COLORADO
Department of Transportation

# *Structure Selection Report*

## *Lone Tree Mobility Hub: Pedestrian Bridge over I-25*

## *CDOT Project Number: 267-0252-499 (24278)*

## *Structure Number: F-17-QX*

*April 2024*

**PREPARED FOR:**

**Colorado Department of Transportation, Region 1**
**2829 West Howard Place**
**Denver, CO 80204**

**PREPARED BY:**

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PROFESSIONAL ENGINEER

RS&H

# Table of Contents

# 1 EXECUTIVE SUMMARY

## 1.1 Project Description

This project will create a new mobility hub for use by Bustang and other transit services along the northbound and southbound ramps of I-25 between Lincoln Ave and Sky Ridge Ave in Lone Tree, CO. A new pedestrian bridge accessed by approach ramps will provide access across I-25. The City of Lone Tree (Lone Tree) anticipates that the pedestrian bridge will divert pedestrian and bike traffic away from Lincoln Ave. The pedestrian bridge will be enclosed with a roof and glazing panels. There will be uncovered approach ramp bridges from the mobility hub to the pedestrian bridge on both sides of I-25. Due to maintenance concerns, there will not be an elevator on either side of I-25 to access the pedestrian bridge.

RS&H was selected by the Colorado Department of Transportation (CDOT) to complete the design for the pedestrian bridge over I-25. This includes completing preliminary design to determine feasible alternatives and developing plans, calculating quantities and cost estimates for feasible alternatives to include in this Structure Selection Report.

The Division of Transit and Rail (DTR) within CDOT will be the owner of the structure. Along with CDOT, Lone Tree and Coventry Development (Coventry) are major stakeholders in the project.

Following is the team involved in developing this document and its approval:

CDOT Region 1:

| | |
|---|---|
| Program Engineer: | Stephanie Alanis, PE |
| Resident Engineer: | Nyssa Beach, PE |
| Project Manager: | Jiovanna Topi, EIT |
| Staff Bridge Unit Leader: | Tristan Siegel, PE |
| Staff Bridge Engineer: | Amanda Mascarenas, PE |

RS&H:

| | |
|---|---|
| Project Manager: | David Woolfall, PE |
| Deputy Project Manager: | Mary Duke, PE |
| Structures Lead: | Mike Patton, PE |

Subconsultants:

Pinyon Environmental Inc: Environmental Assessment
Geocal Inc: Geotechnical Recommendations
Lamb-Star Engineering: SUE Investigation

## 1.2 Structure Recommendations

This Structure Selection Report discusses the design considerations as well as evaluates and compares the structure alternatives investigated for the proposed pedestrian bridge over I-25 as required by the Colorado Department of Transportation (CDOT) *Bridge Design Manual (BDM), Section 2.10*. In addition to the discussing the structural aspects of the project, this report will also provide information related to the roadway, traffic, drainage, utilities, and any conflicts within the project limits.

**The proposed structure for this site is a two-span tied-arch through-truss.** This structure type is the most cost effective which also meets the stakeholder aesthetic requirements. See the "Structure Selection" chapter of this report for a detailed discussion of the various structure alternatives considered for this project.

The approach ramp structures will be covered in a separate Structure Selection Report.

# 2 SITE DESCRIPTION AND DESIGN FEATURES

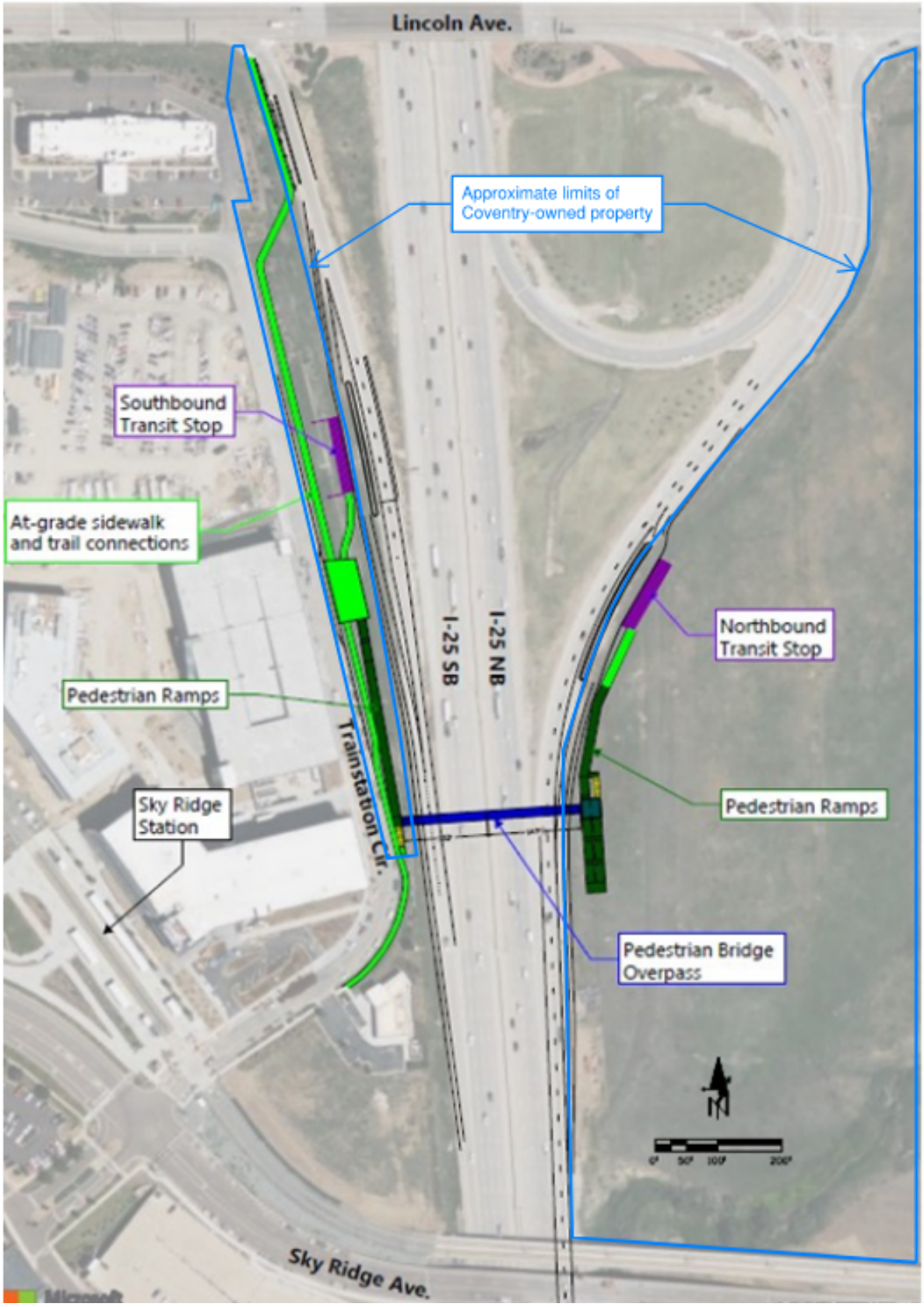
## 2.1 Existing Structures

There are existing bridges north and south of the proposed structure. To the north, Lincoln Ave. spans over I-25. To the south, there are adjacent bridges spanning over I-25: an RTD light rail bridge and Sky Ridge Ave. These structures do not pose any conflicts within the project limits or with the proposed structure.

