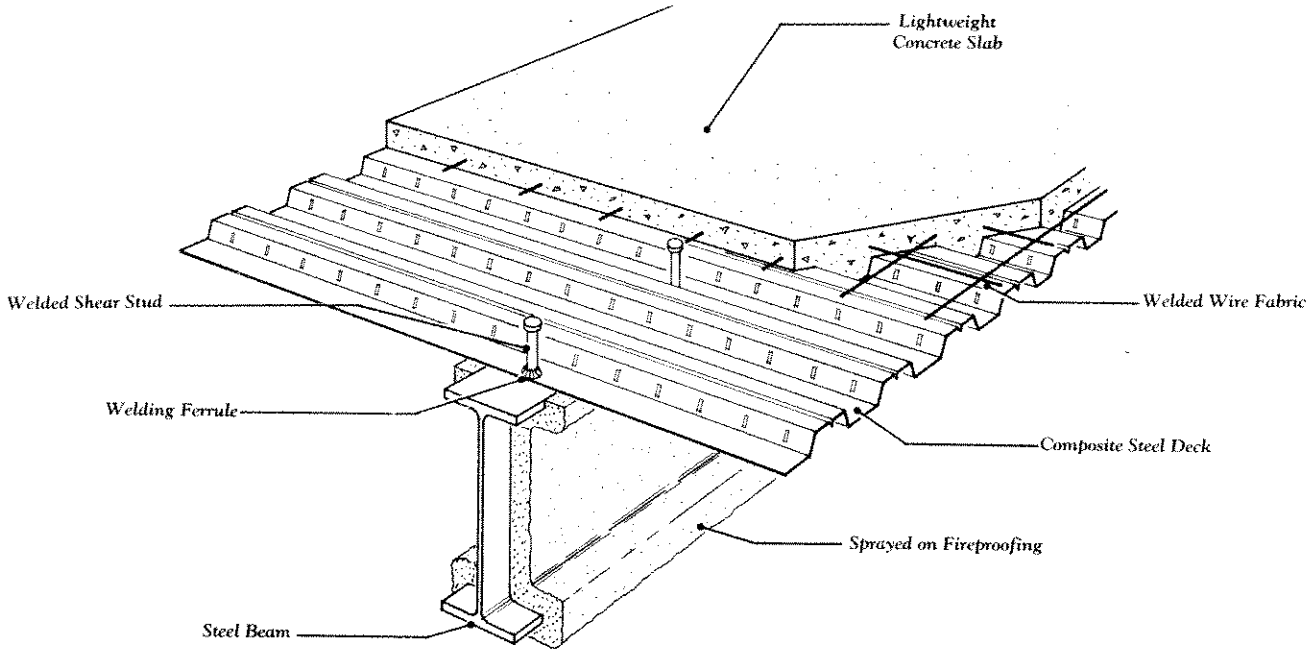
3 SUPERSTRUCTURE
COMPOSITE WF BEAMS, DECK, AND SLAB



Composite Beam, Deck, and Slab

Composite construction, as applied to floor or roof systems, consists of steel beams and girders with shear connectors (metal studs) welded to the top flange of the beam and encased by a concrete slab. This system causes the concrete slab and the steel beam or girder to act as a unit. Because the connectors are sized and spaced to resist horizontal shear between the steel beam and the concrete slab, the effective depth of the system is increased. The concrete slab may also be of composite design by utilizing a composite steel deck for formwork.

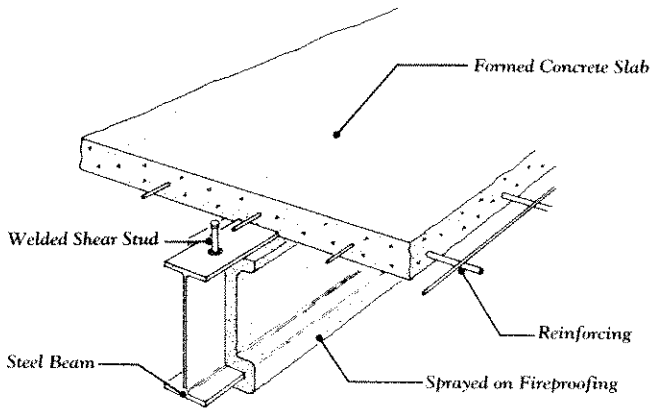
In some designs the steel beams require temporary shoring until the concrete has attained a specified compressive strength. In addition, some composite beams require partial cover plates (a section of steel plate welded to the bottom flange of the beam) to increase the effective tension area of the beam and to balance the effective compressive area of the concrete slab.

Because a composite beam has greater stiffness than a non-composite beam of equal size, it is an effective system to use for heavy loading, relatively long span, and wide beam spacing.

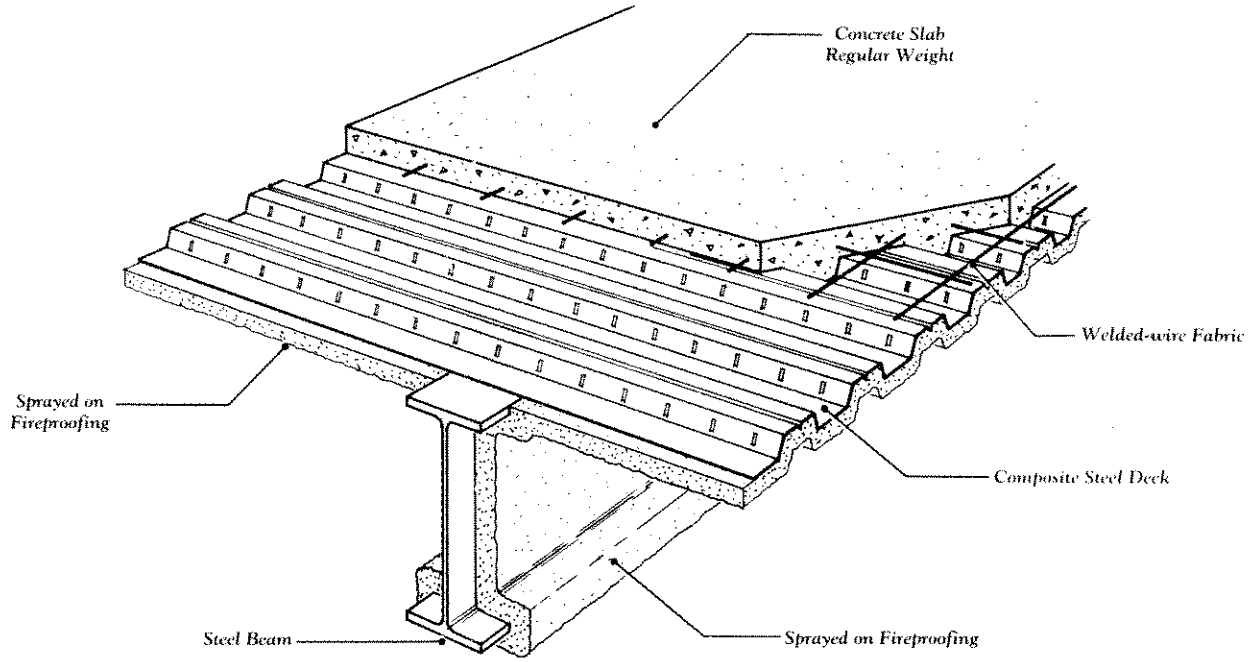
The concrete slab depth usually ranges from 4″ to 5-1/2″ and may be made from regular or lightweight concrete. The use of 4″ lightweight concrete usually conforms to required fire-resistance codes for concrete decks, without using sprayed on fireproofing on the metal deck form. Shear connectors are generally welded studs of 3/4″ or 7/8″ applied to the beams after erection, for safety reasons, with a stud welder.

