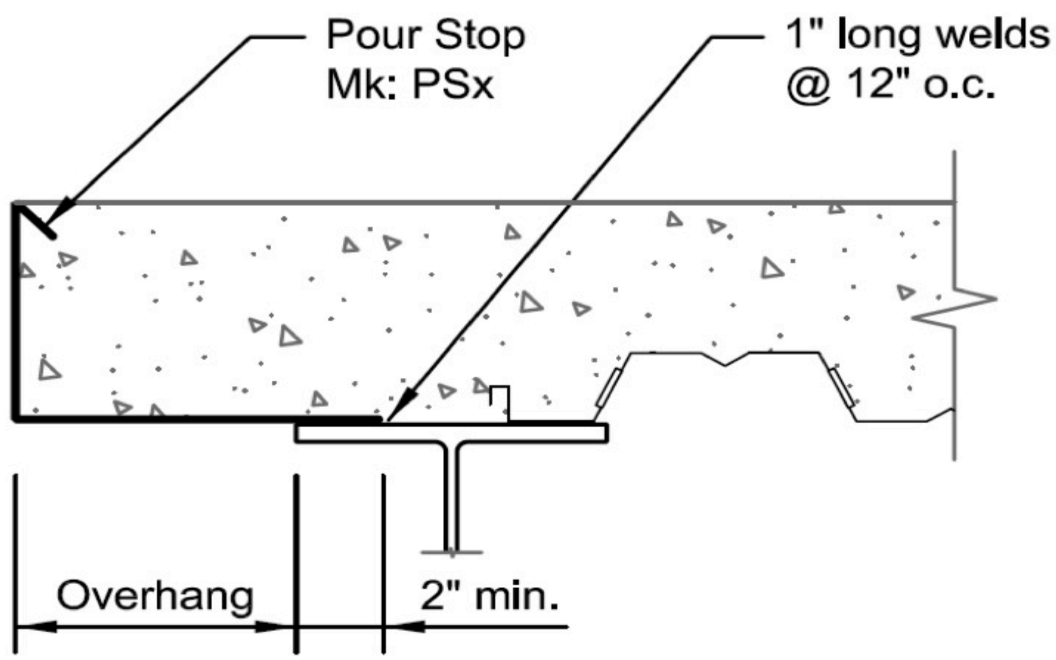
Cell closure



Cell closure is used with composite and form deck to stop the back flow of concrete passing through the flutes of the deck. Cell closure is made of light gauge metal with a vertical leg matching the deck depth and a minimum 1” horizontal leg. They are generally not applied to form decks 1 5/16” or less in depth.

