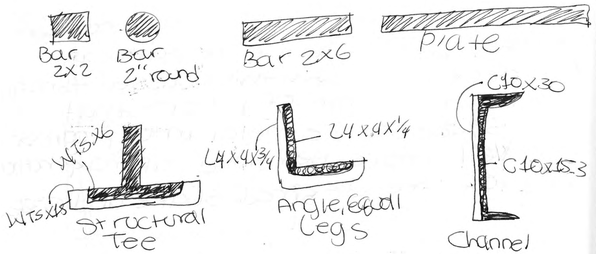
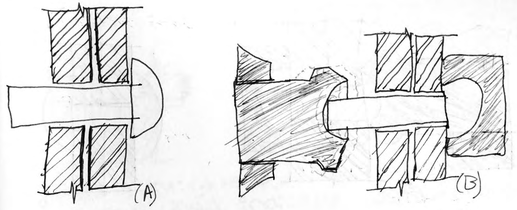


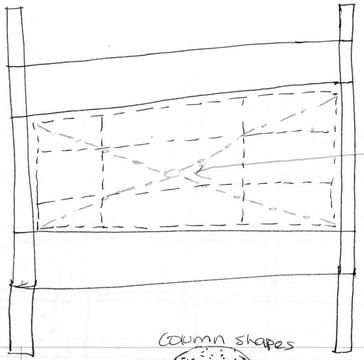


How riveted connections are made.
(a) Hot steel rivet is inserted through holes in the two members to be joined.
(b)(c) Its head is placed in the cup-shaped depression of a heavy, hand-held hammer

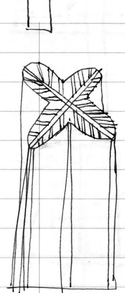
HSS
Hollow Structural Sections

Cold-Worked Steel
Steel can be cold-worked or cold-formed (rolled or bent) in a so-called cold state (at room temperature)

In other parts of the world, a standard range of metric sizes, merely ~~tabulate~~ tabulating metric dimensions for shapes that are produced in conventional units.

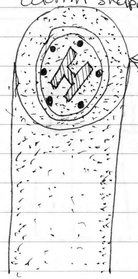


If diagonals are used to brace the structural frame, they will affect the design of the wall units.



Cruciform

Column shapes



Composite columns are structural steel sections thoroughly encased in concrete reinforced with both vertical and spiral reinforcement.

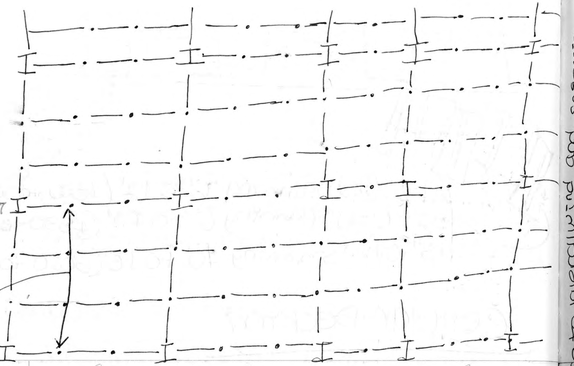
History
Prior to the beginning of the 19th century, metals had little structural role in buildings except in connecting devices.

In the structural mill or breakdown mill, the beam blank is reheated as necessary and then passed through a succession of rollers that squeeze the metal into progressively more refined approximations of the desired shape and size.

Steel - strong and stiff, is a material of slender towers and soaring spans.

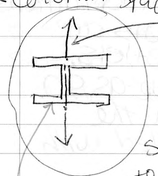
Steel is any of a range of alloy of iron that contain less than 2 percent carbon.