Man-hours

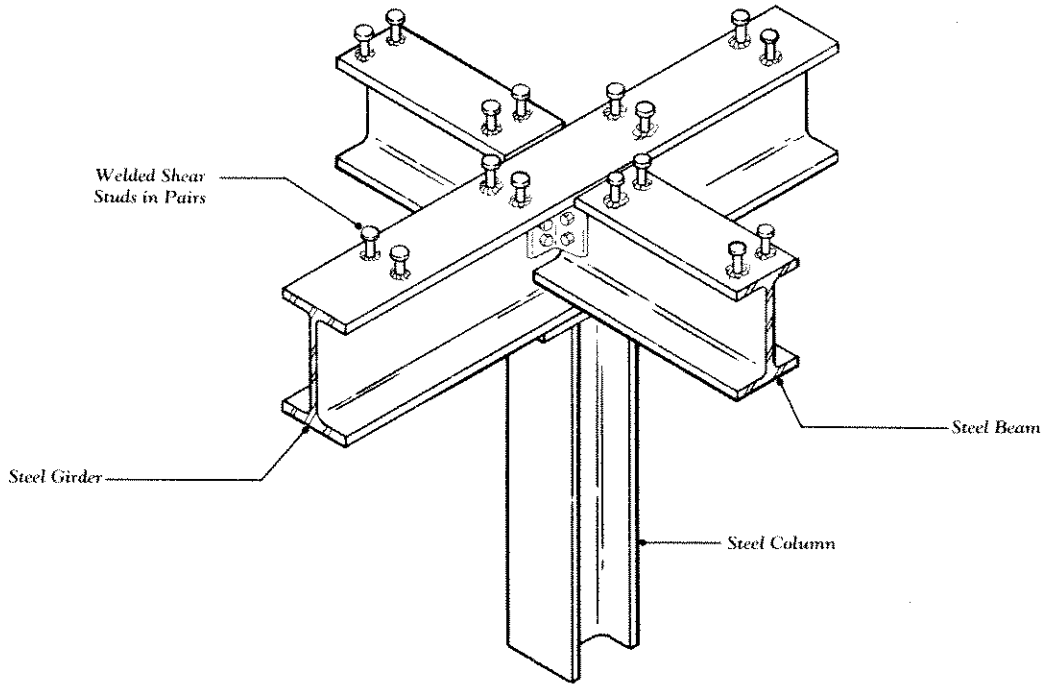
Description	m/hr	Unit
WF Beams Average	4.000	ton
Shear Studs	.016	Ea.
Non-cellular Composite Deck 2″ Deep		
22 Gauge	.008	sf
18 and 20 Gauge	.009	sf
16 Gauge	.010	sf
3″ Deep 22 Gauge	.010	sf
18 and 20 Gauge	.011	sf
16 Gauge	.012	sf



Formed in Place Concrete Slab

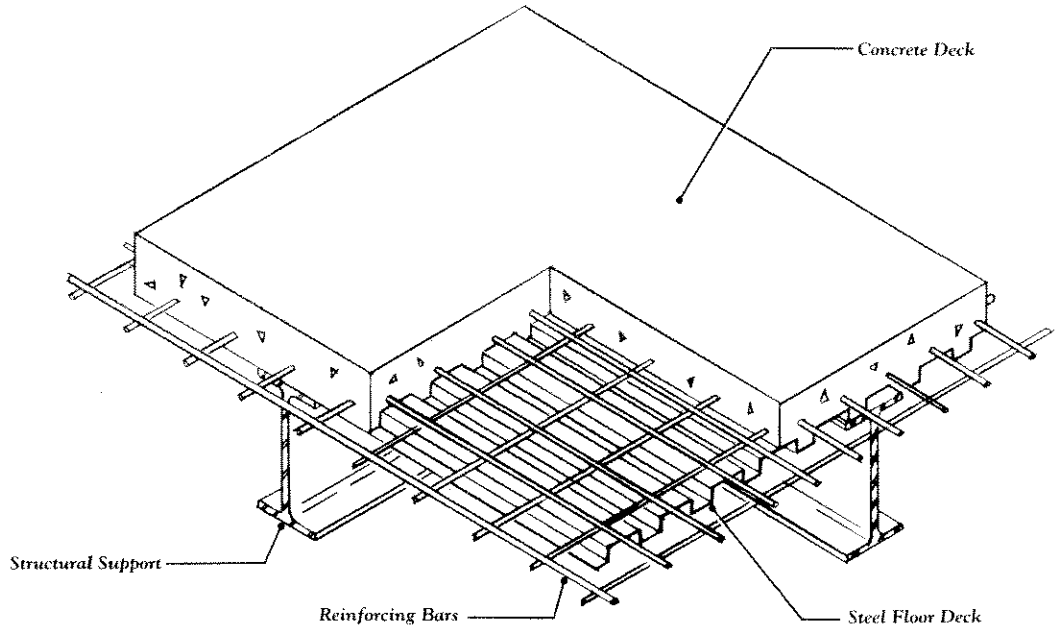


Wide Flange Beam, Composite Deck, and Slab



Paired Shear Studs on Beam and Girder

3 SUPERSTRUCTURE
STEEL FLOOR DECK



Steel Floor Deck

Steel floor deck may be composite or non-composite. In section it may be cellular or non-cellular. When suitably fastened, the steel deck acts as a working platform for the various trades, provides decking as required by OSHA code, and provides the form for the concrete deck.

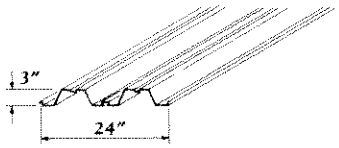
Composite-steel floor deck is cold-formed steel that acts as the permanent form and as the positive bending reinforcement for the concrete slab. It is normally available in 14, 16, 18, 20, and 22 gauge and is galvanized so as to last the life of the structure.

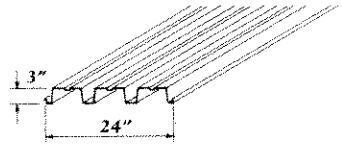
Composite decks vary in depth from 1-1/2″ to 3″ and have cover widths of 12″, 24″, 30″, and 36″. They are available from some manufacturers in a form that allows blending of cellular and non-cellular decks to provide raceways in the floor. Composite cellular deck is available in different gauge steel for the formed section and the flat cover plate.