There are no other structures in the vicinity of the project.

## 2.2 Vicinity Map

The vicinity map below shows the locations of the transit stops (purple), approach ramps (dark green), and pedestrian bridge over I-25 (dark blue) as well as at-grade sidewalk and trail connections (light green). The sidewalk and trail connections show the path pedestrians and cyclists will take from Lincoln Ave south to the pedestrian bridge over I-25.




*Vicinity Map*

## 2.3 Right-of-Way Impact

The land between I-25 and Trainstation Circle to the west is owned by Coventry. Coventry also owns the land east of I-25. CDOT is in the process of acquiring the required land west of I-25 and a small parcel of the land adjacent to I-25 on the east side. This acquisition will allow the entire project to be located within CDOT ROW.

## 2.4 Traffic Detour

All bridge alternatives considered would require a temporary detour of I-25 during bridge erection during a night closure of the highway.

For the two-span through-truss alternative, a single night closure is anticipated to set the truss.

For the single-span and two-span tied-arch through-truss alternatives, two full night closures are anticipated. One night would be to set the through-truss, the second would be to set the arches and install the hangars.

## 2.5 Constructability & Construction Phasing

Temporary lane closures will be required during pier construction in the median of I-25 for the two-span alternatives. This is anticipated to last 2 to 3 weeks.

Temporary lane closures will also be required during the deck pour. These closures will only last the duration of the deck pouring operation and will involve shifting traffic as the deck pour progresses to avoid pouring concrete over live traffic.

Additional lane closures may be required for other construction activities.

## 2.6 Utilities

Lamb-Star Engineering is responsible for the SUE investigation. Quality Level B has been completed on the west side. The east side survey and test holes on both sides still need to be completed.

On the west side of I-25, there are existing utilities owned by CDOT for the ramp lighting and ramp meter equipment. These utilities are near the proposed foundation but will be reset as part of the ramp widening which will eliminate any potential conflicts.

On the east side of I-25, there are existing utilities owned by CDOT for the ramp lighting and ramp meter equipment. There are also several fiber optic lines in CDOT's ROW owned by CDOT and ZAYO. None of these utilities are near the proposed foundation but several will be reset due to conflicts with the transit stop platform.

There are no plans to install any utilities on the bridge except for electrical conduit for the lighting.

## 2.7 Geotechnical Report

A site-specific geotechnical investigation to provide structural recommendations for the bridge foundation has not been completed at the time of this report. Geocal is on the project team and is responsible for performing a field investigation and preparing a report that includes recommendations for foundation design. Based on the current project schedule, a geotechnical report is not expected to be prepared in time for the development of this structure selection report.

For the purpose of this report, foundation design will be assumed based on similar nearby projects.

## 2.8 Hydraulics Summary

The structure does not span any waterways and is not near a floodplain; therefore, no hydraulic investigation will be performed and no accommodations for water crossings will be required.

## 2.9 Environmental Concerns

Pinyon Environmental is responsible for NEPA conformance and environmental design. There is potential for the discovery of fossils, particularly on the east side of I-25. This will be closely monitored throughout construction. The primary concern arises during open excavation, and the proposed foundations involve drilled shafts to minimize subsurface disturbance as much as possible.

## 2.10 Bridge Design Features

### 2.10.1 Cross-Section

The structure will provide a 14'-0" width between handrails and have a 1% cross-slope.

### 2.10.2 Vertical Alignment

At the time of this report, the vertical alignment of the structure has not been determined. A minimum of a 0.5% longitudinal grade will be provided.

### 2.10.3 Horizontal Alignment

The horizontal alignment of the structure is based upon the ramp lengths required to get from the transit platforms to the pedestrian bridge.

# 3 STRUCTURAL DESIGN CRITERIA

## 3.1 Design Specifications

The following design specifications will be utilized in the design of the proposed structure as applicable. The current edition of each of these references at the time of final design will be used for final design.

- American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, 9th Edition
- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2nd Edition
- AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1st Edition including 2020 Interim Revisions
- American Institute of Steel Construction (AISC) Steel Construction Manual, 15th Edition
- AISC Hollow Structural Section Connections, 2nd Edition
- American Society of Civil Engineers (ASCE) Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE 7-22
- CDOT Bridge Design Manual (BDM)
- CDOT Bridge Detail Manual
- CDOT Bridge Rating Manual
- CDOT Staff Bridge Worksheets
- CDOT Standards Plans
- CDOT CADD manuals, workflows, and details

The current edition of the following construction specifications at the time of final design will be used in the design documents as applicable.

- CDOT Standard Specifications for Road and Bridge Construction
- CDOT Standard Special Provisions
- CDOT Project Special Provision

## 3.2 Loading

The project will be designed for applicable strength, service, and extreme event limit states as defined by the load combinations in the AASHTO LRFD Bridge Design Specifications.

Permanent Loads (DC)

Dead loads shall be as specified in the AASHTO LRFD Bridge Design Specifications. Dead loads include self-weight of steel and concrete elements as well as railings, glazing, roofing, and any other required attachments. A 5 psf load will be applied to the structure for future utilities per CDOT BDM.

| | |
|---|---|
| Railing and Glazing | 300 lb/ft |
| Roof | 500 lb/ft |

Live Loads (LL)

Applied live loads include an H-5 truck and pedestrian loading of 90 psf as specified by AASHTO LRFD. Both live loads will be applied separately

Earth Loads (EH, LS, EV)

There are no anticipated earth loads on the structure. It will be founded on drilled shafts and does not have wingwalls.

Wind Loads (WS, WL)

Wind loads will be applied and analyzed as specified by AASHTO LRFD specifications and the CDOT BDM.

Thermal Forces (TU)

Thermal loading will be based on steel material properties. The temperature range will be based on AASHTO LRFD Procedure B.

| | |
|---|---|
| Thermal Coefficient (Steel) | 0.0000065/°F |
| Temperature Range | -20°F to 110°F |

Water Loads (WA)

Water loads are not applicable to this structure.

Ice Loads (IC)

Ice loads are assumed to not control any designs.

Snow Loads (Snow)

Snow loads will be investigated for the design of the roof support members per ASCE 7-22. ASCE load combinations will also be compared to AASHTO load combinations for truss and arch design.

Creep and Shrinkage (CR, SH)

Creep and shrinkage loading and effects on the structure will be analyzed and designed in accordance with AASHTO LRFD.

### 3.2.1 Collision Load (CT)

Columns will be located in the clear zone and are subject to vehicle collision loads. Design will be in accordance with ASHTO LRFD and CDOT BDM.

### 3.2.2 Earthquake Load (EQ)

Earthquake load will be analyzed and designed in accordance with AASHTO LRFD and the recommendations of the Geotechnical Report.