Mild Steel - Ordinary Structural



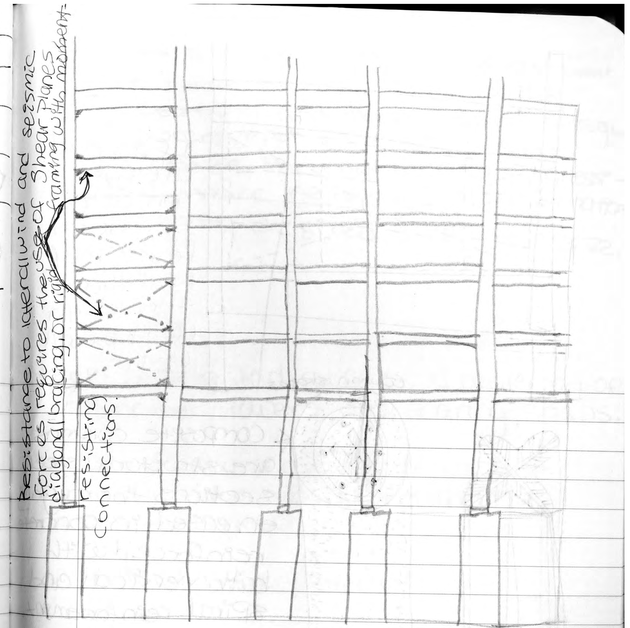
steel framing is most efficient when columns are laid out to support a regular grid of girders, beams, and joists.

column spacing = beam or girder spans

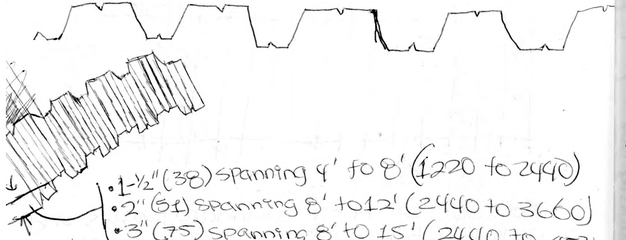


orient the webs of columns parallel to the short axis of the structural frame or the direction along which the structure is most susceptible to lateral forces.

orient the flanges on perimeter columns to the outside to facilitate attachment of curtain walls to the structural frame.



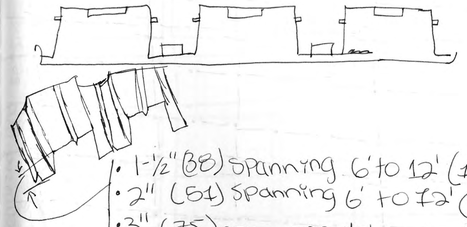
Because steel can lose strength rapidly in a fire, fire-resistive assemblies or coatings are required; In unprotected noncombustible construction, steel framing may be left exposed.



- 1-½" (38) spanning 4' to 8' (1220 to 2440)
- 2" (51) spanning 8' to 12' (2440 to 3660)
- 3" (75) spanning 8' to 15' (2440 to 4580)

Composite Decking

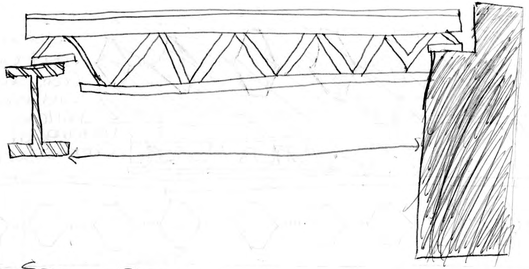
- Composite decking serves as tensile reinforcement for the concrete slab to which ~~is~~ it is bonded with embossed rib patterns. Composite action between the concrete slab and the floor beams or joists can be achieved by welding shear studs through the decking to the supporting beam below.



- 1-½" (38) spanning 6' to 12' (1830 to 3660)
- 2" (51) spanning 6' to 12' (1830 to 3660)
- 3" (75) spanning 10' to 16' (3050 to 4875)

Cellular Decking

- Cellular decking is manufactured by welding a corrugated sheet to a flat steel sheet, forming a series of spaces or raceways for electrical and communications wiring; special cutouts are available for floor outlets. The decking may serve as an acoustic ceiling when the perforated cells are filled with glass fiber.



Span Ranges for open-web joists

- K series standard joists; 8" to 30" (205 to 760) depths.