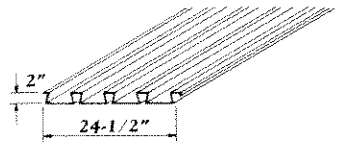
The deck should be erected in accordance with an approved manufacturer's drawing and should span three or more supports, where practical. Deck should be attached to all supporting members, including bearing walls, with a minimum 5/8″ puddle weld at a maximum spacing of 12″ and at side laps by welds or screws at a maximum spacing of 3″. The minimum compressive strength of the concrete used with composite decks should be no less than 3,000 psi. Admixtures containing chloride salts should not be used. Wire mesh or two-way reinforcing bars should be installed near the top of the slab for temperature and crack control.

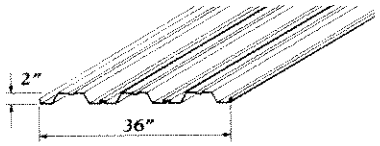
Slab form or form deck is formed steel centering for concrete slabs. When suitably fastened to the supporting members, the deck provides a working platform for the various trades and provides the cover required by OSHA code.

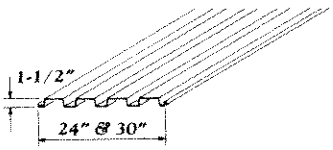
Form deck is normally available galvanized, uncoated, or painted with one coat of primer in 22, 24, 26, and 28 gauge steel. Some available depths include 9/16″, 19/32″, 1-5/16″, 1-1/2″, and 2″. Coverage widths include 27″ and 30″.

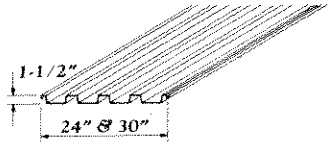


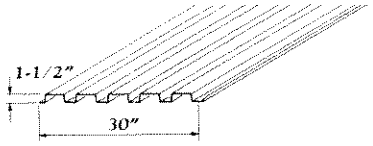


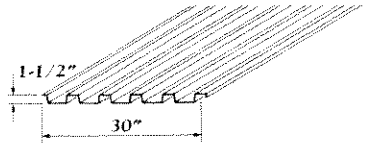




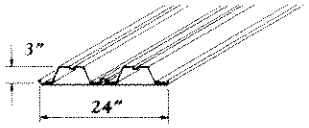


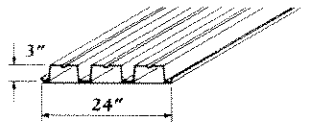


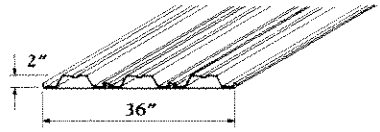


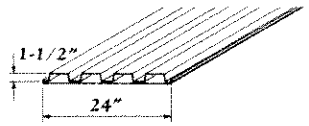


Composite Floor Deck

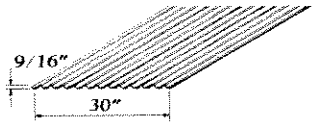


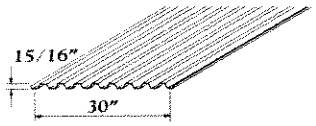


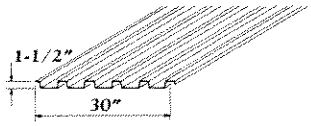


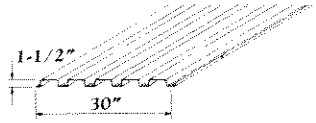


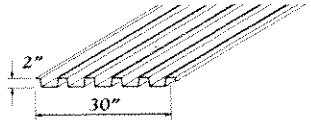
Cellular Deck

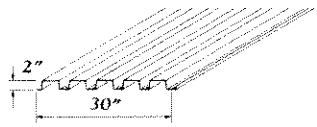




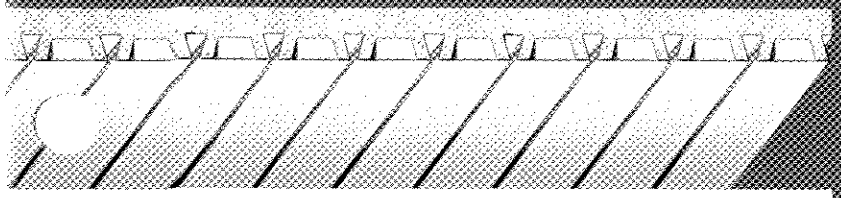




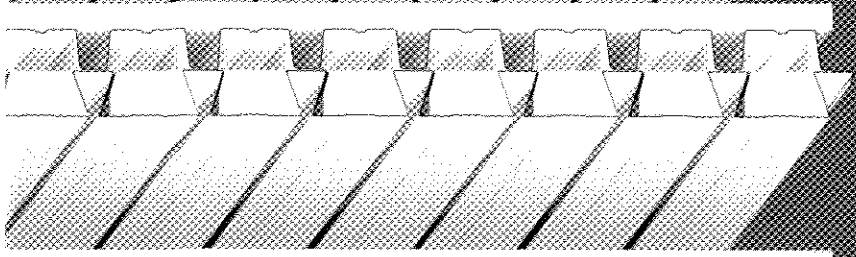




Form Deck



EPICORE® A



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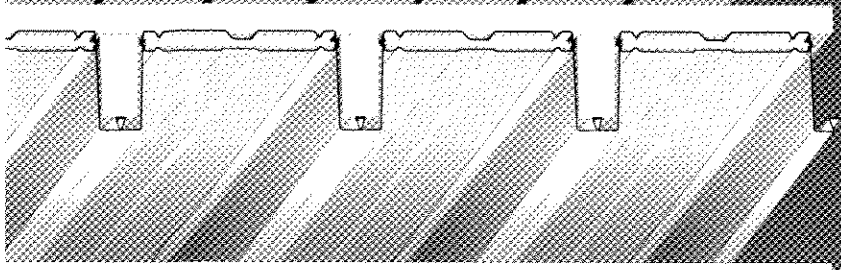
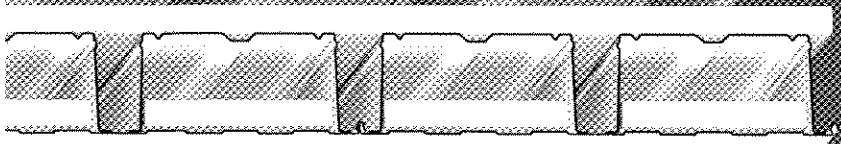


