



Feasibility Study for High Line Canal Crossings

Florida Avenue Crossing

Prepared for:

Arapahoe County Open Spaces

On behalf of the High Line Canal Working Group
6934 South Lima Street, Suite A
Centennial, CO 80112

Prepared by:

Felsburg Holt & Ullevig
6300 South Syracuse Way
Centennial, CO 80111
303/721-1440

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1. INTRODUCTION

The High Line Canal Trail is an important recreational amenity that provides more than 60 miles of multi-use trail through multiple communities in the Denver metropolitan area. The trail presents a unique urban and suburban recreational experience for Denver metro area citizens. Preserving and enhancing this experience as the region continues to grow is important to the many communities served by this amenity.

Arapahoe County initiated the Feasibility Study for High Line Canal Crossings on behalf of the High Line Canal Working Group (HLCWG) to evaluate crossing improvements at nine of the roadway crossings of the High Line Canal Trail. This study was completed in June 2014. The first two chapters of the feasibility study provide introductory and process information related to the overall study. The subsequent chapters document the inventory, crossing alternatives, evaluation, and recommendations for the initial nine crossing locations.

In September 2014, the High Line Canal Crossing & Safety Task Group determined that the High Line Canal Trail crossing at Florida Avenue located west of Parker Road should also be evaluated. This document includes the inventory, crossing alternatives, evaluation, and recommendations for the Florida Avenue crossing. A subset of the HLCWG Crossing and Safety Task Group (including Arapahoe County, City and County of Denver, and Denver Water), which includes technical staff from the various agencies represented by the HLCWG, continued to provide technical input and oversight for this crossing evaluation.

For additional information on the project purpose, project background, and previous studies, please refer to Chapter 1 of the Feasibility Study for High Line Canal Crossings. For additional information about the project oversight, inventory, identification of alternatives, parameters for conceptual design, and evaluation criteria, please see Chapter 2 of the Feasibility Study for High Line Canal Crossings.

2. FLORIDA AVENUE CROSSING

Existing Conditions

The High Line Canal Trail crosses Florida Avenue approximately 1,500 feet west of Parker Road. This section of Florida Avenue is a narrow, two lane road carrying approximately 10,000 vehicles per day (VPD) and has a posted speed limit of 25 miles per hour (MPH). A speed study was conducted in October and December of 2014 to better understand the vehicular speed of traffic crossing the trail. The 85th percentile for both time periods (weekday and weekend) in both directions (east and west) was approximately 29 MPH. The trail crossing currently includes crosswalk markings, and bicycle-pedestrian warning signs (MUTCD: W11-15) and downward arrows (MUTCD: W16-7p) on the vehicular approaches. Sidewalks are present on both sides of Florida Avenue to the west of the trail crossing. East of the trail crossing, a sidewalk is present only on the north side of Florida Avenue. A worn footpath is present on the south side of Florida Avenue indicating pedestrian activity.



The trail crossing is central to many community resources, as seen in **Figure 1**. The Eloise May Library is located approximately one-quarter mile east of the trail crossing. Place Bridge Academy, an Early Childhood Education (ECE) to 8th grade school within Denver Public Schools, is located just west of Quebec Street, approximately one-half mile from the trail crossing. The crossing is primarily surrounded by multi-family and single family residential, with some commercial uses at the intersection of Florida Avenue and Parker Road.

Recreational resources, such as Cook Park, City of Chennai Park, and the Cherry Creek Trail are all located nearby, just southwest of the trail crossing. The City and County of Denver's bike route D-18 terminates at the trail crossing. Trail users can connect to the Cherry Creek Trail by using the D-18 bike route, which follows Florida Avenue from the trail crossing to Quebec Street.

The trail crossing lies in a peninsula portion of the City and County of Denver that is primarily surrounded by unincorporated Arapahoe County. The boundary between the City and County of Denver and Arapahoe County lies approximately 175 feet east of the trail crossing.

Traffic and Trail User Counts

Trail use along this section of the High Line Canal Trail is high, as shown on **Figure 2**. The bicycle and pedestrian counts are some of the highest of the crossing locations evaluated in the initial feasibility study.