## 3.3 Aesthetic Requirements

See Section 4.1.1 of this report for a detailed description of the aesthetic requirements.

## 3.4 Future Widenings

None of the structure alternatives investigated are capable of being widened in the future.

There are existing structures north and south of the project site with pier columns in the I-25 median, so a median pier column at this location does not limit the future I-25 widening options. The end piers will also be located outside of any I-25 widening option limits.

# 4 STRUCTURE SELECTION

The structure selection process focused on identifying a structure type and location that meets aesthetic goals, is cost effective, meets serviceability and longevity goals, and would accommodate site constraints.

## 4.1 Selection Criteria

Factors contributing to the decision-making process are discussed below.

### 4.1.1 Aesthetics

There is an existing CDOT report titled *I-25 South Aesthetic Guidelines* that was developed as part of the Colorado Springs Denver South Connection PEL. This report does not consider the type of superstructure being proposed for this project, and the colors recommended for the substructure will potentially clash with the colors of the superstructure. Preliminary discussions have indicated a matte black finish will be used on the steel elements.

Lone Tree and Coventry want the proposed structure to have an appearance similar to the nearby RTD pedestrian bridges over I-25 north of this project. Based on those structures, the aesthetic requirements for this structure include:

- simple-span through-truss with tied arch superstructure
- painted steel truss and arch members
- painted steel roof
- glazing panels

### 4.1.2 Cost

As with most projects, the overall project cost is a driving factor in the decision-making process. Long-term maintenance costs as well as structure and construction costs will be considered.

The proposed structure type is not the lowest cost alternative, but it meets the aesthetic requirements of the stakeholders. Lone Tree is contributing funds to the project which will help cover the cost of the more expensive structure.

### 4.1.3 Constructability

All options under consideration utilize standard structural elements, details, and materials that are typical in the region, and are considered constructable. Since the proposed bridge spans over I-25 traffic, there are several construction challenges and restrictions to be considered such as difficulty of construction and driver impact during construction.

## 4.2 Structure Layout Alternatives

The structure is on a tangent alignment. Based on structure locations and project requirements, the following layout alternatives are considered.

### 4.2.1 Vertical Clearances

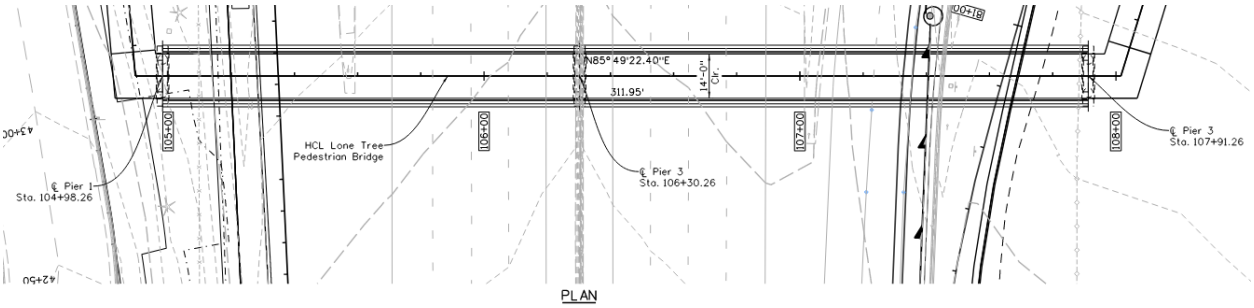
CDOT BDM Section 2.2.2 states that the minimum vertical clearance for pedestrian bridges over roadways is 17.50 ft. This value accounts for future overlays, structural deflections, etc. Live load deflections at the service level will be limited to L/360

### 4.2.2 Horizontal Clearances

There are no horizontal clearance requirements to be considered for structure selection. Horizontal deflections due service level wind loads will be limited to L/360.

### 4.2.3 Skew

There will not be a skew on the proposed structure.



PLAN

### 4.2.4 Span Configurations

There are two span configurations considered for this report that accommodate the existing and future configurations of I-25; a single-span and a two-span structure. The single-span configuration would be 190.0 ft long, and the two-span configuration would have spans of 130.0 ft, and 160.0 ft. The location of the end piers was set to balance the distance from the center of the ramp bridge platforms to the bridge and ramp piers. The center pier is set by the location of the I-25 median. The single-span configuration has a single longitudinal grade which causes the west pier to be higher and the west ramp to be longer than in the two-span configuration which can accommodate a grade break at the median pier. For these reasons, the two-span configuration is the proposed span configuration.

## 4.3 Superstructure Alternatives

The preferred structure alternative will meet the selection criteria above. The proposed structure will minimize total project costs while meeting the aesthetic requirements of the stakeholders. Typical girder superstructures are not feasible for this project due to not meeting the aesthetics requirements. Several steel truss alternatives were investigated as the structure types that meet the aesthetic requirements. Weathering steel is not being considered for this project. All structure alternatives anticipate the structure to be painted with a two-coat epoxy paint system.

### 4.3.1 Concrete Alternatives

There are no concrete structures considered for this project.

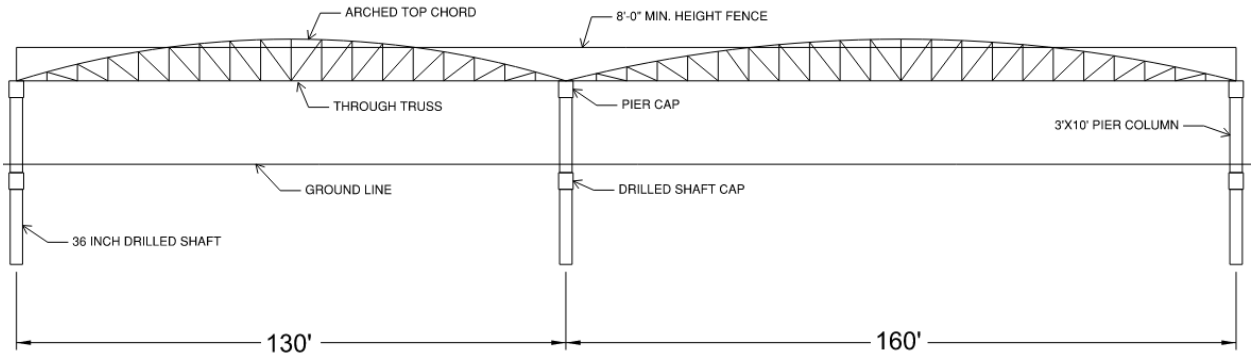
### 4.3.2 Steel Alternatives

There are 3 steel structure alternatives considered for this project.

**Two-Span Arched Through-Truss**

This alternative considered a two-span arched through-truss. The top chord of this structure would be an arch. The structure would be composed of rectangular hollow structural shape (HSS) members, a concrete deck, and stay-in-place steel deck forms. Since the structure spans over I-25, a fence meeting the requirements of Section 2.4.2.1 of the CDOT BDM is required; this will be an 8’-0” tall pedestrian railing. This structure type does not easily accommodate glazing panels or a roof which are required per the aesthetic requirements; this precluded this alternative from further consideration. A typical through-truss with a horizontal top chord could more easily accommodate glazing panels and a roof but ultimately does not meet the aesthetic requirements.