WIDECK® WHFA



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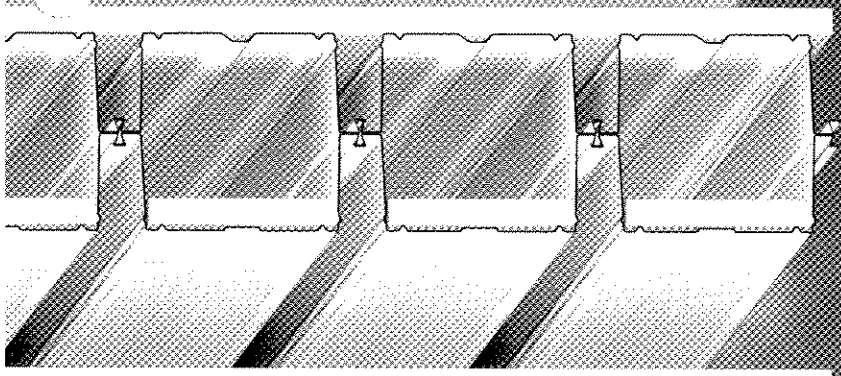
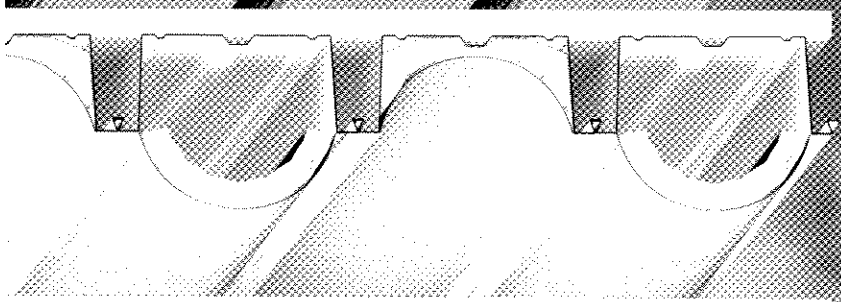


SUPER WIDECK® SWA



ENVISTA™ UDA

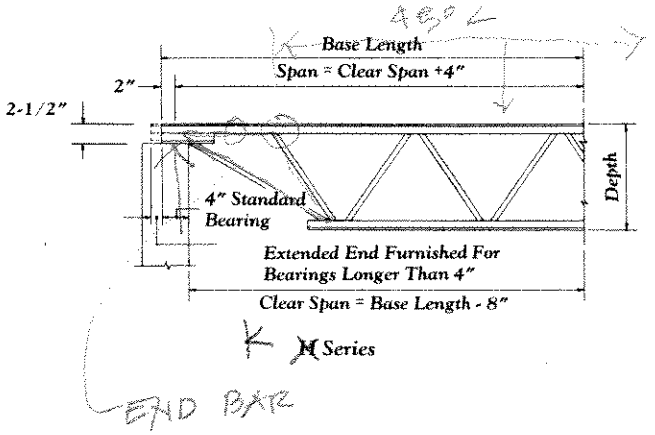
Inspiring creativity through performance.™

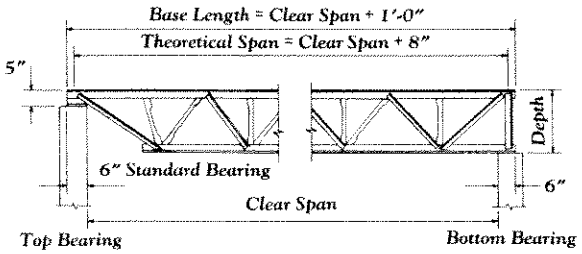
3 SUPERSTRUCTURE
OPEN-WEB STEEL JOISTS: GENERAL

Open-web joists are parallel chord members suitable for the support of floors and roof decks. These joists are normally manufactured in three classifications: H series, in spans of 8′ to 60′ and depths of 8″ to 30″; LH series, in spans of 25′ to 96′ and depths of 18″ to 48″; and DLH series in spans of 89′ to 144′ and depths of 52″ to 72″. H and LH series joists are suitable for the support of floors and roof decks; DLH series are suitable for the support of roof decks only. Joists are manufactured of high-strength steels in accordance with specifications adopted by the Steel Joist Institute. Joist designations are as follows:

18 H 7 are 18″ deep, H series, 7 chord size (approximate weight 10.4 lbs per ft)
40 LH 11 are 40″ deep, LH series, 11 chord size (approximate weight 27 lbs per ft)
60 DLH 13 are 60″ deep, DLH series, 13 chord size (approximate weight 36 lbs per ft)

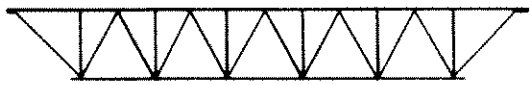
Weights of joists are usually not shown on drawings, but are available in manufacturers' catalogs. This may be important to the estimator, since joists are generally priced by the pound, or ton.





LH and DLH Series

Standard Joist Details



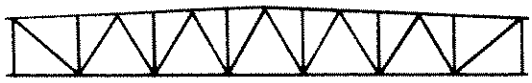
Parallel Chords, Underslung

Top Chord Single Pitched, Underslung

Top Chord Double Pitched, Underslung

Parallel Chords, Square Ends

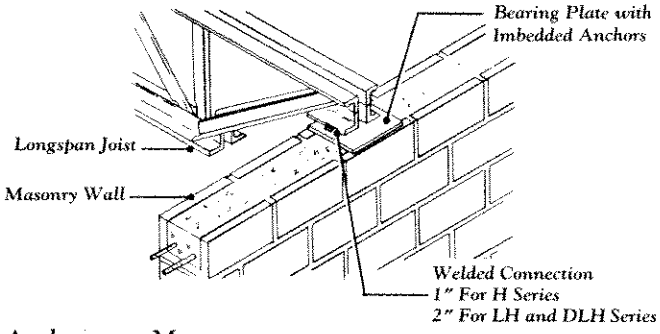
Top Chord Single Pitched, Square Ends



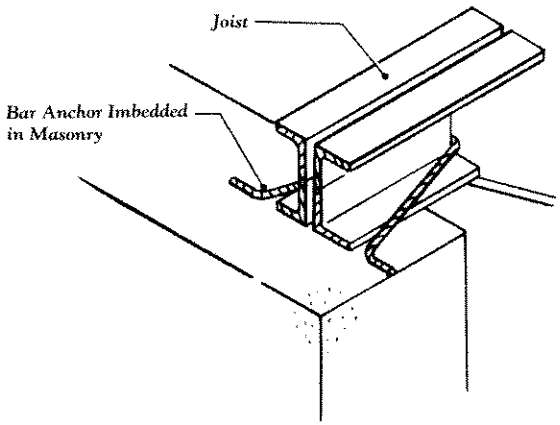
Top Chord Double Pitched, Square Ends

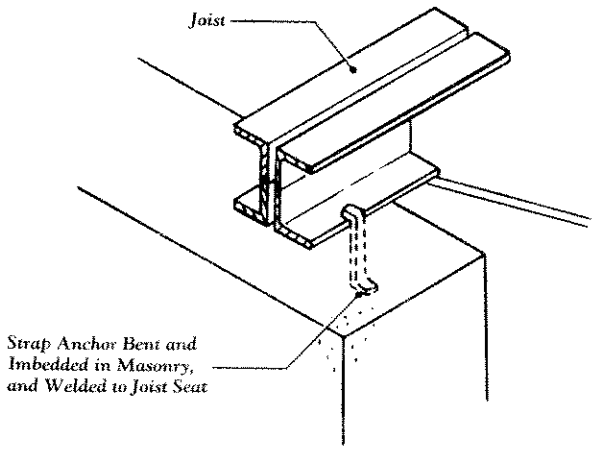
Standard Joist Details

Longspan joists can be furnished with either underslung or square ends with parallel chords, or with single- or double-pitched top chords to provide for roof drainage. The standard pitch of a pitched joist is 1/8″ per foot.