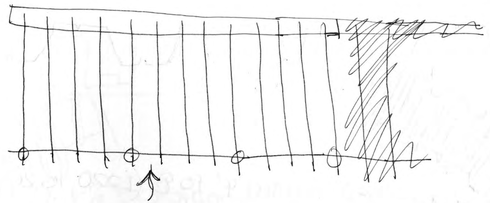
8K1	12' to 16'	(4 to 5m)
10K1	12' to 20'	(4 to 6m)
12K3	12' to 24'	(4 to 7m)
14K4	16' to 28'	(5 to 8m)
16K5	16' to 32'	(5 to 10m)
18K6	20' to 36'	(6 to 11m)
22K9	24' to 42'	(7 to 12m)
24K9	24' to 48'	(7 to 14m)
28K10	28' to 54'	(8 to 16m)
30K12	32' to 60'	(10 to 18m)

- LH series longspan joists; 18" to 48" (455 to 1220) depths

18LH5	28' to 36'	(8 to 11m)
24LH7	36' to 48'	(11 to 14m)
28LH9	42' to 54'	(12 to 16m)
32LH10	54' to 60'	(16 to 18m)

Chord designation

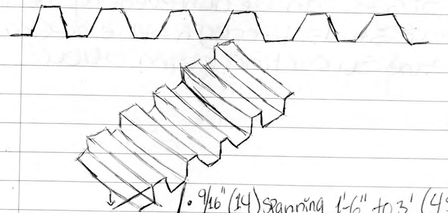
Nominal joist depth in inches



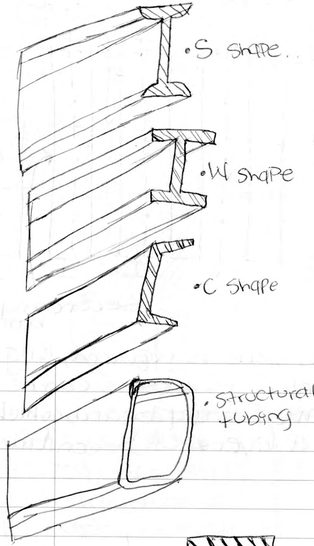
Because of their standard depths and manufactured lengths, open-web joists should span rectangular bays.

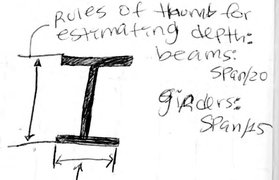
Form Decking

- Form decking serves as permanent formwork for a reinforced concrete slab until the slab can support itself and its live load.



- 9/16" (14) spanning 1'-6" to 3' (455 to 915)
- 1" (25) spanning 3' to 5' (915 to 1525)
- 2" (51) spanning 5' to 12' (1525 to 3660)





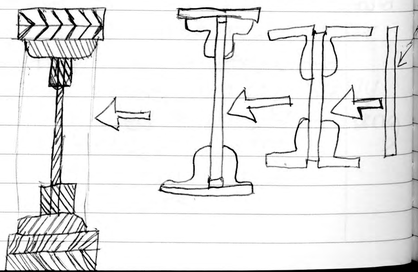
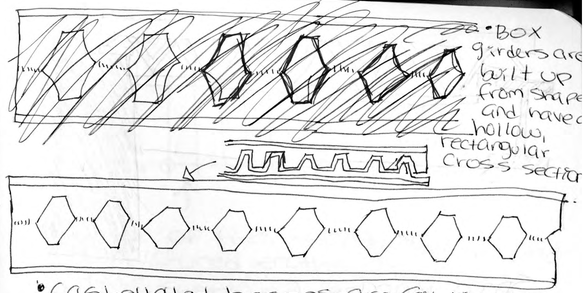