- ▶ Approximately 270 trail users cross at this location on a typical weekday and over 600 cross on a typical Saturday.
- ▶ The split between bicycle and pedestrian activity is approximately 55 percent bicyclists and 45 percent pedestrians.



Accident History

No accidents involving a bicyclist or pedestrian were reported at this crossing during the five year period from January 2008 through December 2012. However, there were four reported bicycle crashes at the intersection of Florida Ave and Quebec Way, the intersection located immediately west of the High Line Canal crossing.

Opportunities and Constraints

- ▶ The high volume of bicycle and pedestrian activity at this crossing suggests that any improvements made at this crossing would benefit a great number of trail users.
- ▶ The sidewalk on the north side of the Florida Avenue bridge over the High Line Canal is narrow. No sidewalk is present on the south side of the bridge. Both of these constraints limit eastward connectivity.
- ▶ This trail crossing is closely located to Arapahoe County's planned trailhead, which will be located southeast of the High Line Canal Trail and Florida Avenue.

Figure 1. Florida Avenue Crossing Connectivity Map

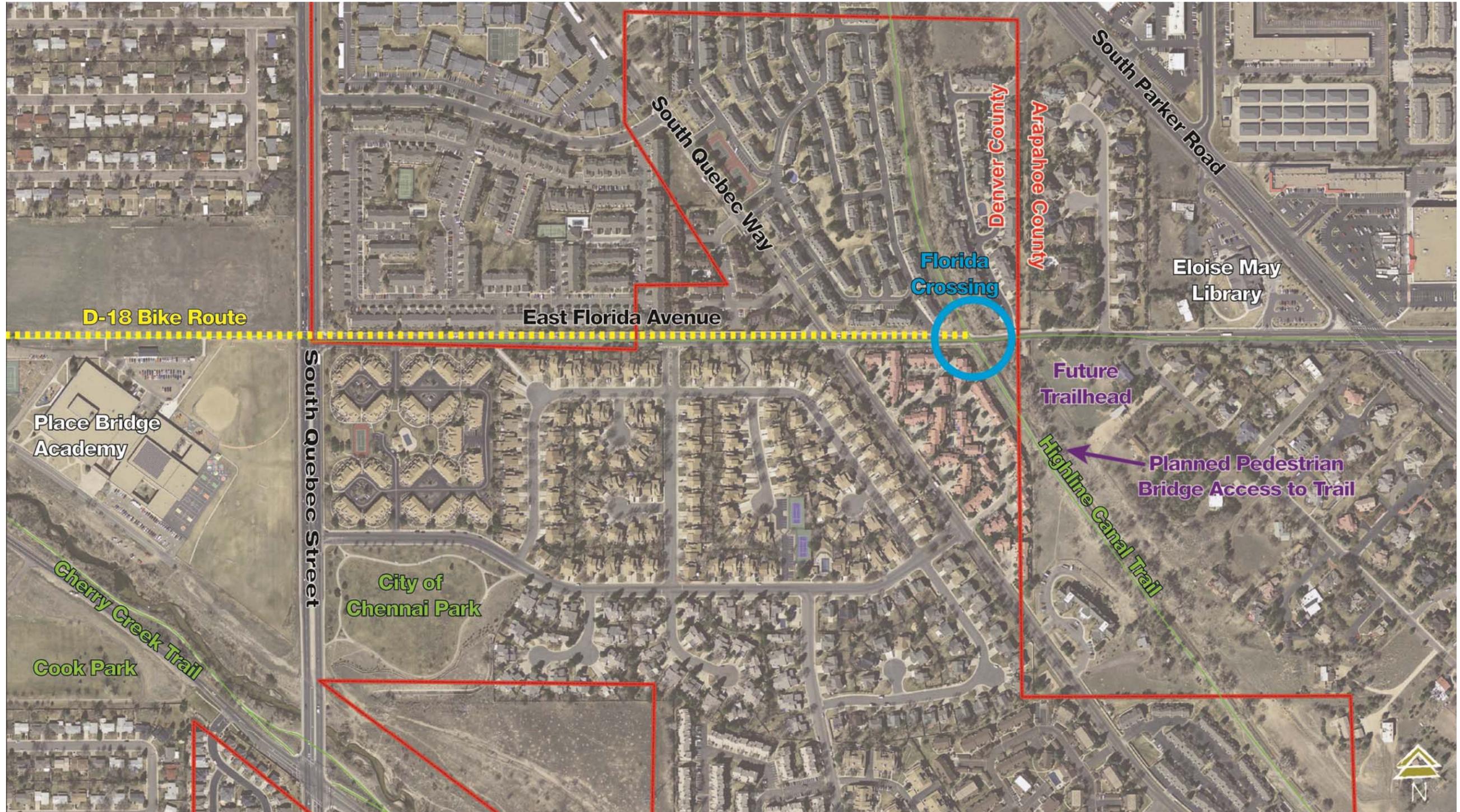


Figure 2. Florida Avenue Crossing Trail User and Traffic Inventory



Crossing Alternatives

Three crossing alternatives have been developed and evaluated at the Florida Avenue crossing.

At-Grade Improvements

Two variations were considered that would improve at-grade conditions of the existing crossing. As shown in the conceptual design (Figure 3), the at-grade improvements include realigning the existing trail to cross East Florida Avenue to 90 degrees. It is preferable for mid-block crossings to intersect the roadway at an angle as close to perpendicular as possible. This minimizes the crossing distance for trail users and maximizes the sight lines for all approaches. The at-grade improvements also include a raised crosswalk/speed table, as well as pedestrian-activated rectangular rapid flashing beacons (RRFBs). The estimated cost for these improvements is \$115,000 (the detailed cost estimate is included in Appendix A).

