1. A simply supported pedestrian bridge over a river bed (exposed to weather) is shown below. The bridge consists of a monolithic reinforced concrete double-tee cross section with \( f'c = 4 \text{ ksi} \) and \( f_y = 60 \text{ ksi} \). The double-tee ends rest on neoprene (rubber) pads that are supported by abutments. For purposes of this exam, consider one end to have a pin end restraint and the other end to have only a roller end restraint. Determine the following:

(a). Determine the depth ‘X’ (see Section A-A) to satisfy the deflection control requirements per ACI Table 9.5a;

(b). Verify that the isolated beam section satisfies ACI 8.10;

(c). Determine the appropriate flexural reinforcement in the web region of the double tee considering the self-weight and a live load of 100 psf. Verify minimum steel requirements;

(d). Determine the appropriate flexural reinforcement in the slab *negative moment region only* of the double tee considering the self weight and a live load of 100 psf. Verify minimum steel requirements.

**Plan:**

![Plan Diagram]

**Section A-A:**

![Section Diagram]

6"x36" concrete guard rail (typ)
Note: Only sits on slab.
<table>
<thead>
<tr>
<th>Member</th>
<th>Minimum thickness, $t$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simply supported</td>
</tr>
<tr>
<td>Solid one-way slabs</td>
<td>$t/20$</td>
</tr>
<tr>
<td>Beams or ribbed one-way slabs</td>
<td>$t/16$</td>
</tr>
</tbody>
</table>

**Notes:**

1) Span length $s$ is in inches.

2) Values given shall be used directly for members with normal-weight concrete ($w_c = 145$ lb/ft$^3$) and Grade 60 reinforcement. For other conditions, the values shall be modified as follows:

   a) For structural lightweight concrete having unit weight in the range 90-120 lb/ft$^3$, the values shall be multiplied by $(1.20 - 0.001w_c)$ but not less than 1.05, where $w_c$ is the unit weight in lb/ft$^3$.

   b) For $f_c$ other than 50,000 psi, the values shall be multiplied by $(0.4 + f_c/100,000)$. 

TABLE 9.5(a)—MINIMUM THICKNESS OF NONPRESTRESSED BEAMS OR ONE-WAY SLABS UNLESS DEFLECTIONS ARE COMPUTED.