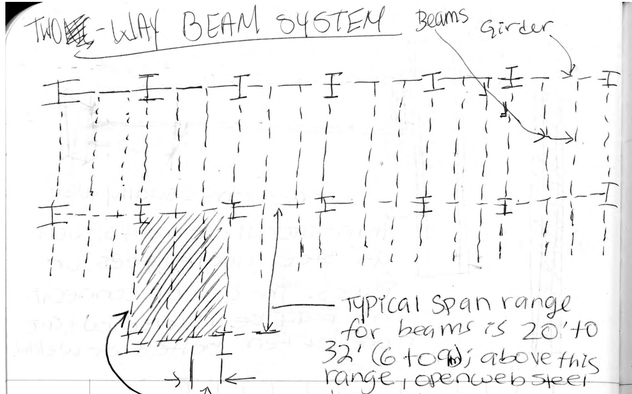
Plate girders are built up from plates or shapes that are welded or riveted together. A web ~~wed~~ plate forms the web of a plate girder. While flange angles form the top and bottom flanges. Shear plates may be fastened to the web of the girder to increase its resistance to shearing stresses.



- Box girders are built up from shapes and have a hollow, rectangular cross section

- Castellated beams are fabricated by dividing the web of a wide-flange section with a lengthwise zigzag cut, then welding both halves together at the peaks, thus increasing its depth without increasing its weight.

TWO-WAY BEAM SYSTEM

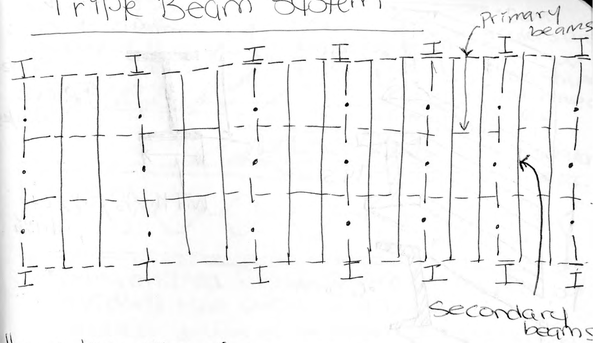


Typical span range for beams is 20' to 32' (6 to 9m); above this range, open web steel joists become an economical alternative due to their reduced weight.

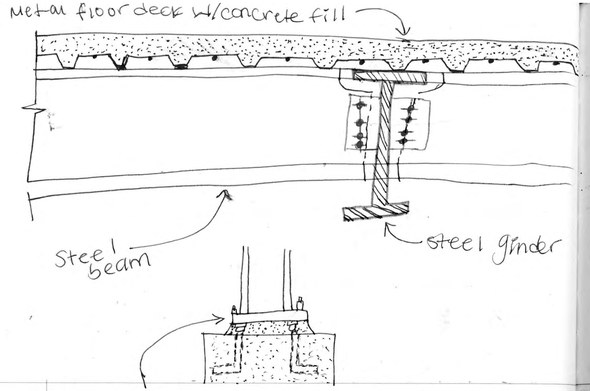
Beams are spaced 6' to 15' (1830 to 4570), depending on magnitude of the applied load and spanning capability of the floor deck.

Steel framing should utilize rectangular bay units, with comparatively lightly loaded beams spanning farther than more heavily loaded girders.

Triple Beam System



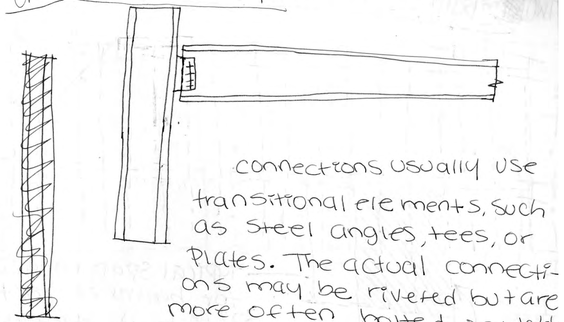
When a large, column-free space is required, long-spanning plate girders or trusses can be used to carry the primary beam, which in turn support a layers of secondary beams.