In addition to these improvements, the existing bridge over the High Line Canal could be widening to include an 8' wide sidewalk on the south side. This new sidewalk would enhance the connection to the east of the trail, and the proposed trailhead. This improvement would work best in conjunction with the sidewalk extension along Florida Avenue to Parker Road, as shown in Figure 4. The estimated cost for these improvements is \$1,050,000 (the detailed cost estimate is included in Appendix A).

Both variations of the at-grade improvements aim at making the motorist more aware of the crossing and slowing traffic on East Florida Avenue. The at-grade improvements could be completed together.

Underpass Improvements

Another alternative considered for the Florida Avenue crossing is an underpass. The underpass would be a 14-foot wide and 10-foot tall box culvert. The underpass shown in the conceptual design (Figure 5) is approximately 100 feet long. Due to the right-of-way constraints and topography, a retaining wall would be required on the west side of the trail. The Denver Water service road would be maintained, paralleling the trail and underpass immediately to the east. The cost for the underpass improvements is estimated to be \$4,400,000.

Evaluation of Alternatives

The two crossing alternatives for Florida Avenue have been evaluated based on the evaluation criteria described in Chapter 2 of the Feasibility Study for High Line Canal Crossings and the results are shown on Table 1. The at-grade improvements would provide some safety improvement and would enhance the visibility of trail users. The cost of implementing these improvements would be significantly less than the underpass, and the at-grade improvements are compatible with the level of traffic volumes on Florida Avenue. While the underpass would eliminate the conflict between trail users and motorists and allow for uninterrupted trail use, it has a considerably higher cost.

Table 1. Florida Avenue Crossing Alternatives Evaluation

Evaluation Criteria	At-Grade Improvements	At-Grade Improvements + Bridge Widening and Sidewalk Extension	Underpass
Benefits			
Safety Benefits	●	●	●
Functionality for Trail Users	●	●	●
Impacts to Motorists	●	●	●
Aesthetics/Context	●	●	●
Equestrian Accommodation	NA	NA	NA
Costs			
Constructability (Utilities, phasing, design standards)	●	●	●
ROW Impacts	●	●	●
Maintenance	●	●	●
Design/Construction Cost	\$115,000	\$1,050,000	\$4,400,000