Examples of steel deck detailing

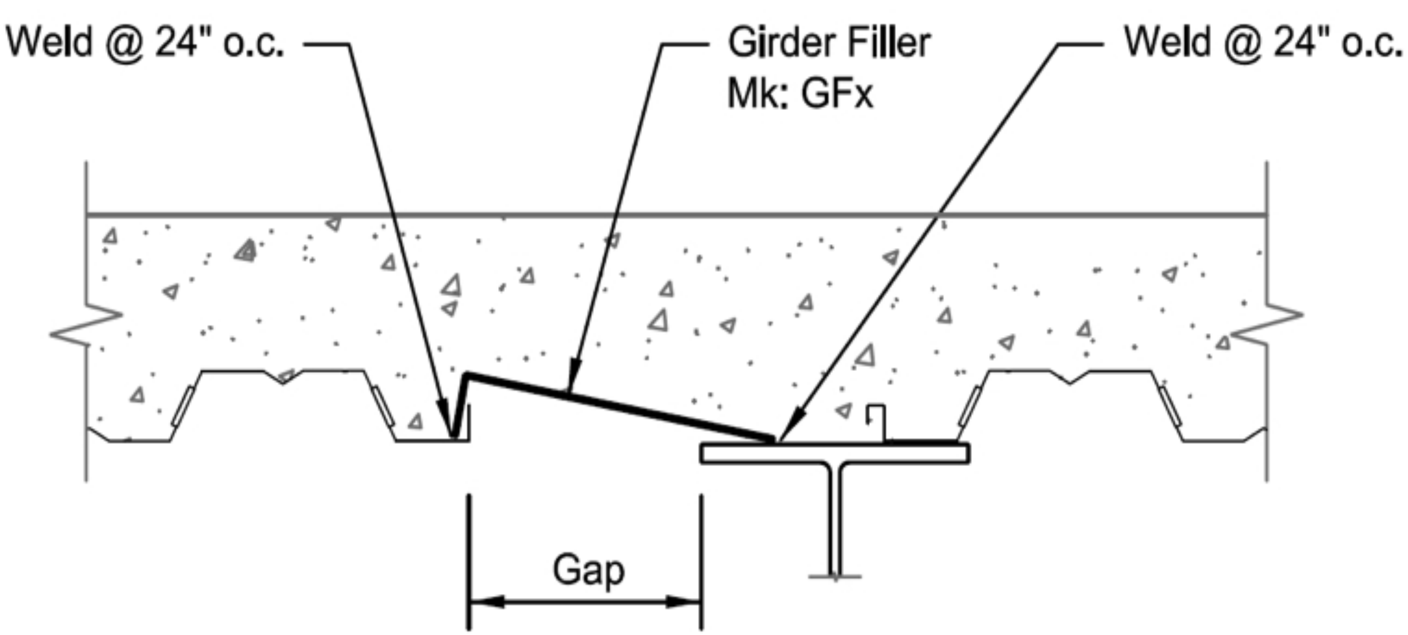
Pour stop



Pour stop is used to stop the concrete pour and to form the edge of the cured concrete. Leg lengths and thickness of the legs given in the Steel Deck Institute pour stop table are based on a fully supported horizontal leg along the length of the pour stop, vertical deflection limit of ¼” and a design stress limit of 22KSI for the overhang of the light gage material under the given slab thickness of normal weight concrete, which determines the height and overhang of the pour stop. A return or lip along the vertical leg of the pour stop is used to prevent differential buckling of the light gage material and maintain a straight edge. The deck manufacturer’s engineering can be consulted to design pour stop, which is unsupported between support spans.

Examples of steel deck detailing

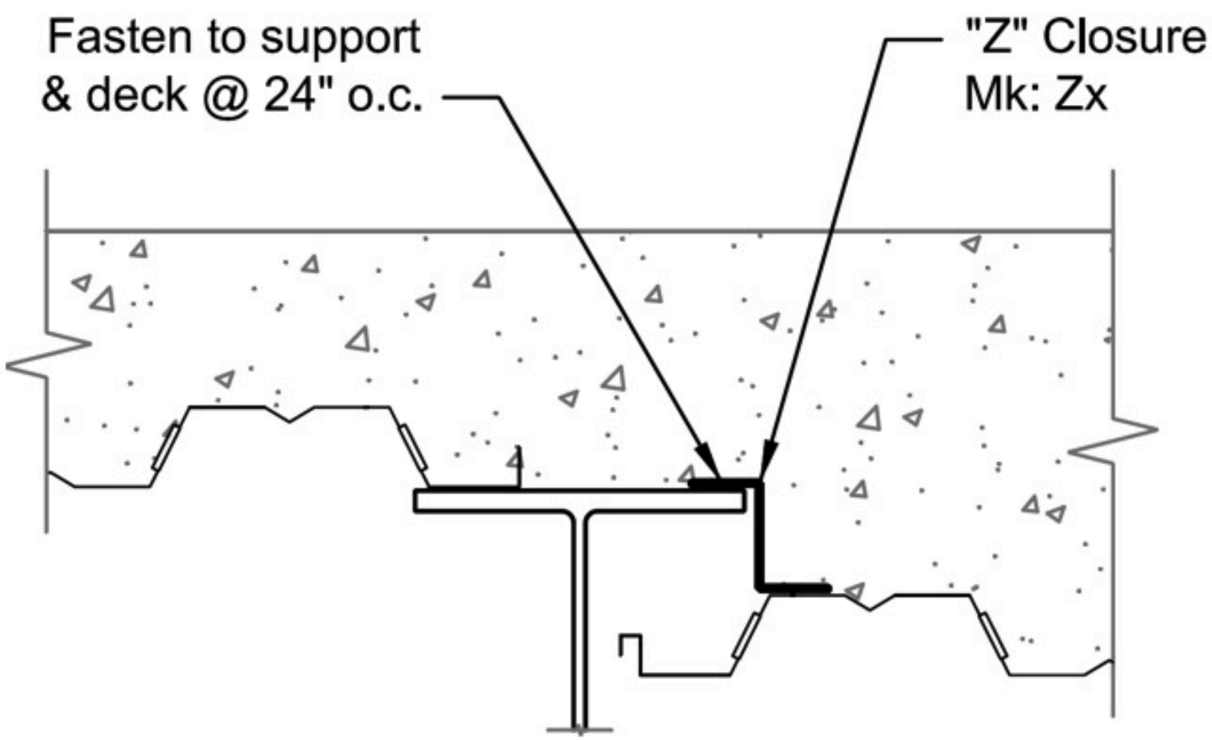
Finish strip



Finish strip or girder filler is used with composite floor deck to make up deck cover between the last sheet of deck to the next adjacent beam or joist parallel to the deck span so as not to add another full sheet of deck and/or ripping a deck length to the width needed to clear shear studs when used.