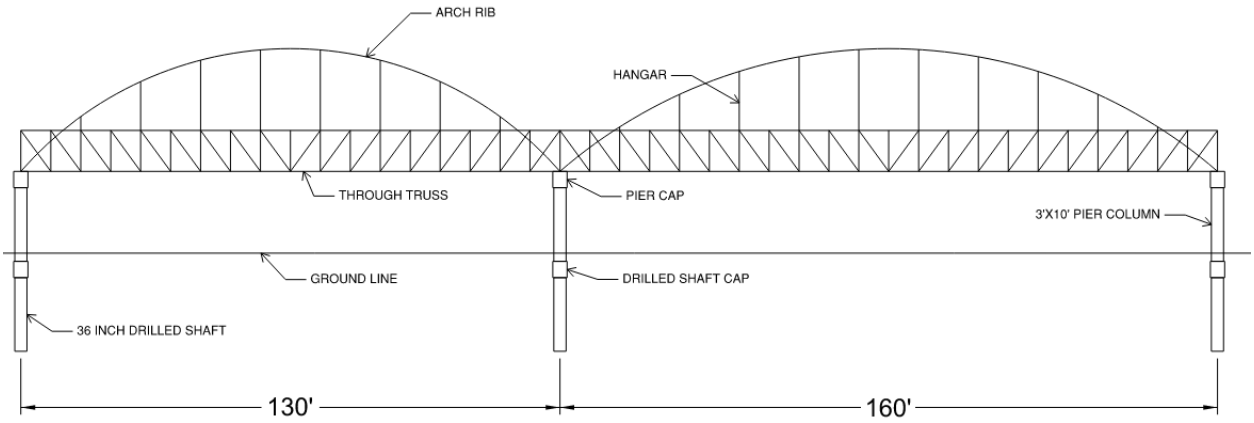
Through-trusses are considered fracture critical structures due to the non-redundancy in the bottom chord. This results in more stringent Charpy-V notch and weld testing as well as regular inspections which increases fabrication and maintenance costs.




**Two-Span Tied-Arch Through-Truss**

This alternative considered a two-span through-truss with a tied-arch. The through-truss would be composed of rectangular HSS members, a concrete deck, and stay-in-place steel deck forms. The arch would be either a W shape or round HSS member and use threaded bars as the hangars to tie the through-truss to the arch. This alternative would have a roof and transparent glazing along the length of the structure. Since it is an enclosed structure, a typical pedestrian railing will not be needed, but a hand rail will be attached to the steel truss at a height of 3’-0” above the concrete deck.

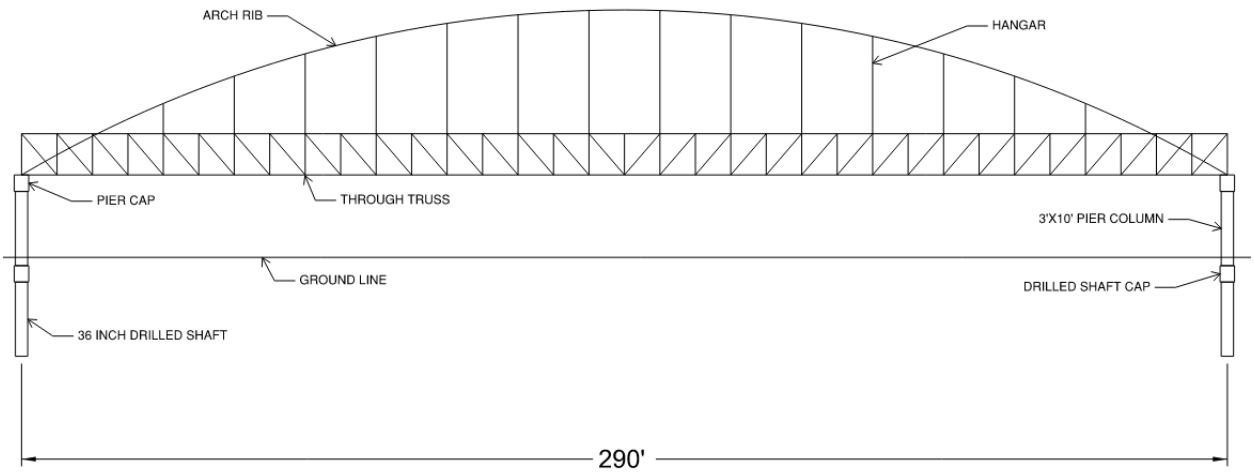
A benefit of this alternative is that the tied-arch provides redundancy to the through-truss. This means the through-truss is not considered fracture critical which eliminates the testing and inspection requirements associated with fracture critical structures. Another benefit is that the through-truss can typically be composed of smaller member sizes since the tied-arch carries a portion of the load.




**Single-Span Tied-Arch Through-Truss**

This alternative considered a single-span through-truss with a tied-arch. This alternative would be similar to the two-span through-truss with tied-arch alternative but would require larger member sizes due to increased loads from the larger span.

This alternative requires the approach ramp on the west side of I-25 to be roughly 30.0 ft longer than the two-span alternatives.




## 4.4 Substructure Alternatives

Final design of the substructure elements will be in accordance with AASHTO LRFD, CDOT BDM, the recommendations of the Geotechnical Report, and the current CDOT structural worksheets.

### 4.4.1 Abutment Alternatives

No traditional, backfilled abutment alternatives were investigated for this structure.

### 4.4.2 Pier Alternatives

The proposed substructures will be rectangular pier columns with a hammerhead pier cap. Each pier column will be founded on 2 drilled shafts with a rectangular cap.

In lieu of designing for the 600 kip collision load, the columns will meet the minimum thickness and cross-section requirements to be considered having adequate structural resistance to bridge collapse due to vehicular impacts as specified in AAHTO LRFD 3.6.5.1. Barrier protection for the end pier columns will be provided along the I-25 on and off ramps. The middle column will be in the median of I-25 and will include a tapered median section to eliminate a blunt transition.

The following assumptions for each pier were made for quantity calculations and cost estimation:

- 3’-6” wide x 4’-0” deep (min.) x 20’-6” long pier cap
- 3’-0” wide x 10’-0” long x 18’-0” tall columns
- 3’-6” wide x 4’-0” deep x 16’-0” drilled shaft cap
- (2) 36” diameter x 40’-0” long drilled shafts

## 4.5 Wall Alternatives

There are no wall structures associated with the proposed structure.

## 4.6 Deck Drainage

The proposed structure will be covered with a roof. There will not be any deck drainage on this structure, but the roof will have gutters and downspouts.

## 4.7 Expansion Joints

Coordination will be required to determine the joints details required between the proposed structure over I-25 and the approach ramps.

