The Austin Bridge, D-272, spans the Sevier River along SR-118, in Sevier County, Utah. The bridge was built in 1935 and is structurally sound. However, D-272 is deteriorating slightly and is too narrow, presenting a traffic hazard. The Utah Department of Transportation (UDOT) wants to replace the bridge. Our group chose to design a replacement bridge.

We evaluated several alternative solutions before selecting one and creating a design. Replacing D-272 required the design of various project elements such as a traffic management solution, bridge superstructure members, abutments, parapets, and a roadway realignment.

### ALTERNATIVE SOLUTIONS

#### Traffic Management Alternatives:

- **Bypass Bridge**: A temporary bridge, 12 ft wide, built adjacent to the bridge, constructed of culverts and compacted soil that span the Sevier River.
  - **Phasing**: The existing structure is demolished, and the new bridge is constructed in phases such that traffic can continue to pass over the bridge during construction.
  - **Side by Side**: Construction of the new bridge, parallel to the existing structure. Approaching segments of roadway will require realignment.

#### Structural Alternatives:

- **Steel Girder**: I-section or box section girders, requires frequent maintenance. Rapid construction.
- **Cast-in-Place Concrete Girder**: Low cost, however, the concrete requires 56 days to completely cure, resulting in increased construction time. Large traffic impact.
- **Prestressed Concrete Girder**: Cast and prestressed off site, then trucked to the site and hoisted into place. Rapid construction is obtainable.
- **Contech O-series**: Prefabricated modular bridge unit. Includes pre-cast foundations, headwalls, and wingwalls, as well as cast-in-place structural cells.

### BRIDGE ALTERNATIVES ANALYSIS MATRIX

<table>
<thead>
<tr>
<th>Analysis Criteria</th>
<th>Cast in Place</th>
<th>Prestressed Concrete</th>
<th>Steel Girder</th>
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<tbody>
<tr>
<td>Durability</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td>Speed of Construction</td>
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<tr>
<td>Geometry Adj. to SR-118</td>
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<td>1</td>
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<tr>
<td>Cost</td>
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<tr>
<td>Total</td>
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</tbody>
</table>

The selected traffic management alternative is a temporary, single lane bypass road. UDOT has requested a traffic management solution that allows for the continued use of SR-118 throughout construction. A temporary bypass road removes the need to detour traffic off SR-118, does not require a permanent realignment of the existing road, and is the least restrictive for demolition and construction. A temporary, timed traffic light will be used to route traffic, in alternating directions, across the single lane bypass road.

Prestressed concrete girders are the selected structural alternative. Prestressed concrete girder bridges are low maintenance, moderately expensive, durable, and can be rapidly constructed. The deck of the bridge will be cast in place reinforced concrete slab. Constructing the bridge using precast girders will require a permanent vertical realignment of the existing roadway.

### DESIGN

#### ANALYSIS

- **Cost**: $687,000
- **Durability**: Medium
- **Speed of Construction**: 56 days
- **Geometry Adj. to SR-118**: 1%
- **Total**: 6

The design of the replacement bridge required the following: roadway vertical curvature, girders, bridge deck, parapets, wingwalls, approach slabs, abutments, and piles. These various sections of design included aspects of structural, geotechnical, hydraulic, hydrological, and transportation engineering. Design work done for this project included optimization of the roadway vertical curvature, and sizing and placement of the girders.

#### ROADWAY DESIGN PROFILE

The new bridge elevation is three feet higher than the existing bridge. A new vertical curvature was calculated to provide a smooth transition between the existing road surface and the bridge deck. A crest curve was placed on top of the bridge which transitioned into a 1% grade on either end. Iterative calculations of sag curves were created and the option that optimized the smoothest transition with the least amount of fill was selected.

### CONCLUSION

The total structure cost is estimated at $687,000. The replacement bridge is 64 ft long and 44 ft wide. It is designed to pass a 100-year flood event. Girders are Utah Bulb T 42’s, with an 8 in. reinforced concrete deck. Piles for the Northern and Southern abutments are 16 in. round piles with lengths of 54 ft and 48 ft respectively. Just under 6,000 cubic feet of concrete is required.

### SITUATION AND LAYOUT

The Austin Bridge Design Team

SR-118: Bridge Replacement Over the Sevier River

We evaluated several alternative solutions before selecting one and creating a design. Replacing D-272 required the design of various project elements such as a traffic management solution, bridge superstructure members, abutments, parapets, and a roadway realignment.