Examples of steel deck detailing

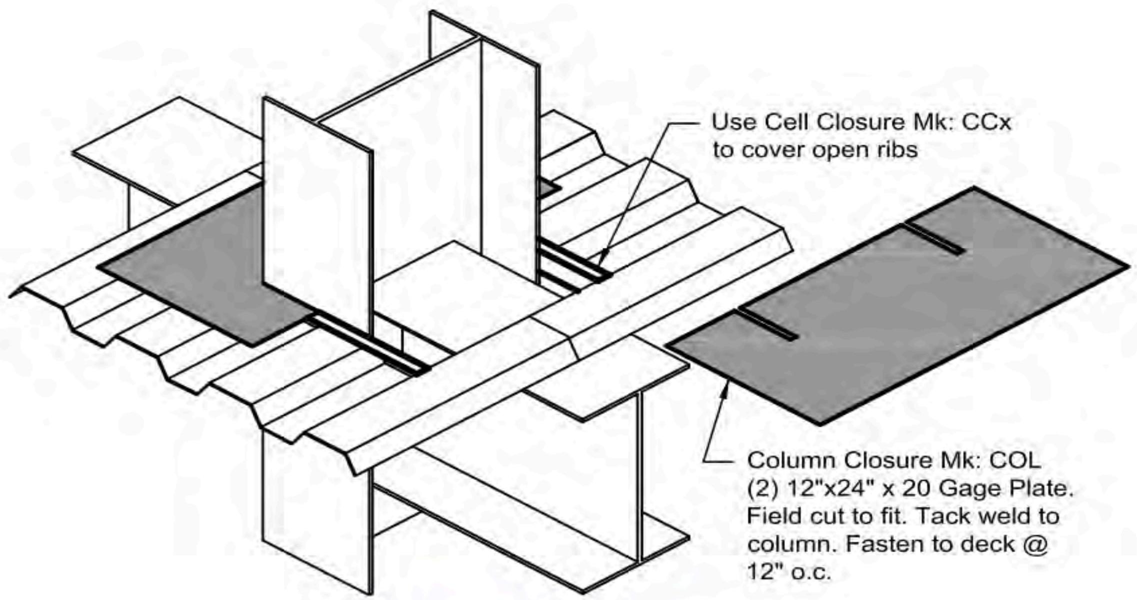
Z closure



Z-closure is commonly used with floor deck to stop the pour when there is a change in deck elevation between a deck support and a supporting beam flange. A Z-closure can also be used at the roof to make-up for deck cover around the perimeter of the building.

Examples of steel deck detailing

Column closure

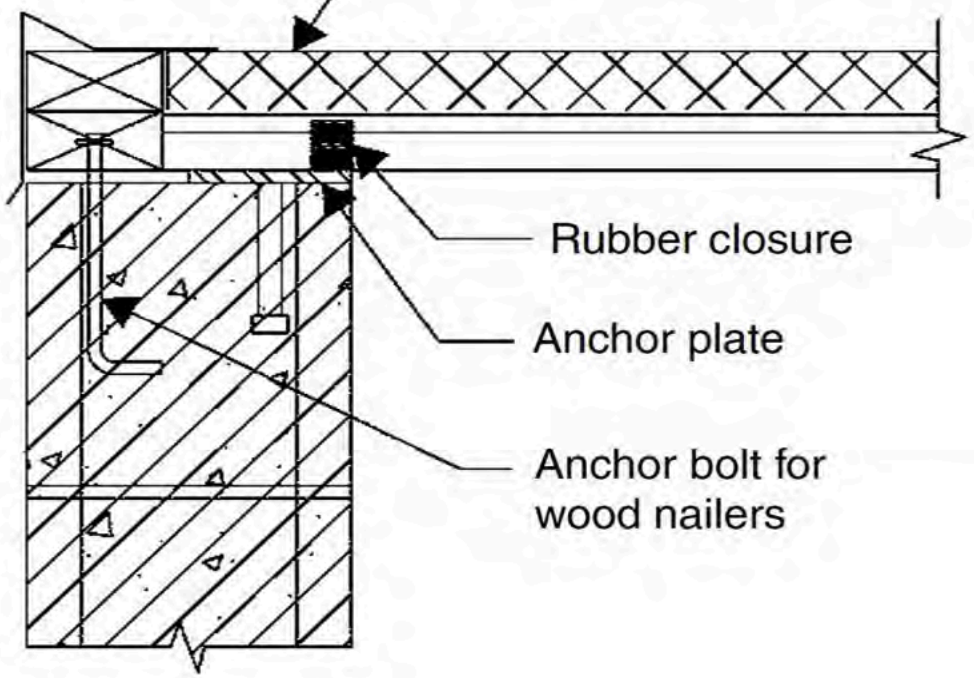


COLUMN CLOSURE DETAIL

Column closure is used on floors around columns to stop the pour and may be 1'x2' gauged plate or wire mesh. Each column requires 2 pieces of 1'x2' flat plate. So a project requiring 40 columns will need 80 pieces of enclosure plate. Cell closure may be required to prevent concrete backflow through the flutes of the decking if gaps are created between the floor opening and the column closure.

