LONG X BRIDGE DESIGN

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LONG X BRIDGE ALTERNATIVES

3 bridge options presented in the EIS:

- Option LX-1: New Two-lane Bridge, Rehabilitate Existing Long X Bridge
- Option LX-2: New Four-lane Bridge, Retain Existing Long X Bridge for Alternate Use
- Option LX-3: New Four-lane Bridge, Remove Existing Long X Bridge (Selected Alternative)
STRUCTURE TYPES CONSIDERED

Steel Plate I-Girder Bridge: Length 950 ft

Prestressed Concrete I-Beam Bridge: Length 950 ft

Preliminary Cost Analysis – Estimated Steel Alternative cost was +$3 million
  - Long X Single Pier Cost: $1.2 million (excavation, concrete, reinforcing, piling, cofferdam)
BRIDGE GEOMETRY

Bridge Width:
• 85 feet:

Bridge Length:
• 790’-0” Overall

Span Arrangement:
• 5-span
BRIDGE DESIGN: UNIQUE CONDITIONS

Large Active Landslide:
- History of landslide activity on south end of bridge
- Existing bridge was designed for adjustment if movement occurred
- Movement detected in inclinometers near south abutment during project development
LANDSLIDE MITIGATION
BRIDGE LENGTH REDUCTION

Original bridge length was increased for slope stability reasons.

Our landslide mitigation components allowed us to reduce the bridge length from the preliminary length of 950 feet to a final length of 790 feet.
CHAPTER IV — Structural Design

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DESIGN LOADING CRITERIA

- **Dead Load**: Weight of the structure itself
- **HL-93 Loading**: Design Truck/Tandem with 640 plf design lane load (Designed for 6-Lanes of traffic loading – function of bridge clear rdwy width)
- Also, designed for water, wind, ice, and soil loading.

*Less is More???*
Beam Length: 156 ft

NDDOT Designs Prestressed Beams for 4 conditions:

1. Release Stresses: After prestressing strands are cut (beam cambers up)
   - Check tension in top flange
   - Check compression in bottom flange
2. Final Stresses: Loading from self-weight of structure and Traffic Loading
   - Objective is to control cracking
   - Stresses a combination of non-composite and composite loading
   - Compression in top flange
   - Tension in bottom flange (typically controls number of prestressing strands)
3. Ultimate Strength:
   - How much can the beam handle ($M/L/L_0 = 1.14$)
4. Handling
   - Check allowable lifting hook locations

Beam Fabricator Design Conditions:

1. Conditions above
2. TRANSPORTATION (Controlled ultimate beam design for Long X)
We have a lot to go over today so I just wanted to touch on some of the interesting aspects of the bridge design.

- Remainder of bridge design were typical to most bridges and straight forward.

Feel free to contact me with any questions.