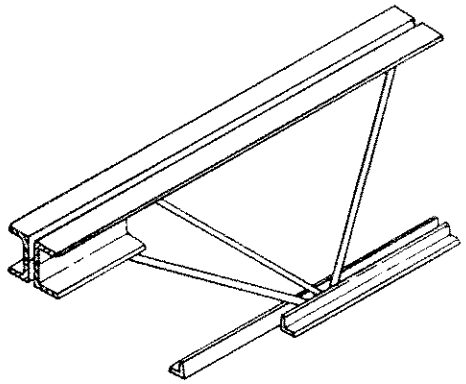
Anchorage to Masonry



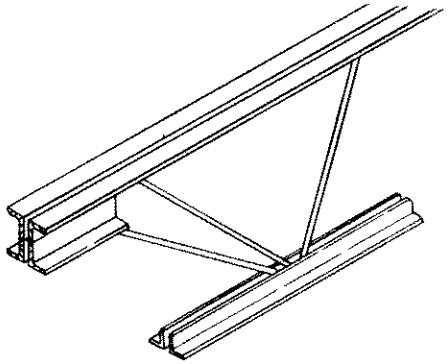


Anchorage to Masonry (Alternates) - H Series

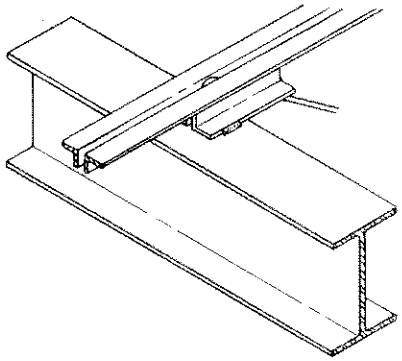
Joists anchored to masonry may be welded to an imbedded anchored plate or by the use of masonry anchors for H series joists.



Ceiling Extension



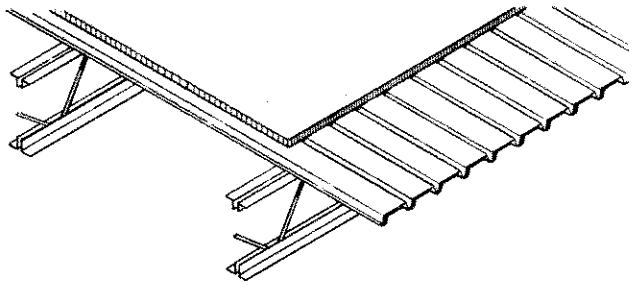
Bottom Chord Extension



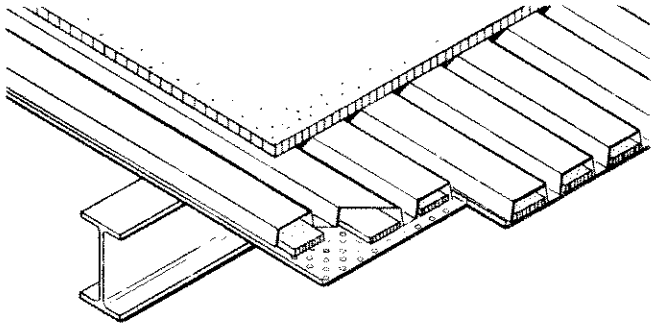
Top Chord Extension

Joists may be ordered with ceiling extensions (extensions of the bottom chord from the first web member to the joist end) to allow attachment of ceiling furring.

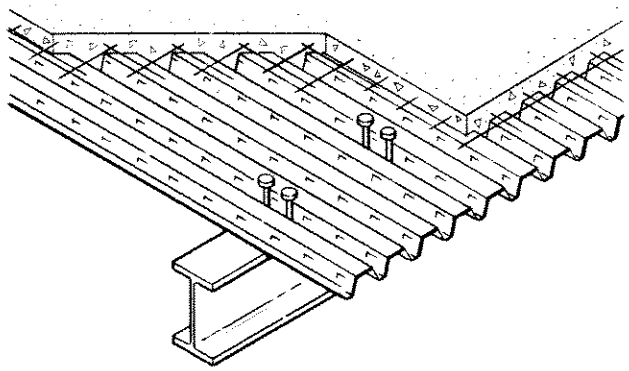
3 SUPERSTRUCTURE
STEEL ROOF DECK



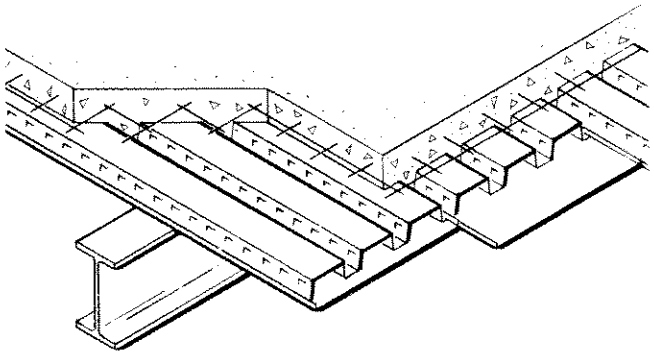
Roof Deck System with Insulation



Acoustic Deck System



Composite Beam, Deck and Slab



Cellular Deck System

Steel roof decking has the advantages of being a lightweight material that covers a large area and can be installed in a minimum amount of time. Decking is manufactured in depths ranging from 1-1/2″ to 7-1/2″, thicknesses from 18 gauge to 22 gauge, and various cover widths. Economy dictates that lengths cover a minimum of two supporting members. Roof deck measuring 1-1/2″ thick is rolled in three configurations: narrow rib, intermediate rib, and wide rib. The interior finish may be galvanized or factory painted.

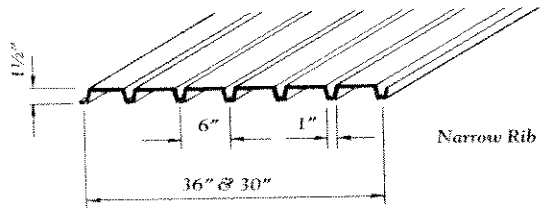
Steel deck stored on site should be blocked off the ground with one end higher than the other to provide drainage. They should be covered with ventilated waterproof material for protection from the elements. The deck may be welded to supporting members, including bearing walls, or fastened with screws. Welds are made from the topside of the deck with puddle welds at least 1/2″ diameter and fillet welds at least 1″ long. Screws should be a minimum size No. 12. Spacing of welds or screws are as follows for all widths of deck: all side laps plus a sufficient number of interior ribs to limit the spacing between adjacent points of attachment to 18″. For spans greater than 5′, side laps shall be fastened between supports, center-to-center, at a maximum spacing of 3′.

Deck sheets should be placed in accordance with an approved erection-layout drawing supplied by the deck manufacturer and in accordance with the deck manufacturers standards. Roofs having a slope of 1/4″ in 12″ or more should be erected from the low side up to produce a shingle effect. The ends of the sheet should lap a minimum of 2″ and be located over a support.

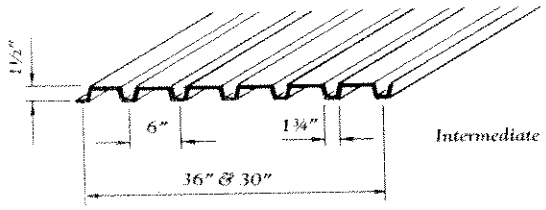
The deck erector normally cuts openings in the roof deck which are shown on the erection drawings and are less than 16 square feet in area, as well as skew cuts. Openings for stacks, conduits, vents, etc. should be cut (and reinforced if necessary) by the trades requiring the openings.