Least ----->Most Favorable

Recommendations and Next Steps

The underpass is the recommended alternative for the Florida Avenue crossing since it would improve the safety and experience for trail users as well as minimize delay for the many trail users at this location. It is recommended to phase the improvements over time, beginning with the lower-cost, at-grade improvements. The inclusion of Rectangular Rapid Flashing Beacons (RRFB) is subject to the findings of Denver’s ongoing Pedestrian Crossing Measures study. The sidewalk connection could be constructed in conjunction with the at-grade improvements, or over time, as funding is secured. The at-grade improvements would be an interim solution until funding is obtained for the underpass. The sidewalk connection would complement both the at-grade improvements and the underpass.

Figure 3. Florida Avenue Crossing At-Grade Improvements

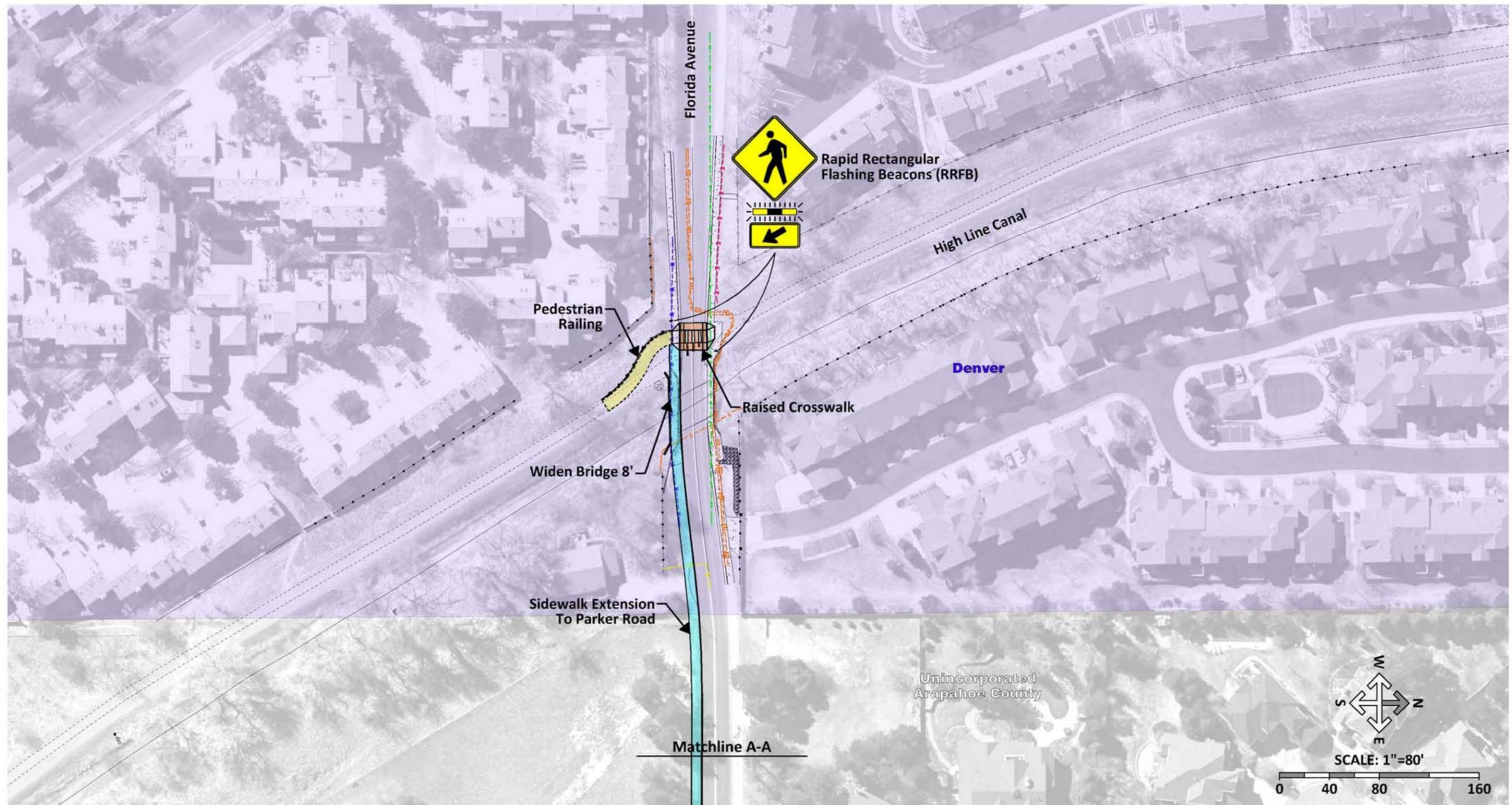


Figure 4. Florida Avenue Crossing Sidewalk Connection

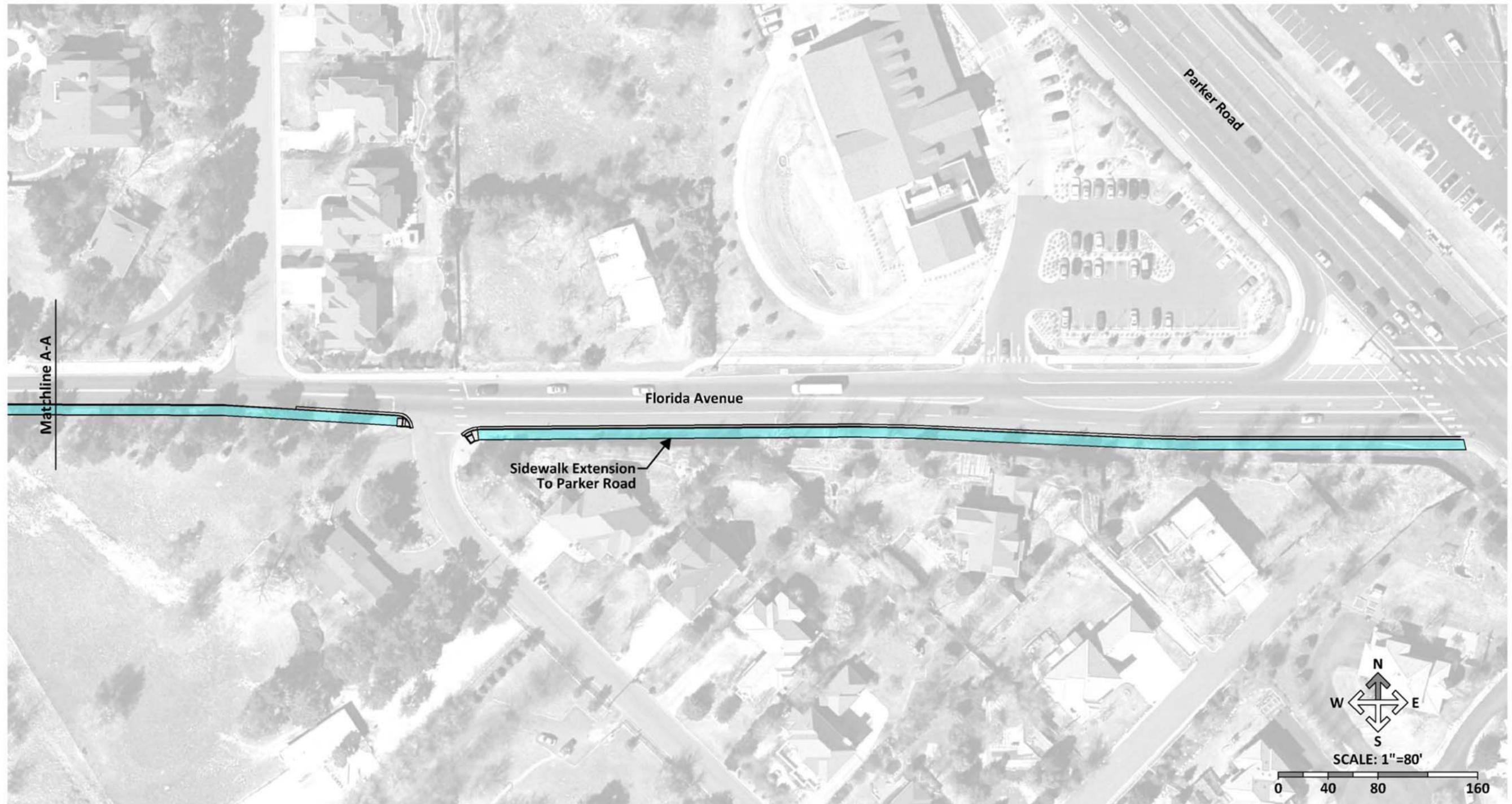
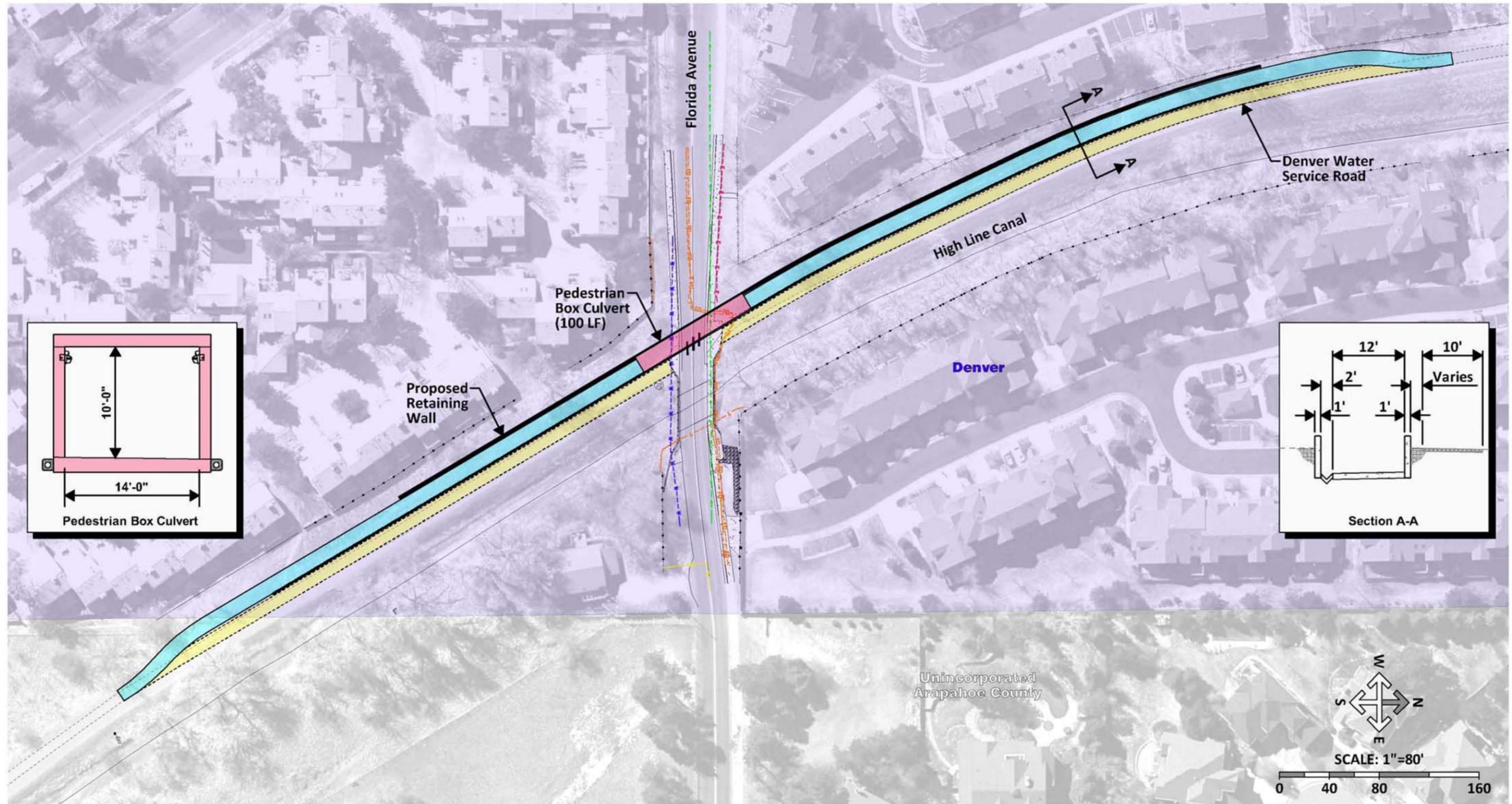


