**Welded Connection Design**

- **considerations**
  - shear stress
  - yielding
  - rupture

**Welds**

- welded steel connections

**Welded Connection Design**

- **weld terms**
  - butt weld
  - fillet weld
  - plug weld
  - throat

- field welding
- shop welding

(AISC - Steel Structures of the Everyday)
Welded Connection Design

- **weld process**
  - melting of material
  - melted filler - electrode
  - shielding gas / flux
  - potential defects
- **weld materials**
  - E60XX
  - E70XX
  - $F_{EXX} = 70$ ksi

- **shear failure assumed**
- **throat**
  - $T = 0.707 \times$ weld size
- **area**
  - $A = T \times$ length of weld
- **weld metal generally stronger than base metal** (ex. $F_y = 50$ ksi)

Welded Connection Design

- **minimum**
  - table
- **maximum**
  - material thickness (to $\frac{1}{4}$”)
    - $1/16$” less
- **min. length**
  - $4 \times$ size min.
  - $\geq 1 \frac{1}{2}$”

TABLE J2.4

<table>
<thead>
<tr>
<th>Material Thickness of Thicker Plate (in.)</th>
<th>Minimum Size of Fillet Weld (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{4}$</td>
<td>$\frac{1}{8}$</td>
</tr>
<tr>
<td>$\frac{1}{8}$</td>
<td>$\frac{1}{16}$</td>
</tr>
</tbody>
</table>

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

$R_u \leq \phi R_n$

$R_n = 0.6 F_{EXX} T l = S l$

**Available Strength of Fillet Welds**

<table>
<thead>
<tr>
<th>Weld Size (in.)</th>
<th>E60XX (ksi)</th>
<th>E70XX (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{1}{4}$</td>
<td>3.50</td>
<td>25.0</td>
</tr>
<tr>
<td>$\frac{1}{8}$</td>
<td>4.77</td>
<td>35.0</td>
</tr>
<tr>
<td>$\frac{1}{16}$</td>
<td>5.97</td>
<td>45.0</td>
</tr>
<tr>
<td>$\frac{1}{32}$</td>
<td>7.16</td>
<td>55.0</td>
</tr>
<tr>
<td>$\frac{3}{64}$</td>
<td>8.35</td>
<td>65.0</td>
</tr>
<tr>
<td>$\frac{3}{32}$</td>
<td>9.55</td>
<td>75.0</td>
</tr>
<tr>
<td>$\frac{3}{64}$</td>
<td>11.14</td>
<td>85.0</td>
</tr>
<tr>
<td>$\frac{3}{32}$</td>
<td>13.92</td>
<td>95.0</td>
</tr>
</tbody>
</table>

(not considering increase in base walls unhardened arc welds)
Framed Beam Connections

• welded example (shear)

(AISC - Steel Structures of the Everyday)

Framed Beam Connections

• welded moment example

(AISC - Steel Structures of the Everyday)

Framed Beam Connections

• welded/bolted moment example

(AISC - Steel Structures of the Everyday)
Light-gage Steel

- sheet metal
  - shaped
- studs, panels, window frames
- gage
  - based on weight of 41.82 lb/ft² / inch of thickness
  - 24, 22, 18, 16, i.e.
  - 0.0239, 0.0329, 0.0474, 0.0598 in
  - 0.6, 0.85, 1.0, 1.3, 1.6 mm

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Steel Decks

- “Texas” style
  - corrugated
- common
  - 1 – 3 spans
  - can be insulated
  - composite
    - with concrete

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Steel Decks

- common fire proofing
  - cementicious spray
  - composite concrete
- non-composite
  - concrete is fill
- lateral bracing
- diaphragm action

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Steel Decks

- load tables

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Steel Decks

- Steel Decks

- Steel Decks