1.6 Standard Rolled Shapes

(see Part 1 of AISC Manual)

<table>
<thead>
<tr>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange</td>
</tr>
<tr>
<td>Web</td>
</tr>
</tbody>
</table>

W-Shape: (W- x- )

approx. weight in lb/ft.

approx. depth in inches

American Standard (S- x- )

approx. weight in lb/ft.

depth in inches

k = 3" - t

6" - t = 3/8"
<table>
<thead>
<tr>
<th>Shape</th>
<th>Steel (Preferred)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angles</td>
<td>A36</td>
</tr>
<tr>
<td>Plates</td>
<td>A36</td>
</tr>
<tr>
<td>S, M</td>
<td>A36</td>
</tr>
<tr>
<td>C, MC</td>
<td>A36</td>
</tr>
<tr>
<td>W</td>
<td>A992</td>
</tr>
<tr>
<td>Pipe</td>
<td>A53 Grade B</td>
</tr>
<tr>
<td>HSS</td>
<td>A500 Grade B or C</td>
</tr>
<tr>
<td>HP</td>
<td>A572 Gr. 50</td>
</tr>
</tbody>
</table>

(see p. 2-39 of AISC Manual)
Chapter 2: Concepts in Structural Design

2.1) Design philosophies: (pp. 2-6; 2-7 in ATSC Manual)

Allowable Stress Design or Working Stress Design (ASD or WSD)

ASD: $f_a \leq K \cdot F_y$ or $K \cdot F_u$

Where: $f_a$ = computed stress due to service loading conditions.

$K \cdot F_y$ or $K \cdot F_u$ = "allowable" (or "working") stress

$F_y$, $F_u$ = yield; ultimate strength (stress)

typical values for $K$: 0.50, 0.6, 0.67

depending on structural element.

Written in terms of loads:

$R_u \leq R_n/2$

Where: $R_u$ = required strength (based on service loads)

$R_n$ = nominal strength.
\( \Omega = \text{factor of safety} \)
(typical values of 1.5, 1.67, 2.0)

Load and Resistance Factor Design (LRFD)
(Ultimate Strength Design)

LRFD:
\[ \sum \gamma_i \cdot \text{Load}_i \leq \phi \cdot \text{Resistance} \]

\( \gamma_i = \text{load factor, function of the element of load, typically but not always, } \geq 1.0. \)

\( \phi = \text{reduction factor, function of structural element, typically } \leq 1.0. \)
2.2 American Institute of Steel Construction (AISC)

ASD Specifications: 1st (1923)

9th (1989) latest

LRFD Specifications: 1st (1986)


LRFD philosophy (ultimate strength design) has been used by ACI (Concrete) since 1971. "Limits states" design for steel has been used in Canada since 1974.

U.S. engineers have been very slow to adapt to LRFD philosophy for steel. "If it isn't broken why are we trying to fix it?"

2.3 Load and Resistance Factor Design

Fundamental design equation:

\[ \sum \gamma_i Q_i \leq \phi R_n \]

- \( Q_i \): load effect (force or moment)
- \( \gamma_i \): load factor
- \( R_n \): nominal resistance or strength (force or moment)
- \( \phi \): resistance factor.


See p. 22 of textbook.

Typically fluid (F) and earth (H) pressures and self-straining forces (T) are not applicable in steel structures, i.e., these equations reduce to those shown on p. 23 of textbook or p. 2-8 of AISC Manual.