Figure 5. Florida Avenue Crossing Underpass



APPENDIX A. COST ESTIMATES

High Line Canal Feasibility Study

Estimate of Conceptual Project Costs

(Florida Avenue) Conceptual Design (At Grade)



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Date Prepared: September 14, 2015

Item		Unit Cost	Quantity	Extended Cost	Notes	
1	Clearing and Grubbing	LS	\$1,000.00	1	\$1,000	3-Inch Thickness (Raised Crosswalk)
2	Removal of Curb and Gutter	LF	\$5.00	40	\$200	
3	Removal of Sidewalk	SY	\$7.00	90	\$600	
4	Earthwork (CIP)	CY	\$14.00	25	\$400	
5	Hot Mix Asphalt	Ton	\$92.00	5	\$500	
6	Concrete Curb Ramp	Sy	\$110.00	12	\$1,300	
7	Curb and Gutter	LF	\$15.00	40	\$600	
8	Concrete Sidewalk/Bikeway (6 Inch)	SY	\$42.00	110	\$4,600	
9	Pedestrian Railing (Steel)	LF	\$125.00	90	\$11,300	
Total Major Items					\$20,500	
		% of Major Item Cost				
Total Major Items					\$20,500	A
Removals / Resets		% of A	8.0%		\$1,700	B-1
Landscaping		% of A	20.0%		\$4,100	B-2
Erosion Control		% of A	15.0%		\$3,100	B-3
Drainage		% of A	9.0%		\$1,900	B-4
Traffic Control / Detour		% of A	25.0%		\$5,200	B-5
Traffic - Striping		% of A	5.0%		\$1,100	B-6
Mobilization		% of A	30.0%		\$6,200	B-7
Misc. - Lighting/Seeding/Top Soil		% of A	15.0%		\$3,100	B-8
Signing (RRFB Assembly)		\$10,000 Each x 2 = \$20,000			\$20,000	B-9
Total of Bid Construction Items					\$66,900	B
Force Account Items		% of B	10.0%		\$6,700	C-1
Minor Contract Revisions		% of B	15.0%		\$10,100	C-2
Total of Bid Construction Items & Force Account Items					\$83,700	C
Design Engineering		% of C	10.0%		\$8,400	D-1
Construction Engineering		% of C	15.0%		\$12,600	D-2
Total Design & Construction Cost					\$104,700	D
Utility Relocations		% of D	0.0%		\$0	E-1
Contingency (Total Design & Construction Cost)		% of D	10.0%		\$10,500	E-2
Total Project Cost Estimate					\$115,200	E

Opinion of Probable Construction Costs

In providing opinions of probable construction cost, the Client understands that Felsburg Holt & Ullevig has no control over costs or the price of labor, equipment or materials, or over the Contractor's method of pricing, and that the opinions of probable construction costs provided herein are to be made on the basis of our qualifications and experience. FHU makes no warranty, expressed or implied, as to the accuracy of such opinions as compared to bid or actual costs.

