Design and Construction of the SH58 Ramp A Flyover Bridge over IH70
SH58 Ramp A

1 traffic lane with two full shoulders
Provides access to East side of Golden, CO from IH70
Spans over Clear Creek, Bike Path, IH70 and Eastbound SH58
Connects eastbound IH70 to westbound SH58
What’s so special about this Bridge?

- Contractor Initiated VE Redesign
- Built over complex site with numerous traffic crossings
- Varying Curvature along length
- Refined details from previous projects
- Innovative substructure design
- Slender Cross Section relative to spans
- Aesthetically pleasing structure in high profile area
### Ramp A Bridge Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>U86 CDOT Girders</td>
<td>7 ½” Webs</td>
</tr>
<tr>
<td>Number of Spans</td>
<td>10</td>
</tr>
<tr>
<td>147.50’ to 235.00’</td>
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<tr>
<td>Number of Girder Lines</td>
<td>2</td>
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<tr>
<td>4230 l.f.</td>
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<tr>
<td>Deck Width</td>
<td>38.00’</td>
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<tr>
<td>Girder Spacing</td>
<td>19.50’</td>
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Unit 1 at West End Bridge

4 Span Unit, 154’, 205’, 235', & 186'

Eastbound IH70 exits to Ramp A

Roadway in spiral curve at Abutment 1 transitions to 809' radius curve
+5.00% cross fall and 6.00% cross fall

Span 2 crosses bike path and Clear Creek
Span 3 crosses Eastbound IH70
Span 4 crosses Westbound IH70
Ramp A, Unit 2
3 Span Unit, 147.5', 205' & 186'
Span 6 crosses Eastbound SH58
Ramp A Unit 3 at East End Bridge
4 Span Unit, 187’, 200’, 200’ & 188.5’
Roadway transitions from 809’ radius curve to straight bearing
-5.00% cross fall and 6.00% to -2.00% cross fall transition
Returns to grade at Abutment 11
Abutments at each end of bridge with expansion bearings
7 Integral Fixed Piers – No Bearings
2 Interior Expansion Piers with expansion bearings
Drilled shaft foundations
Conventional Abutments supporting the superstructure on expansion bearings
Abutment Diaphragm Formwork
Abutment Diaphragm ready for post tensioning
Back wall and wing walls are cast after PT is stressed and grouted
Completed Abutment 1
MSE wall at approach slab
Expansion joint built into back wall
Fixed Interior Piers

13’ x 4’ Column on side by side 48” Caissons
Integral with Superstructure
Flexible piers and foundations accommodate longitudinal movements without bearings
Erection at Fixed Piers

Girders supported on falsework on either side of pier
Bottom section of pier cap supports concrete of upper cap
5’-0” x 12’-6” composite cap w/ 2 rows of 4 – 1 3/8” PT bars
3’-4” lower section of cap supports 8’-9” upper section during casting
Composite cap shown supports Dead Load of Bridge
Full Section w/ top mat of deck reinforcing supports SDL & traffic loads
Integral Cap after post tensioning
Section shown supports bridge dead load including deck
Interior Expansion Pier

13’ x 6’ Column on footing and 4 - 36” Caissons
8’ wide cap to accommodate two rows of bearings
Shallow cap post tensioned to match fixed pier aesthetics
Expansion Pier Cap Reinforcing

8'-0" wide cap, 7'-0" Deep, Post Tensioned w/ 7 – 1 3/8" PT bars

ELEVATION – EXPANSION PIER CAP
(TYPICAL DECK, BOTTOM SLAB, HAUNCH AND DIAPHRAGM STEEL NOT SHOWN)
Completed Fixed and Expansion Piers
Precasting of U Girders
Curved casting bed, Single girder casting
Typical Girder Cross Section

Typical U86 Precast Girder Section

Precast Girder Section at Interior Piers
Typical Girder Reinforcing
Post Tensioning Details at Girder Splices

Section @ Typical Girder Anchor Block

Elevation View – Post Tensioning Anchors @ Typical Closure
Reinforcing and PT ducts in place in curved girder casting bed
End Diaphragm of typical Girder
Grouted Post Tensioning in bottom slab
Shear keys in face of diaphragm / splice
Mono strand temp PT for handling and crack control
Maximum Girder Weight = 265 kips
Trucked from casting yard on high load, steerable trailers
Girders erected with 240 ton to 300 ton hydraulic and crawler cranes
Night erection at road crossings, Day erection on Units 2 & 3
Supported on falsework, curved girder braces for stability
Precast Girders supported on falsework during erection

Primary support provided by vertical shoring
Straddle bents used at IH70 and SH58 traffic crossings
Typical shoring tower at girder splice
Precast Girders lifted with cranes and set on Falsework
Curved girders on Falsework

- Girders are braced against shoring prior to being released from cranes
- Set on ¾” Leveling Pads at all shoring towers
- Girders set on permanent bearings at Abutments and Expansion Piers
Unit 1 Erection, Looking west

- Straddle Bents support girders over IH70
- Girder Erection - December 2007
- PT stressed and falsework removed March 2008
Unit 1 Erection

- Looking west at Spans 1 & 2
- Span 2 crosses bike path and Clear Creek
- Span 2 Girders set with 400 ton crane on existing bridges
- Longitudinal PT is stressed and falsework removed
Unit 1 Erection

Looking east at Spans 3 & 4

Span 3, 235’ span over eastbound IH70 on 809’ curve

Span 4, 186’ end span cross westbound IH70
Unit 3 Erection, Began May 5, 2008

- Girders erected from Abutment 11 in down station direction
- Majority of Girders erected during the day.
Unit 3 Erection, Completed May 7, 2008

4 spans, 14 girders, set in 2 ½ shifts
Unit 2 Erection, Began May 8, 2008

- Span 6, 205’ long, crosses SH58.
- Girders supported on straddle bent at SH58 crossing.
- Girders erected at night in down station direction toward Unit 1
Unit 2 Erection Completed, May 9, 2008
Combined Units 2 & 3, 24 Girders set in 5 days
Curved Girders braced against to bracket attached to pier caps
Girders supported on “tongue” section in notch on permanent bearings
CIP Diaphragms cast at end of each girder.
Post Tensioning Details at Expansion Piers

- Girders set on precast “tongue” section
- CIP Diaphragm cast against end of girder doubles at PT anchorage block
- Diaphragms designed to allow double end stressing with short stroke ram
Expansion Pier Diaphragm cast on one side
Units 2 & 3 Prepared for Post Tensioning

- Closures Cast at each Splice
- Fixed Pier Diaphragms Cast and Pier Caps stressed
- Precast Lid Slabs placed between webs
Precast Girder Lid Slab Details

Precast Panel set between webs and closure cast and cured prior to post tensioning. Lid Slab closes the cross section and greatly increases the torsional strength and...
Girders ready for longitudinal post tensioning

- Lid Slabs set between webs
- Girder splices cast
- End Diaphragms cast
- Fixed Pier Caps cast and post tensioned.
Post Tensioning Stressed, Girders are self supporting

- Deck Panels between girders set
- Overhang forms placed
- Deck reinforcing placed
- Deck grades set and concrete placed.
Bridge Construction completed and opened to traffic in November 2008
Officially dedicated on December 12, 2008
SH58 Ramp A Flyover Bridge

Advances CDOT’s vision of establishing precast concrete as a viable design option for complex, long span interchange projects.

Establishes a sustainable technology that utilizes standard, commercially available precast concrete products and construction methods.

Creates an aesthetically pleasing, durable, cost effective structures.