## 4.8 ABC Design

An Accelerated Bridge Construction (ABC) approach will not be applicable for the proposed structure. The majority of the structure can be constructed with minimal impact to the traveling public. The end piers are outside of the travelway. The steel truss and arch members will be delivered to the site in segments and can be constructed off-line. Erection of the steel truss and arches will likely require two (2) night closures of I-25. Other construction operations such as the concrete deck pour will require shifting traffic.

The construction of the median pier is estimated to take 3-4 weeks and will require a longer-term traffic shift.

## 4.9 Maintenance and Durability

The DTR will be responsible for maintenance of the structure.

Based on similar nearby structures, the proposed structure will require minimal maintenance and is considered very durable. The roof will keep snow off the structure; therefore, snow removal and deicing salts will not be necessary.

There will not be any vehicle access to the structure.

The paint is anticipated to have a 30-year life span. Similar nearby structures have not needed to be repainted and are approximately 20 years old.

## 4.10 Corrosive Resistance

The roof and glazing on the proposed structure will eliminate exposure to rain, snow, and deicing salts. Mag-Chloride overspray from I-25 traffic below may reach the underside of the truss and steel deck forms. The structural steel elements will receive an epoxy paint finish which will protect the steel from corrosion. Steel deck forms are required to be galvanized to protect the steel against corrosion.

Epoxy coated rebar will be used in all concrete elements.

## 4.11 Summary of Structure Type Evaluation Table

The following table was created to summarize the comparison of the structure selection criteria. Each selection criteria is on a scale of 1 to 10, with 10 being the best, and is based on factors including cost, aesthetic criteria, and constructability concerns. The weighted average is a sum of the factored criteria values. Weight factors are shown below the table. Since aesthetics are a driving factor in the structure selection process, their weight factor is equal to the project cost weight factor with the remaining portion being accounted for with the constructability values.

The constructability scale is based on the number of piers, construction time frame, crane lifts, and road closures. The aesthetics scale is based on the aesthetics requirements highlights in Section 4.1.1. The cost scale is set using an estimated lowest and highest costs that could be considered feasible for the project and comparing the alternative costs to that range.

This shows that all 3 options are close once the selection factors are weighted and combined, but that the 2-span tied-arch through-truss alternative is the preferred alternative because it balances the aesthetic requirements with cost and constructability concerns to produce the highest weighted average.

**Structure Alternative Selection Criteria Evaluation Table**

| | Constructability | Aesthetics | Cost | Weighted Average |
|---|---|---|---|---|
| Through-Truss | 6.63 | 1.38 | 9.12 | 5.38 |
| 2-Span Tied-Arch | 3.25 | 7.00 | 4.84 | 5.65 |
| 1-Span Tied-Arch | 5.50 | 8.50 | 2.30 | 5.41 |

- *Weight Factors: Constructability = 10%, Aesthetics = 45%, Cost = 45%*
- *Scale is out of 10*

## 4.12 Construction Costs

The following table summarizes the estimated construction costs for each bridge alternative investigated. For a more detailed breakdown of the quantities and cost estimates, see Appendix B.

**Structure Alternative Cost Comparison**

| | Estimated Project Cost |
|---|---|
| Through-Truss | $2,197,000 |
| 2-Span Tied-Arch | $3,146,000 |
| 1-Span Tied-Arch | $3,710,000 |

# Appendix A: FIR Level Plans

## GENERAL NOTES

All work shall be done in accordance with the Colorado Department of Transportation 2023 Standard Specifications for Road and Bridge Construction.

Structure excavation and backfill shall be as shown on the plans.

Expansion joint material shall meet AASHTO Specification M213.

All exposed concrete surfaces shall receive a Class 2 final finish to one foot below the ground line.

Deck concrete shall receive a final transverse broom finish.

A colored Structural Concrete Coating finish will be required as shown on the plans and on all exposed concrete surfaces to 2 feet below finished ground. The color shall be xxxx, equivalent to Federal Standard 595 Color No. xxxx, and shall be selected from test panels provided by the Contractor.

All structural steel not otherwise noted shall be painted in accordance with Section 509 of the Specifications. The color shall be xxxx, equivalent to Federal Standard 595 Color No. xxxx.

All plate steel shall be ASTM A572, Gr. 50 unless otherwise noted.

All rectangular HSS shall be ASTM A500, Gr B.

All bolts shall ASTM A325, 7/8" diameter, high strength, unless otherwise noted. All bolt holes shall be 13/16" diameter unless noted otherwise. Provide one hex nute and washer with each bolt.

Field welding of any kind shall not be permitted on the steel superstructure.

Grade 60 reinforcing steel is required.

All reinforcing steel shall be epoxy coated.

The Contractor shall be responsible for the stability of the structure during construction.

Permanent Steel Deck Forms are allowed.

For structure number installation, see Standard S-614-12.

Stations, Elevations, and Dimensions contained in these plans are calculated from a recent field survey. The Contractor shall verify all dependent dimensions in the field before ordering or fabricating any material.

All longitudinal and transverse dimensions are measured horizontally and include no correction for grade.

The information shown on these plans concerning the type and location of underground utilities is not guaranteed to be accurate or all inclusive. The Contractor is responsible for making their own determination as to the type and location of underground utilities as may be necessary to avoid damage thereto. The Contractor shall contact the Utility Notification Center of Colorado at 811 (1-800-922-1987) at least 3 days (2 days not including the day of notification) prior to any excavation or other earthwork.

## DESIGN DATA

AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020
AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2nd Edition, 2009
AASHTO LRFD Specification for Structural Supports for Highway Signs, Luminaires, and Traffic Signals

Design Method: Load and Resistance Factor Design

Pedestrian Live Load: 90 psf
Vehicular Live Load: None
Dead Load: Assumes 5 psf for permanent deck forms

Reinforced Concrete:
Class D Concrete: f'c = 4,500 psi
Reinforcing Steel: fy = 60,000 psi

Drilled Shaft Concrete:
Class BZ Concrete: f'c= 4,000 psi
Reinforcing Steel: fy= 60,000 psi

Structural Steel:
ASTM A572 Grade 50 fy = 50,000 psi
ASTM A500 Grade B fy = 46,000 psi
ASTM A36 fy = 36,000 psi

## BRIDGE DESCRIPTION

Two-simple span (130'-0", 160'-0") bridge
Enclosed steel through-truss and steel tied-arch
Pedestrian path over I-25
14'-0" walkway rail-to-rail
90° 00'00" skew
36" tall handrail

## INDEX OF DRAWINGS



* INDICATES DRAWINGS INCLUDED IN THIS SUBMITTAL. REMAINING DRAWINGS WILL BE INCLUDED IN A SEPARATE SUBMITTAL. INDEX IS PRELIMINARY AND SUBJECT TO CHANGE.

| INITIALS | DESIGN | DATE | DETAIL | DATE | QUANTITY | DATE |
|---|---|---|---|---|---|---|
| Designed By | | | | | | |
| Checked By | | | | | | |

All seals for this set of drawings are applied to the cover page(s)

Print Date: 1/4/2024
File Name: 24278-RSH-HW-025A-ST-DR-GNNT.dgn
Horiz. Scale: 1"=XX' Vert. Scale: As Noted
Unit Information JT
RS&H