Examples of steel deck detailing

Rubber closure



Rubber closure is used to create a sound barrier around the perimeter of a building or interior space, such as a room that needs to be sound isolated. Rubber closure is also used as a barrier against the elements at cantilevered conditions where roof deck flutes are exposed. Rubber closure is optional, so the detailer needs to pay close attention to the take-off and the contract sections and specifications.

Examples of steel deck detailing

Deck bundling

The steel deck detailer will also provide special instructions to guide the deck erection process safely and efficiently. An example of this is the safe placement of steel deck bundles on the project site. Deck bundling cannot exceed 4000 pounds per OSHA requirements. Deck bundles need to be placed over four supports (3 span conditions), and placed within 1’-0” from a primary structural member.

Factory Mutual requirements

- Roof Deck Span
- Deck Fastener Spacing
- Perimeter Zone Definition
- Welds and Fastener Recommendations

Another role of the steel deck detailer is to account for any Factory Mutual (FM) compliant provisions in the detailing of the deck erection drawings. FM is an insurance company that insures buildings for natural disasters, such as earthquakes and hurricanes. To control their losses, FM specifies deck design that is based on their research for different load conditions, especially wind loads and fire and the behavior it has on buildings. Class 1 and 2 roofs are described in relation to fire hazards. Class 1-60, 1-90, etc. roofs are described in relation to wind resistance. Listed here are some of the design considerations addressed by FM.

Listed here are some examples of Factory Mutual provisions.

Roof Deck Span – if Factory Mutual 1-28 is specified, check allowable deck spans per profile. The specifying professional is advised to consult the deck manufacturer.

Deck Fastening – if the specification references Factory Mutual I-60 thru I-90 Windstorm Classification then the minimum support fastener spacing requirements are 6” on centers at the perimeter and 12” on centers at the building interior. Classifications 1-105 through 1-135 will require Grade 80 steel in addition to more frequent attachments.

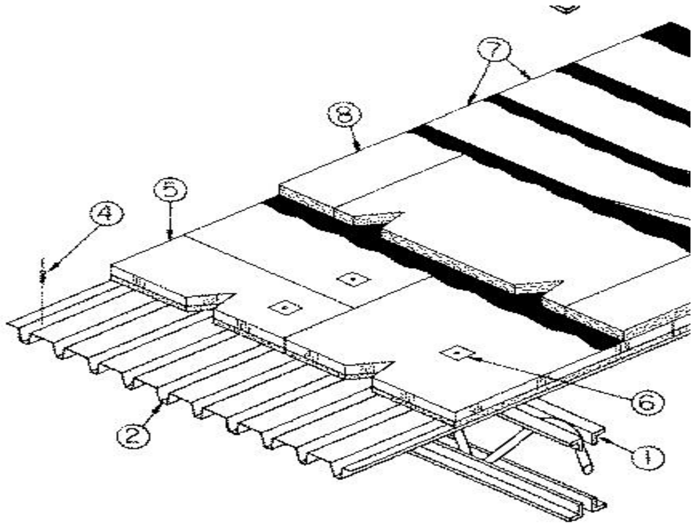
Factory Mutual requirements

- Roof Deck Span
- Deck Fastener Spacing
- Perimeter Zone Definition
- Welds and Fastener Recommendations

If the perimeter zone is not defined on the contract drawings, then use the Factory Mutual definition as the smaller of: (1) 0.1 times the buildings lesser dimension; (2) 0.4 times the eave height; (3) subject to a minimum width of 4 ft. Steel Deck Design Attachment Recommendations – minimum 5/8" diameter welds are used in wind exposure 2; minimum ½" diameter welds are used in wind exposure one. If FMRC-approved deck fasteners are used instead of welds, they should be spaced as stated in the deck manufacturers' catalogs.

UL requirements

- Construction No. 143: Form deck
- Construction No. 155: Form deck, galvanized
- Construction No. 157: F and B deck



Steel deck detailers must also be proficient at reviewing any Underwriter's Laboratory (UL) requirements related to the decking. For example, if a UL fire rating is specified on the contract drawings, then the EOR has selected materials in an assembly that comply with the specified fire resistance rating. The proactive detailer is to review the specified UL rating and match it against the material being detailed. Discrepancies should be reported to the specifying professional along with a request for a review and advice.

The Underwriter's Laboratory also tests roof assemblies for uplift. Most deck types can be engineered and manufactured to follow (UL) deck constructions, which are rated for wind uplift Class 90. The most common UL constructions are listed here.

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