Steel Welding: welds & light gages

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
Welded Connection Design

- **weld process**
  - melting of material
  - melted filler - electrode
  - shielding gas / flux
  - potential defects

- **weld materials**
  - E60XX
  - E70XX
  - \( F_{EXX} = 70 \text{ ksi} \)

**Welded Connection Design**

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

**Welded Connection Design**

- **shear**

\[
R_a \leq \frac{R_n}{\Omega} \\
R_a \leq \phi R_n
\]

\[
R_n = 0.6 F_{EXX} T l = S I
\]

- **area**

**TABLE J2.4 Minimum Size of Fillet Welds**

<table>
<thead>
<tr>
<th>Material Thickness of Welded Part (in.)</th>
<th>Minimum Size of Fillet Welds (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/32</td>
<td>1/32</td>
</tr>
<tr>
<td>1/16</td>
<td>1/16</td>
</tr>
<tr>
<td>1/8</td>
<td>1/8</td>
</tr>
<tr>
<td>5/32</td>
<td>5/32</td>
</tr>
<tr>
<td>3/16</td>
<td>3/16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weld Size</th>
<th>0.6000</th>
<th>0.5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_{EXX} )</td>
<td>3.56</td>
<td>4.10</td>
</tr>
<tr>
<td>%</td>
<td>4.77</td>
<td>5.57</td>
</tr>
<tr>
<td>%</td>
<td>5.97</td>
<td>6.06</td>
</tr>
<tr>
<td>%</td>
<td>7.16</td>
<td>8.35</td>
</tr>
<tr>
<td>%</td>
<td>8.35</td>
<td>9.74</td>
</tr>
<tr>
<td>%</td>
<td>9.55</td>
<td>11.14</td>
</tr>
<tr>
<td>%</td>
<td>11.93</td>
<td>13.92</td>
</tr>
<tr>
<td>%</td>
<td>13.32</td>
<td>16.70</td>
</tr>
</tbody>
</table>

(Not considering increased stress with unaffected air weld process)
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

**Steel Decks**

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

---

**Steel Decks**

- **load tables**

---

**Steel Decks**

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