Man-hours

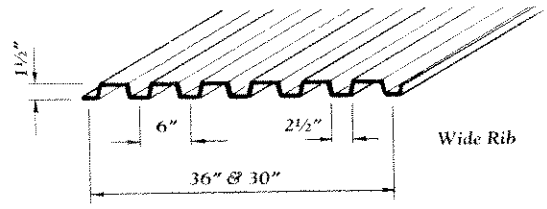
Description	m/hr	Unit
Roof Deck Open Type		
1-1/2″ Deep		
22 Gauge	.007	sf
18 and 20 Gauge	.008	sf
3″ Deep		
22 and 20 Gauge	.009	sf
18 Gauge	.010	sf
16 Gauge	.011	sf
4-1/2″ Deep		
20 Gauge	.012	sf
6″ Deep		
18 Gauge	.016	sf
7-1/2″ Deep		
18 Gauge	.019	sf
Roof Deck Cellular Units Galv.		
3″ Deep 20-20 Gauge	.023	sf
4-1/2″ Deep 20-18 Gauge	.029	sf



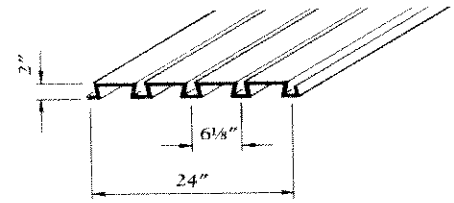
Narrow Rib

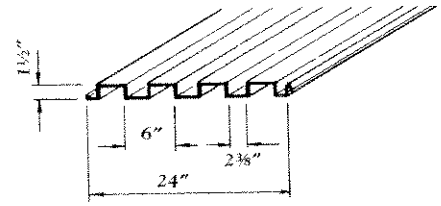


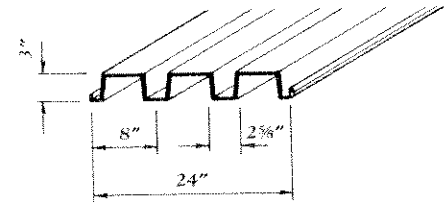
Intermediate Rib

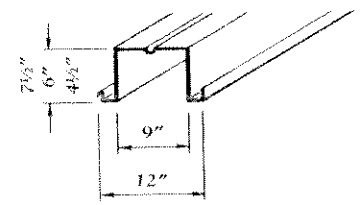


Wide Rib

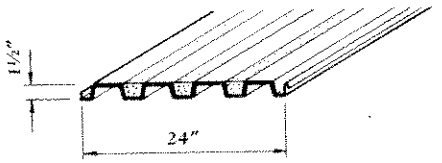


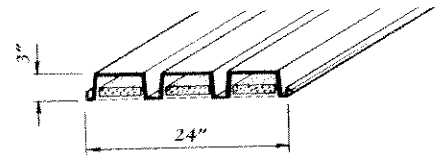


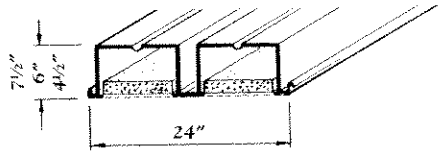




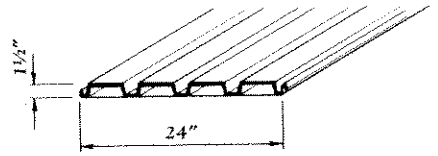
Roof Deck

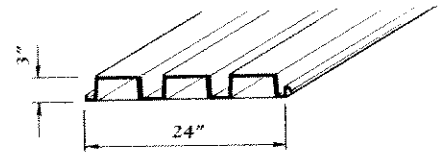


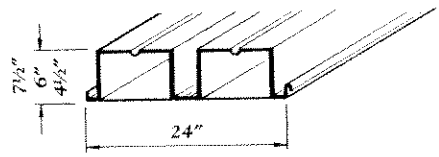




Acoustic Deck



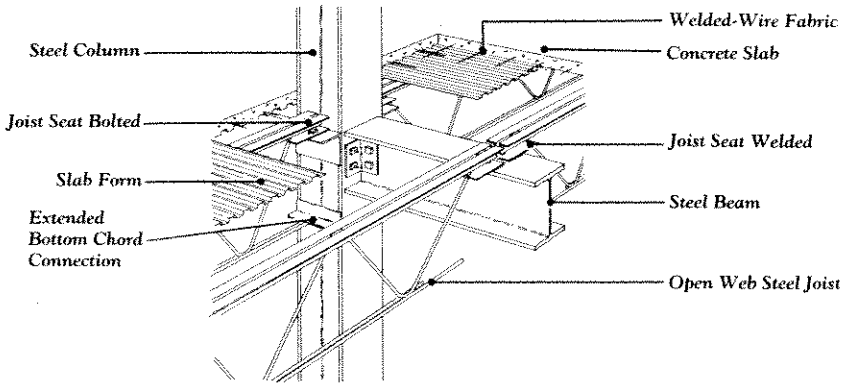




Cellular Deck

3 SUPERSTRUCTURE

CONCRETE FLOORS ON SLAB FORM, STEEL JOISTS, COLUMNS, BEAMS, OR BEARING WALLS



Steel Floor Systems

Concrete floors on slab form or centering, joists, or beams and columns (or columns and bearing walls) is a widely used structural system because of its light weight, fast erection time, and flexibility in bay sizes. The joists are normally welded to the steel beams or girders and are attached to bearing walls with masonry anchors, or welded to preset embedded plates. When joists are attached to columns and form a part of the framing system, OSHA requires a bolted connection for both the top and bottom chords. Concrete slabs are normally placed over steel forms attached to the joists by welding or by self-tapping screws. In multistoried buildings the deck is normally installed immediately following joist attachment to provide a working platform and to satisfy safety requirements.

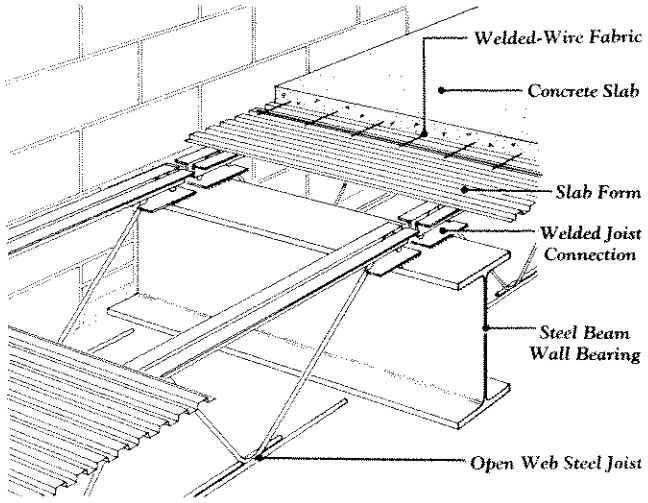
Slabs are normally reinforced with welded-wire fabric. They may be also placed over a centering of lightweight tongue and groove planks, channel slabs, or hollow slabs. They are attached by welding where the planks are metal edged, or by clips when no welding attachments are included.