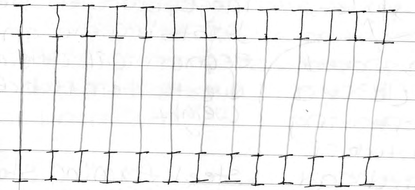
When bearing on ~~steel~~ concrete ~~on~~ or masonry, steel bearing plates are required to distribute the concentrated load imposed by a column or beam so that the resultant unit bearing pressure does not exceed the allowable unit stress for the supporting material.

Structural steel girders, beams, and columns are used to construct a skeleton frame for structures ranging in size from one-story buildings to ~~stye~~ skyscrapers.

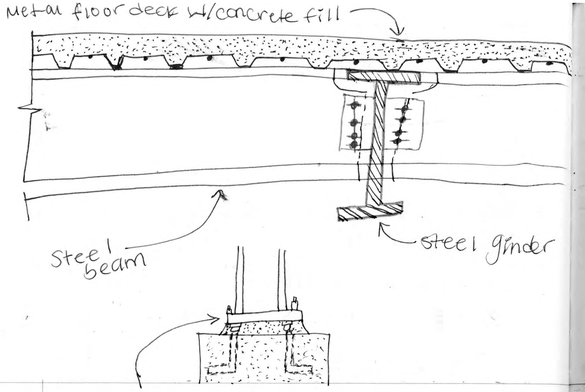
ONE-Way Beam System



connections usually use transitional elements, such as steel angles, tees, or plates. The actual connections may be riveted but are more often bolted or welded



Each pair of external columns supports a long-spanning beam or ~~and~~ girder. This system is suitable for long, narrow buildings, especially when a column-free space is desired.



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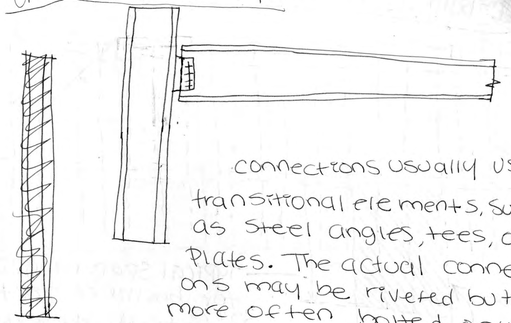
Structural steel girders, beams, and columns are used to construct a skeleton frame for structures ranging in size from one-story buildings to ~~stor~~ skyscrapers.

ONE-Way beam system



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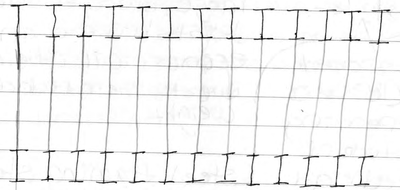


•Each pair of external columns supports a long-spanning beam or ~~and~~ girder. This system is suitable for long, narrow buildings, especially when a column-free space is desired.

The cast iron process continued to facilitate the use of sculptural motifs that repeat in a structure.

~~Mansr~~ Masonry clad steel to the steel frame

Steel is recycled

60% or higher of the steel used is recycled

Cast Iron
↓
Wrought Iron
↓
puddle iron steel
↓
Bessemer process
↓
open hearth method

Iron ore (2.1% to 4% carbon)

Iron Alloy (very low carbon)

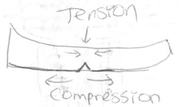
Refining cast iron evolving process to improve strength of cast iron.

Birth of modern steel production

Making steel production efficient.

Wrought Iron	Steel	Cast Iron
Very low Carbon	Less than 2% carbon	3% - 4% Carbon
Malleable / Weaker	Workable / Strong	hard / Brittle

Tension - the state of being stretched tight.



• Steel shape/size designations:
W21 x83

21 ⇒ Nominal depth
83 ⇒ LBs / Foot of Length

L4 x 3 x 3/8

4 x 3 ⇒ Nominal depth of each leg
3/8 ⇒ Thickness of the legs

Cross bracing - A system utilized to reinforce building structures in which diagonal supports intersect. (Can increase a building's capability to withstand seismic activity)