Sheet Revisions

| Date: | Comments | Init. |
|---|---|---|
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18500 E. Colfax Ave.
Aurora, CO 80011
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Region 1-South Program NB


As Constructed
No Revisions:
Revised:
Void:

I-25 MOBILITY HUB (LONE TREE) PEDESTRIAN BRIDGE
GENERAL INFORMATION

Designer: M. PATTON
Detailer: M. WELCH
Sheet Subset: BRIDGE
Structure Numbers: F-17-QX
Subset Sheets: B01 of 011
Near: Lone Tree Sec. 10 Township 6S Range 67W

Project No./Code: 267 0252-499
24278
Sheet Number
Station 105+00.26 to Station 107+90.26

## SUMMARY OF QUANTITIES

| ITEM NO. | DESCRIPTION | UNIT | F-17-QX |
|---|---|---|---|
| 503 | Drilled Shaft (36 Inch) | LF | 240 |
| 509 | Paint Structural Steel | LS | 1 |
| 512 | Bearing Device (Type I) | EACH | 8 |
| 514 | Hand Rail | LF | 386 |
| 601 | Concrete Class D (Bridge) | CY | 156 |
| 601 | Structural Concrete Coating | SY | 211 |
| 602 | Reinforcing Steel (Epoxy Coated) | LB | 38131 |
| 628 | Bridge Girder And Deck Unit | EACH | 2 |

| INITIALS | DESIGN | DATE | DETAIL | DATE | QUANTITY | DATE |
|---|---|---|---|---|---|---|
| Designed By | | | | | | |
| Checked By | | | | | | |

All seals for this set of drawings are applied to the cover page(s)

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File Name: 24278-RSH-HW-025A-ST-DR-SMQT.dgn
Horiz. Scale: 1"=XX' Vert. Scale: As Noted
Unit Information JT
RS&H

Sheet Revisions

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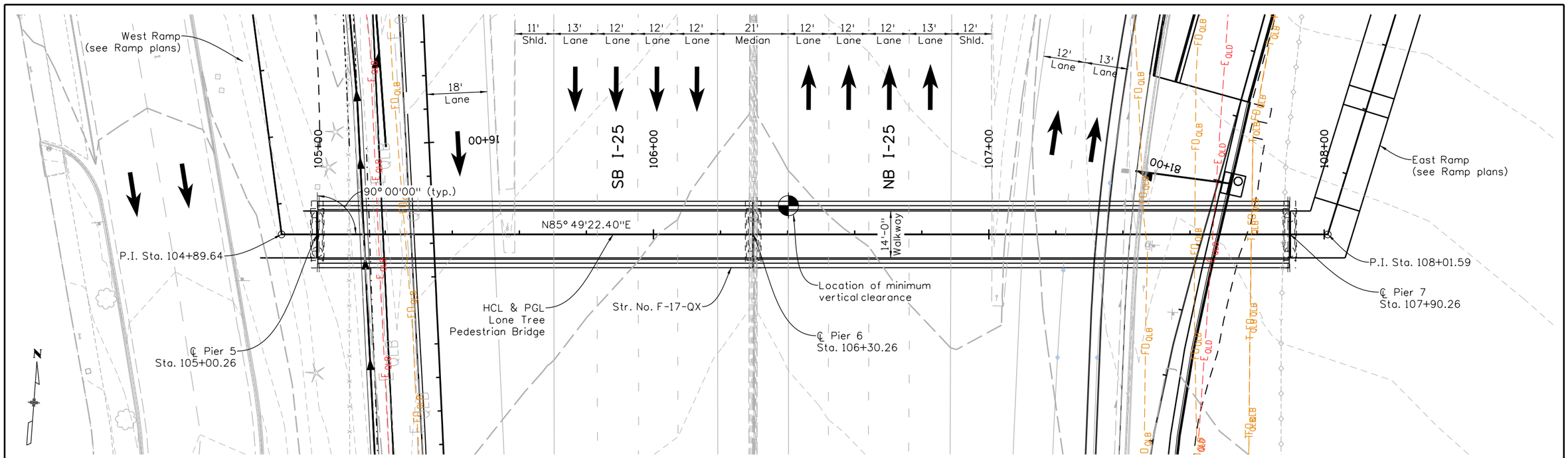
Region 1-South Program NB

As Constructed
No Revisions:
Revised:
Void:

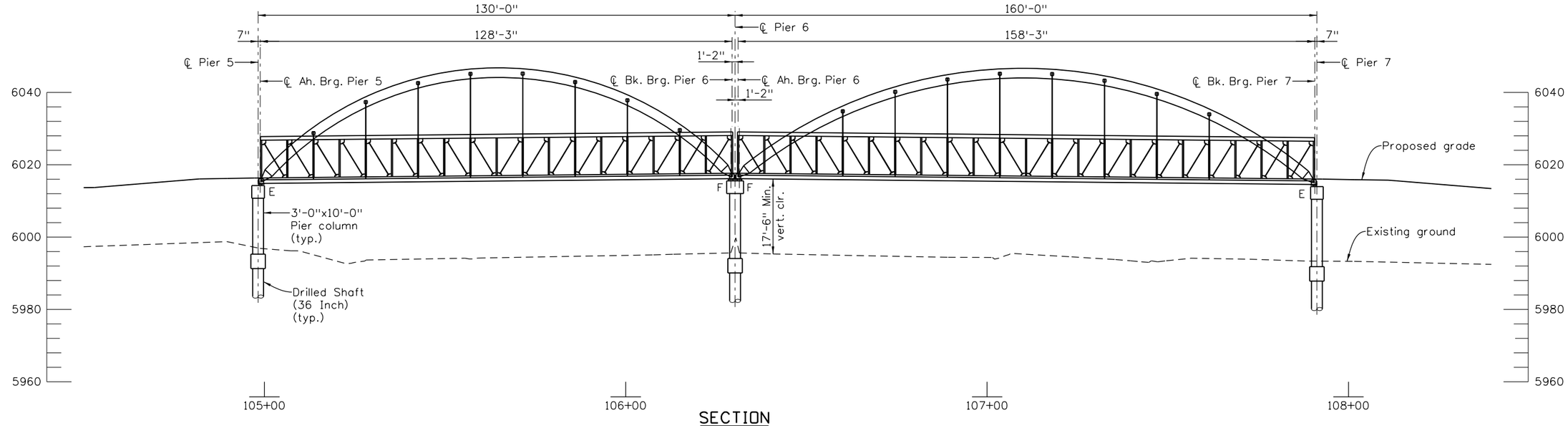
I-25 MOBILITY HUB (LONE TREE)
PEDESTRIAN BRIDGE
SUMMARY OF QUANTITIES

Designer: M. PATTON
Detailer: M. WELCH
Sheet Subset: BRIDGE
Structure Numbers: F-17-QX
Subset Sheets: B02 of 011

Project No./Code
267 0252-499
24278
Sheet Number




PLAN




SECTION

(Taken at HCL Lone Tree Pedestrian Bridge)

| INITIALS | DESIGN | DATE | DETAIL | DATE | QUANTITY | DATE |
|---|---|---|---|---|---|---|
| Designed By | | | | | | |
| Checked By | | | | | | |