Plywood installed directly on the joists creates a very economical sub-flooring system and working deck. New developments in fastening systems make connection of the plywood to the steel joists fast and economical.

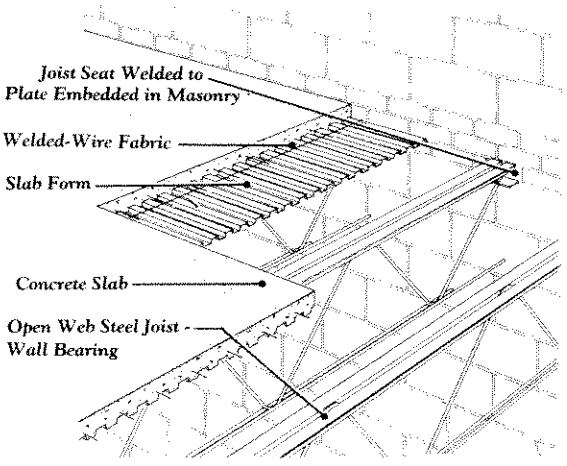
The system may be fire rated by using a rated suspended ceiling of acoustical tile or gypsum board, or a plaster ceiling on metal lath.

Man-hours

Description	m/hr	Unit
Steel Joists H Series		
Horizontal Bridging to 30' Span	6.667	ton
30' to 50' Span (Includes One Row of Bolted Cross Bridging for Spans Over 40' Where Required)	6.353	ton
LH Series Bolted Cross Bridging Spans to 96'	6.154	ton
DLH Series Bolted Cross Bridging Spans to 144' Shipped in 2 Pieces	6.154	ton
Slab Form Steel		
28 Gauge 9/16" Deep to 24 Gauge 1-5/16" Deep	.006	sf
Welded-Wire Fabric Rolls 6 x 6-10/10	.457	CSF
2-1/2" Thick Concrete Floor Fill Including Finish	.021	sf



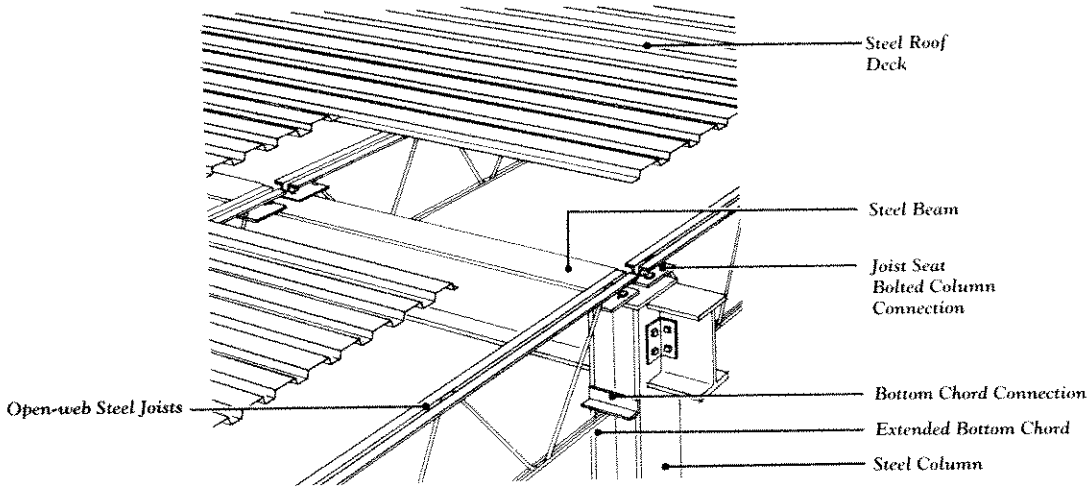
Deck and Joists on Steel Beams



Deck and Joists on Bearing Walls

3 SUPERSTRUCTURE

STEEL ROOF DECK ON STEEL JOISTS, BEAMS AND COLUMNS



Steel roof deck on open-web joists is a widely used roof-support system due to its light weight, fast erection time, and span flexibility. The deck is normally attached to the joists by welding or by self-drilling, self-tapping screws. For economy, joist spacing should be close to the maximum allowable span for the deck used. Spans may be limited by construction and maintenance loads or by insurance regulations. When the deck bearing terminates at a bearing wall, the deck specifications require a positive attachment at the wall, such as a continuous embedded plate for welding or other suitable attachment devices. Steel deck is typically covered by rigid insulation boards, but may also be insulated with vermiculite, perlite, or cellular types of roof fill which are then covered by the roofing material.

Forming roof decks over open-web joists can also be accomplished using bulb T's, formboards and gypsum fill, structural wood fiber planks, or plywood. The roof deck system may be fire-rated with the use of a rated, suspended acoustical-ceiling system, gypsum board or plaster.

Man-hours

Description	m/hr	Unit
Columns Steel Concrete Filled		
4" Diameter	.072	lf
5" Diameter	.055	lf
6-5/8" Diameter	.047	lf
Steel Pipe		
6" Diameter	6.000	ton
12" Diameter	2.000	ton
Structural Tubing		
6" x 6"	6.000	ton
10" x 10"	2.000	ton
Wide Flange		
W8 x 31	3.355	ton
W10 x 45	2.412	ton
W12 x 50	2.171	ton
W14 x 74	1.538	ton
Beams WF Average	4.000	ton
Steel Joists H Series Horizontal Bridging		
To 30' Span	6.667	ton
30' to 50' Span	6.353	ton
(Includes One Row of Bolted Cross Bridging for Spans Over 40' Where Required)		
LH Series Bolted Cross Bridging		
Spans to 96'	6.154	ton
DLH Series Bolted Cross Bridging		
Spans to 144' Shipped in 2 Pieces	6.154	ton
Metal Decking Open Type		
1-1/2" Deep		
22 Gauge	.007	sf
18 and 20 Gauge	.008	sf
3" Deep		
20 and 22 Gauge	.009	sf
18 Gauge	.010	sf
16 Gauge	.011	sf
4-1/2" Deep		
20 Gauge	.012	sf
18 Gauge	.013	sf
16 Gauge	.014	sf
7-1/2 Deep		
18 Gauge	.019	sf
16 Gauge	.020	sf

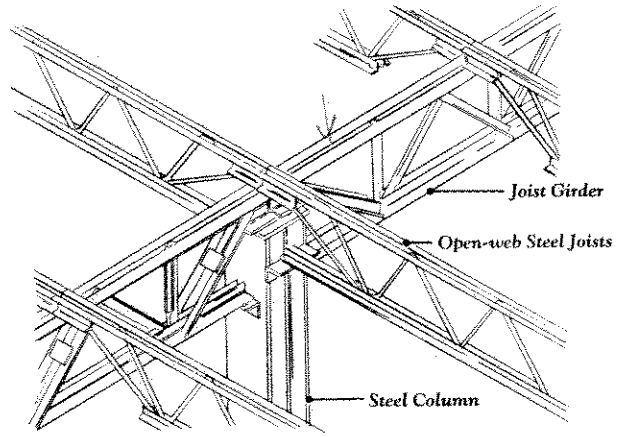
3 SUPERSTRUCTURE
JOIST GIRDERS

Joist girders are framing members that span between columns and support floor or roof joists. They are often used in place of steel beams or girders. Joist girders are steel trusses that look like longspan, open-web joists. They are designed as single-span members and support equally spaced open-web joists at the panel points. Spans vary in length from 20′ to 100′ and in depth from 20″ to 96″. The standard designation and a sketch follow. Approximate weights per foot are shown in manufacturers' catalogs.

