KDOT LRFD Prestressed Beam Design Guidelines Summary

Section Properties
• For Strength Limit States use Article 5.7.2
• For Fatigue and Services Limit States, use gross un-cracked and un-transformed sections without reductions for reinforcement per Article 5.7.1
• Composite sections use the effective flange = tributary slab width, Article 4.6.2.6

Concrete Stresses

<table>
<thead>
<tr>
<th>LRFD Design Stress Limit, (ksi) at Service Limit States</th>
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<tbody>
<tr>
<td>Stage</td>
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<tr>
<td>Initial Compression</td>
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<tr>
<td>* Initial Tension</td>
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<tr>
<td>Final Compression</td>
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<td>Final Tension</td>
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<tr>
<td>Final Allowable Compression with LL+1/2($P_{ef}+DL$)</td>
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<tr>
<td>Final DL Compression</td>
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<tr>
<td>Shipping &amp; Handling Compression</td>
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<tr>
<td>* Shipping &amp; Handling Tension</td>
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</tbody>
</table>

* Where $A_s$ is proportioned as stated in Article C.5.9.4.1.2

Concrete Strength and Strand Usage
• Use 0.5 in. 270 ksi strands for K2 and K3 with $f'_{ci} = 4$ ksi and $f'_c = 5$ ksi
• Use 0.5 or 0.6 in. 270 ksi strands for K4 with up to $f'_{ci} = 5$ ksi and $f'_c = 6$ ksi
• Use 0.6 in. 270 ksi strand for K6 with $f'_{ci} = 5$ ksi and $f'_c = 6$ ksi

Note: Adjust $f'_{ci}$ in 0.10 ksi increments as needed

Calculation of Losses
• Include elastic shortening per Article 5.9.5.2.3
• Use the “Approximate Method” for time dependant losses, Article 5.9.5.3; this calculated value can be used as a lump sum for software which does not have the “Approximate Method” available.
**Diaphragms**

- Use temporary intermediate diaphragms for the following conditions
  - Up to 40 ft. spans: none are required
  - 40-80 ft. spans: use at first and third quarter points
  - 80 -120 ft. spans: use at first three quarter points
  - Greater than 120 ft. spans: use a special design
- Temporary diaphragms are property of the contractor, to be removed from site
- Use CIP diaphragms at all supports (detail per Bridge Design Manual)
- Use CIP intermediate diaphragms when the structure is heavily skewed or splayed

**Time to Continuity** *(Article 5.14.1.4.4)*

- KDOT assumes continuity is made at approximately 50 days; use this to calculate camber
- The minimum beam age will be 28 days at the time of continuity
- Restraint moments are not used in determining beam design moments
- The CIP continuity diaphragm is considered partially effective per *Article 5.14.1.4.5*
- Full continuity is assumed at interior supports for determining the required slab reinforcement at the Strength Limit State

**Analysis (+M) regions**

- Beam self weight will be resisted by considering simply supported member conditions for Service and Strength Combinations
- Non-Composite DL will be resisted by considering simply supported member conditions for Service and Strength Combinations
- Composite DL will be resisted by considering simply supported member conditions for Service and Strength Combinations
- Live Load and Dynamic Load will be resisted by considering simply supported member conditions for Service and Strength Limits States.

**Analysis (-M) regions**

- Composite DL will be resisted by considering the members as continuous
- Live Load and Dynamic Load (LL/IM) will be resisted by considering the members as continuous
- As a minimum, reinforce the slab per *Article(s) 5.7.3.2, 5.7.3.3 and 5.7.3.4*
- As a minimum, develop the slab reinforcing steel past the quarter point of the longest span, in-lieu of *Article 5.14.1.4.8*, and then begin to stagger the bars to be cut-off

**Strand Extension** *(Article 5.14.1.4.9a)*

- Provide positive restraint moment capacity at piers and abutments by extending strands a minimum of 36 in. to resist $0.6*M_{cr}$
- As a minimum extend six strands; four on the bottom and two on the top

**Confinement /Splitting** *(Article 5.10.10)*

- Do not exceed 3 in. spacing within the splitting zone defined as a region $h/4$ from the beam end
- Do not exceed 6 in. spacing within the distance of $1.5d$ for the confinement reinforcing steel

**Shear** *(Article 5.8.3)*

- Do not exceed 18 in. spacing, or exceed 6 in. change in spacing, or reduce the shear capacity by more the 50% at a section along the member