All seals for this set of drawings are applied to the cover page(s)

Print Date: 1/4/2024
File Name: 24278-RSH-HW-025A-ST-DR-GNLY.dgn
Horiz. Scale: 1"=XX' Vert. Scale: As Noted
Unit Information JT

RS&H

| Sheet Revisions | | |
|---|---|---|
| Date: | Comments | Init. |
| | | |
| | | |
| | | |
| | | |

Colorado Department of Transportation

18500 E. Colfax Ave.
Aurora, CO 80011
Phone: (303) 746-8639
Fax: N/A

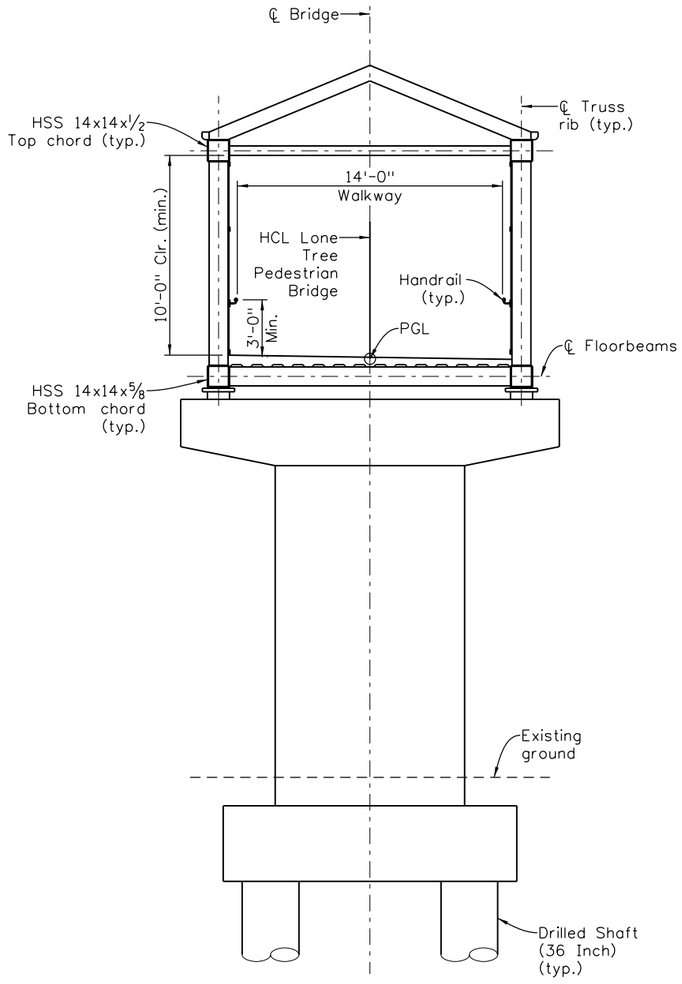
Region 1-South Program NB

As Constructed
No Revisions:
Revised:
Void:

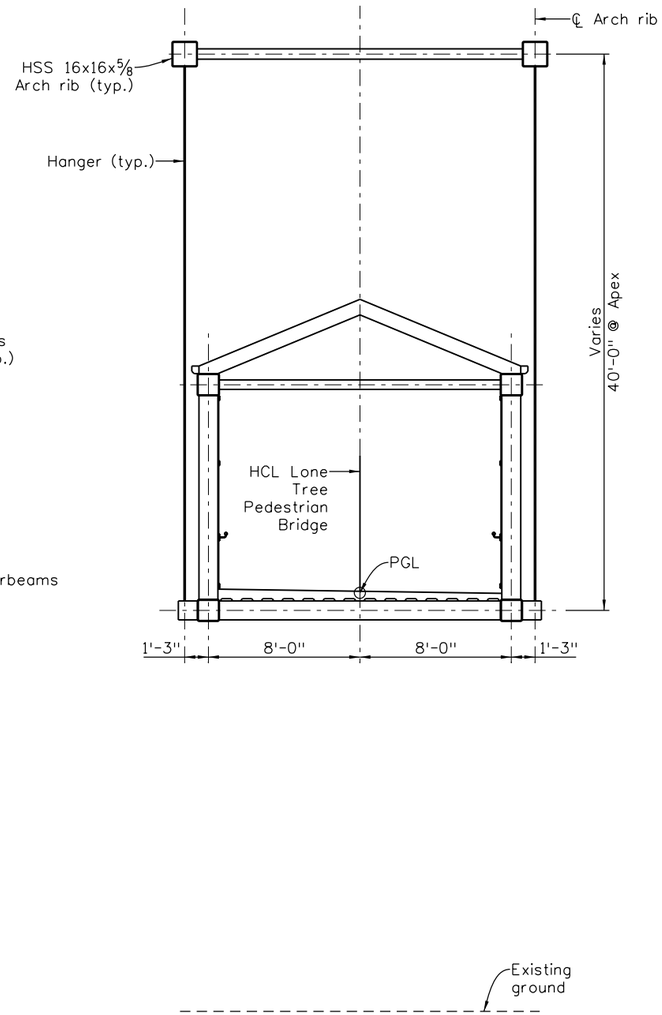
# I-25 MOBILITY HUB (LONE TREE) PEDESTRIAN BRIDGE GENERAL LAYOUT

| | | | |
|---|---|---|---|
| Designer: | M. PATTON | Structure Numbers | F-17-QX |
| Detailer: | M. WELCH | | |
| Sheet Subset: | BRIDGE | Subset Sheets: | B03 of 011 |

Project No./Code
267 0252-499
24278
Sheet Number




TYPICAL SECTION AT PIER




TYPICAL SECTION AT MID-SPAN
(Similar to Typical Section at Pier except as shown)

| INITIALS | DESIGN | DATE | DETAIL | DATE | QUANTITY | DATE |
|---|---|---|---|---|---|---|
| Designed By | | | | | | |
| Checked By | | | | | | |

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Unit Information JT
RS&H

Sheet Revisions

| Date: | Comments | Init. |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

Colorado Department of Transportation
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As Constructed
No Revisions:
Revised:
Void:

I-25 MOBILITY HUB (LONE TREE)
PEDESTRIAN BRIDGE
TYPICAL SECTION

Designer: M. PATTON
Detailer: M. WELCH
Sheet Subset: BRIDGE
Structure Numbers: F-17-QX
Subset Sheets: B04 of 011