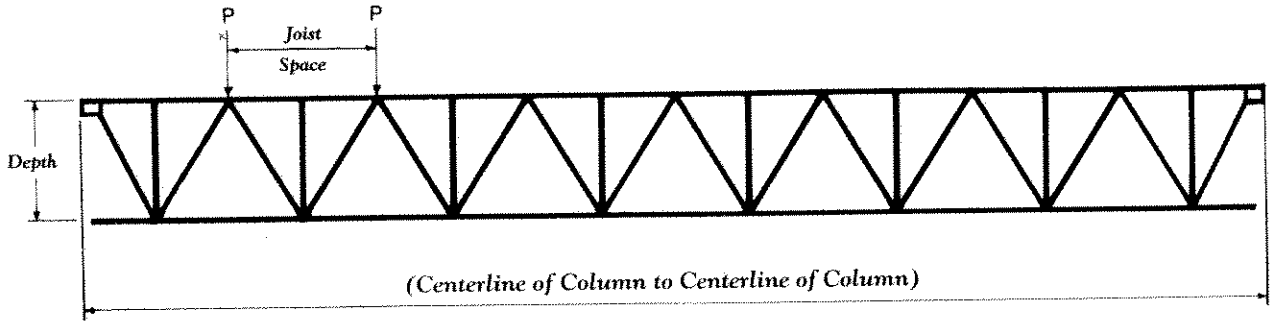
Joist girders allow larger bay sizes, fewer columns, and more usable floor space. They are easily erected, form rigid connections at columns, and provide openings for passage of ducts and piping.

Man-hours

Description	m/hr	Unit
Joist Girders Average	6.154	Ton



Joist Girder System



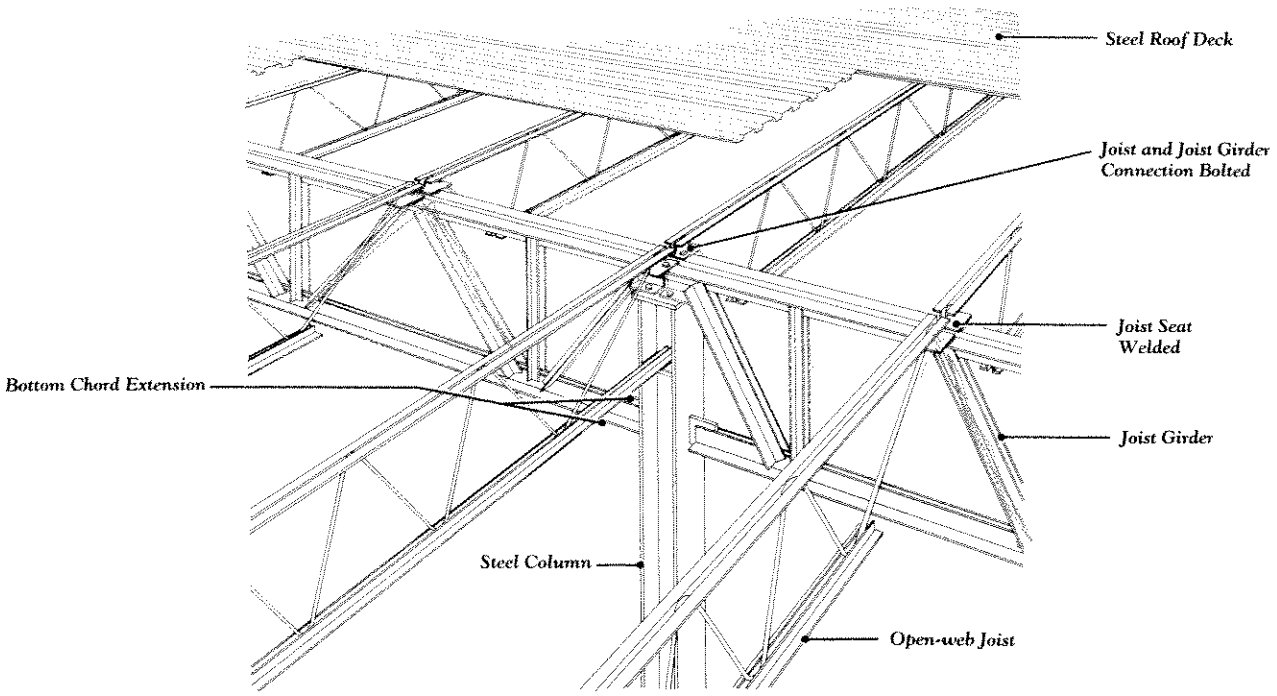
Standard Designation

48G	8N	8.8K
Depth in Inches	*Number of Joist Spaces*	*Kip Load on Each Panel Point (One Kip = 1000 lbs)*

14G 7N

3 SUPERSTRUCTURE

STEEL ROOF DECK ON STEEL JOISTS, JOIST GIRDERS, AND COLUMNS



Steel roof deck on open-web joists, joist girders, and columns allows for long spans in both directions with openings for pipes, conduit, and ductwork through all of the roof-support members. The system is economical and lightweight, and can be quickly erected in most types of weather conditions.

***Note:** The following regulations were developed by OSHA: "As soon as joists are erected, all bridging shall be completely installed and the joists permanently fastened into place before the application of any loads except the weight of the erectors. Many joists exhibit some degree of lateral instability under the weight of an erector until bridging is installed. Therefore, where three or more rows of bridging are required caution shall be exercised by the erectors until all bridging is completely and properly installed.

Where five rows of bridging are required in spans of over 40 feet, each joist shall be adequately braced laterally before the next joist is erected and before any loads are applied. Hoisting cables shall not be released until support has been provided by the center row of diagonal bridging and the bridging line has been anchored to prevent lateral movement, and where joists are bottom bearing, their ends have been restrained laterally."

Man-hours

Description	m/hr	Unit
Columns Steel Structural Tubing		
6" x 6"	6.000	ton
10" x 10"	2.000	ton
Wide Flange		
W8 x 31	3.355	ton
W10 x 45	2.412	ton
W12 x 50	2.171	ton
W14 x 74	1.538	ton
Joist Girders Average	6.154	ton
Steel Joists H Series Horizontal Bridging		
To 30' Span	6.667	ton
30' to 50' Span	6.353	ton
LH Series Bolted Cross Bridging Spans to 96'	6.154	ton
DLH Series Bolted Cross Bridging Spans to 144'	6.154	ton
Metal Decking Open Type		
1-1/2" Deep		
22 Gauge	.007	sf
18 and 20 Gauge	.008	sf
3" Deep		
20 and 22 Gauge	.009	sf
18 Gauge	.010	sf
16 Gauge	.011	sf