**BEAM DEPTHS**

W-shape beam depth estimate

- **Beam**: ½ in. depth \( d \) per foot of span \( L \), so 30 ft span means 15 in. beam depth (W16)
- **Girder or Beam with heavy loads**: Use above estimate, but round up one size (W18)
- **Roof Purlin**: Use above estimate for beams, but round down one size (W14)

**CANTILEVERS**

Cantilevers are typically \( \frac{1}{4} \) the length of the backspan. Longer cantilevers require deeper, heavier structure for strength and servicability.

**CONNECTIONS**

Lateral, tension, and compression forces must travel from beams, braces, and columns down to foundations through connections.

**TRUSSES**

Appropriate for long spans (>50 ft)

- **Truss depth estimates**
  - triangular or arched: 3–4 in. depth \( d \) per foot of span \( L \)
  - rectangular: 1–1½ in. depth \( d \) per foot of span \( L \)
  - space truss: 1 in. depth \( d \) per foot of span \( L \)

**Some truss examples**

- Parallel chord
- Triangular (Belgian)
- Scissor
- Crescent
- Inverted
- Inverted queen post

<table>
<thead>
<tr>
<th>System</th>
<th>Typ. Span Range</th>
<th>Spacing</th>
<th>Typ. Shapes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Girder</td>
<td>20–40 ft</td>
<td>—</td>
<td>W12–W30</td>
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<tr>
<td>Steel Beam</td>
<td>25–45 ft</td>
<td>10–15 ft</td>
<td>W12–W24</td>
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<tr>
<td>Open Web Joist</td>
<td>10–60 ft</td>
<td>2–5 ft</td>
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<tr>
<td>Steel Truss</td>
<td>40–300 ft</td>
<td>10–20 ft</td>
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<tr>
<td>Roof Purlins</td>
<td>Per truss spacing</td>
<td>Each truss node</td>
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<tr>
<td>Space Frame</td>
<td>80–300 ft</td>
<td>Typ. modules are 4 ft, 5 ft, 8 ft, 12 ft</td>
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</tbody>
</table>

(C.O. & Z, p. 243), (I & R, p. 3), and (A & I, p. 427)
**Columns**

**W-Shapes (Wide-flange)**

Column Size Estimates (larger numbers mean larger columns)

- One-story: W6, W8, W10
- Low-to-mid-rise: W8, W10, W12
- High-rise: W12, W14

(Wruby, pp 15–17)

W-shape columns typically have square proportions in plan.

**HSS (Hollow Structural Steel)**

Column Size Estimates (the number refers to the external dimension)

- One-story: HSS4, HSS6
- Low-rise: HSS8, HSS10

Steel Decking Depth Estimates

- Steel roof decking depth without concrete: 1½ in. and 3 in. typ.
- Composite floor deck with poured concrete depth: 1½–3 in. deck plus 2–4 in. concrete

**Lateral Systems**

Common types of lateral bracing systems that go the height of the building:

- Moment/rigid frame: stability achieved at beam to column connection—balance cost with performance and architectural coordination
- Chevron- or K-braced frame
- Rigid horizontal diaphragm floor or roof
- Shear wall: vertical solid walls
- Cross- or X-braced frame

(ASCI, p. 25)

**Options for Tall Steel Lateral Systems**

<table>
<thead>
<tr>
<th>Stories</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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</table>

**Interior Systems**

- A Moment/rigid frame
- B Braced rigid frame
- C Shear wall and frame
- D Outrigger

**Exterior Systems**

- E Steel braced tube
- F Diagrid
- G Space truss

**References**


**Additional Resources**


These estimates and rules of thumb are for preliminary design estimates only using the most common elements; actual conditions may result in refined solutions. Layout and sizing need to be verified by a licensed professional through structural analysis.

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