Project No./Code
267 0252-499
24278
Sheet Number

# Appendix B: Summary of Quantities and Cost Estimate Tables

## 2-Span Through-Truss Alternative Quantity and Cost Estimate

| ITEM NO. | DESCRIPTION | UNIT | UNIT COST | Quantities | Cost Estimate |
|---|---|---|---|---|---|
| 503 | DRILLED SHAFT (36 INCH) | LF | $600 | 240 | $144,000 |
| 509 | PAINT STRUCTURAL STEEL | L S | - | 1 | $326,300 |
| 512 | BEARING DEVICE (TYPE I) | EACH | $5,000 | 8 | $40,000 |
| 514 | PEDESTRIAN RAILING (STEEL) | LF | $350 | 386 | $135,100 |
| 601 | CONCRETE CLASS D (BRIDGE) | CY | $590 | 156 | $92,300 |
| 601 | STRUCTURAL CONCRETE COATING | SY | $18 | 211 | $3,800 |
| 602 | REINFORCING STEEL (EPOXY COATED) | LB | $2.10 | 38131 | $80,100 |
| 628 | BRIDGE GRIDER AND DECK UNIT | EACH | - | 2 | $1,088,000 |

*- Pedestrian Railing (Steel) needs to meet the requirements of CDOT BDM Section 2.4.2.1*

Subtotal = $1,910,000
15% Contigency = $287,000
Cost Estimate = $2,197,000

## 2-Span Tied-Arch Alternative Quantity and Cost Estimate

| ITEM NO. | DESCRIPTION | UNIT | UNIT COST | Quantities | Cost Estimate |
|---|---|---|---|---|---|
| 503 | DRILLED SHAFT (36 INCH) | LF | $600 | 240 | $144,000 |
| 509 | PAINT STRUCTURAL STEEL | L S | - | 1 | $541,500 |
| 512 | BEARING DEVICE (TYPE I) | EACH | $5,000 | 8 | $40,000 |
| 514 | HAND RAIL | LF | $75 | 386 | $29,000 |
| 601 | CONCRETE CLASS D (BRIDGE) | CY | $590 | 156 | $92,300 |
| 601 | STRUCTURAL CONCRETE COATING | SY | $18 | 211 | $3,800 |
| 602 | REINFORCING STEEL (EPOXY COATED) | LB | $2.10 | 38131 | $80,100 |
| 628 | BRIDGE GRIDER AND DECK UNIT | EACH | - | 2 | $1,805,000 |

*- Hand Rail is pipe rail attached to steel truss*

Subtotal = $2,736,000
15% Contigency = $410,000
Cost Estimate = $3,146,000

## 1-Span Tied-Arch Alternative Quantity and Cost Estimate

| ITEM NO. | DESCRIPTION | UNIT | UNIT COST | Quantities | Cost Estimate |
|---|---|---|---|---|---|
| 503 | DRILLED SHAFT (36 INCH) | LF | $600 | 160 | $96,000 |
| 509 | PAINT STRUCTURAL STEEL | L S | - | 1 | $590,900 |
| 512 | BEARING DEVICE (TYPE I) | EACH | $5,000 | 4 | $20,000 |
| 514 | HAND RAIL | LF | $75 | 386 | $29,000 |
| 601 | CONCRETE CLASS D (BRIDGE) | CY | $590 | 116 | $68,700 |
| 601 | STRUCTURAL CONCRETE COATING | SY | $18 | 139 | $2,600 |
| 602 | REINFORCING STEEL (EPOXY COATED) | LB | $2.10 | 26153 | $55,000 |
| 628 | BRIDGE GRIDER AND DECK UNIT | EACH | - | 1 | $2,364,000 |

*- Hand Rail is pipe rail attached to steel truss*

Subtotal = $3,226,000
15% Contigency = $484,000
Cost Estimate = $3,710,000

# Appendix C: Structure Selection Report QA Checklist

# Structure Selection Report QA Checklist

This checklist is to serve as quality assurance of the structure selection process. The sections in the report need not be in the same order as this checklist. This checklist must be signed by Staff Bridge Unit Leader or designee prior to submittal of FIR documents to the Region.

Structure Number(s): F-17-QX

**Cover Sheet**

- ☒ Name of the Project and Site Address
- ☐ Structure Number(s)
- ☒ Property Owner Name and Contact Information
- ☒ Report Preparer Name and Contact Information
- ☒ Submittal and Revision Dates as Applicable

**Executive Summary**

- ☒ Project Description
- ☒ Structure Recommendations

**Site Description and Design Features**

- ☒ Existing Structure(s) ☐ N/A: _____
- ☒ Vicinity Map
- ☒ ROW Impact ☐ N/A: _____
- ☒ Traffic Detour ☐ N/A: _____
- ☒ Constructability & Construction Phasing ☐ N/A: _____
- ☒ Utilities ☐ N/A: _____
- ☒ Geotechnical Summary
- ☒ Hydraulics Summary ☐ N/A: _____
- ☒ Environmental Concerns ☐ N/A: _____
- ☒ Roadway Design Features
  - ☒ Cross Section
  - ☒ Vertical Alignment
  - ☒ Horizontal Alignment

**Structural Design Criteria**

- ☒ Design Specifications
- ☒ Loading ☐ N/A: _____
  - ☒ Collision Load
  - ☒ Earthquake Load
- ☒ Aesthetic Requirements ☐ N/A: _____
- ☒ Possible Future Widenings ☐ N/A: _____

**Structure Selection**

- ☒ Selection Criteria
- ☐ Rehabilitation Alternatives ☒ N/A: _____
  - ☐ Inspection Summary
  - ☐ Load Testing Requirements ☒ N/A: _____

Add figures/sketches to the following topics as needed to clarify discussion:

- ☒ Structure Layout Alternatives
  - ☒ Vertical Clearances
  - ☒ Horizontal Clearances
  - ☒ Skew
  - ☒ Span Configurations
- ☒ Superstructure Alternatives ☐ N/A: _____
  - ☒ Concrete Girder Alternatives
  - ☒ Steel Girder Alternatives

☒Substructure Alternatives ☐N/A:_____
☒Abutment Alternatives (GRS, Integral, Semi-integral, etc.)
☒Pier Alternatives
☒Wall Alternatives ☐N/A:_____
☒Deck Drainage ☐N/A:_____
☒Expansion Joints
☒ABC Design (include pre-scoping ABC rating results from spreadsheet found on the CDOT website)
☒Maintenance and Durability
☒Corrosive Resistance
☒Summary of Structure Type Evaluation Table
☒Construction Costs (including costs of alternatives)

**Other**

_____

_____

**Figures and Appendices**

☒General Layout of the Selected Structure
Alternative Typical Sections (if not provided in the report)
☒Summary of Quantities and Cost Estimate Tables
☐ABC Rating spreadsheet

**List of Variances**

Requested Variance:_____
Approved?☐Yes ☐No

Requested Variance:_____
Approved?☐Yes ☐No

Requested Variance:_____
Approved?☐Yes ☐No

*If you need more space, use an additional sheet(s) of paper.*

**CDOT Staff Bridge Quality Assurance Sign-off**

By signing this checklist Staff Bridge Unit Leader acknowledges approval of the Structure Selection Report findings, recommendations, and all design deviations from the CDOT Structural Standards and design criteria.

| Amanda Mascarenas | Amanda Mascarenas Digitally signed by Amanda Mascarenas DN: C=US, E=amanda.mascarenas@state.co.us, CN=Amanda Mascarenas Date: 2024.04.10 13:17:21-06'00' | 4-10-2024 |
|---|---|---|
| Print Name | Signature | Date |