High Line Canal Feasibility Study

Estimate of Conceptual Project Costs

(Florida Avenue) Conceptual Design (Widen Bridge)



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Date Prepared: September 14, 2015

Item		Unit Cost	Quantity	Extended Cost	Notes	
1	Clearing and Grubbing	LS	\$10,000.00	1	\$10,000	
	Removal of Curb and Gutter	LF	\$5.00	30	\$200	
2	Concrete Curb Ramp	SY	\$110.00	20	\$2,200	
3	Curb and Gutter	LF	\$15.00	470	\$7,100	
4	Concrete Sidewalk/Bikeway (6 Inch)	SY	\$42.00	1,170	\$49,100	
5	Bridge Widening	SF	\$200.00	520	\$104,000	
				Total Major Items	\$172,600	
Total Major Items		% of Major Item Cost			\$172,600	A
	Removals / Resets	% of A	12.0%	\$20,800	B-1	
	Landscaping	% of A	10.0%	\$17,300	B-2	
	Erosion Control	% of A	15.0%	\$25,900	B-3	
	Drainage	% of A	12.0%	\$20,800	B-4	
	Traffic Control / Detour	% of A	25.0%	\$43,200	B-5	
	Traffic - Striping	% of A	5.0%	\$8,700	B-6	
	Mobilization	% of A	45.0%	\$77,700	B-7	
	Misc. - Lighting/Seeding/Top Soil	% of A	25.0%	\$43,200	B-8	
Total of Bid Construction Items				\$430,200	B	
	Force Account Items	% of B	10.0%	\$43,100	C-1	
	Minor Contract Revisions	% of B	15.0%	\$64,600	C-2	
Total of Bid Construction Items & Force Account Items				\$537,900	C	
	Design Engineering	% of C	30.0%	\$161,400	D-1	
	Construction Engineering	% of C	20.0%	\$107,600	D-2	
Total Design & Construction Cost				\$806,900	D	
	Utility Relocations	% of D	15.0%	\$121,100	E-1	
	Contingency (Total Design & Construction Cost)	% of D	15.0%	\$121,100	E-2	
Total Project Cost Estimate				\$1,049,100	E	

Opinion of Probable Construction Costs

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High Line Canal Feasibility Study

Estimate of Conceptual Project Costs

(Florida Avenue) Conceptual Design (Underpass)



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Date Prepared: September 14, 2015

Item			Unit Cost	Quantity	Extended Cost	Notes
1	Clearing and Grubbing	LS	\$10,000.00	1	\$10,000	
2	Removal of Asphalt Mat	SY	\$10.00	115	\$1,200	
3	Removal of Curb and Gutter	LF	\$5.00	110	\$600	
4	Removal of Sidewalk	SY	\$7.00	85	\$600	
5	Earthwork (CIP)	CY	\$14.00	3,990	\$55,900	
6	Aggregate Base Course (Class 6)	Ton	\$35.00	350	\$12,300	6-Inch Thickness (Denver Water Service Rd)
7	Hot Mix Asphalt	Ton	\$92.00	50	\$4,600	8-Inch Thickness (Replace HMA on Havana)
8	Curb and Gutter Type 2	LF	\$15.00	110	\$1,700	
9	Retaining Walls	SF	\$90.00	12,965	\$1,166,900	
10	Concrete Box Culvert	LF	\$1,700.00	100	\$170,000	14-foot by 10-foot RCBC
11	Concrete Sidewalk/Bikeway (6 Inch)	SY	\$42.00	1,545	\$64,900	6-Inch Thickness Sidewalk/Trail
12	Trench Drain	LF	\$20.00	675	\$13,500	
Total Major Items					\$1,502,200	
Total Major Items			% of Major Item Cost			
					\$1,503,000	A
Removals / Resets			% of A	5.0%	\$76,000	B-1
Landscaping			% of A	4.0%	\$61,000	B-2
Erosion Control			% of A	5.0%	\$76,000	B-3
Drainage			% of A	9.0%	\$136,000	B-4
Traffic Control / Detour			% of A	25.0%	\$376,000	B-5
Signing and Striping			% of A	3.5%	\$53,000	B-6
Mobilization			% of A	8.5%	\$128,000	B-7
Misc. - Lighting/Fence/Median Cover Material/Seeding			% of A	10.0%	\$151,000	B-8
Total of Bid Construction Items					\$2,560,000	B
Force Account Items			% of B	6.0%	\$154,000	C-1
Minor Contract Revisions			% of B	8.5%	\$218,000	C-2
Total of Bid Construction Items & Force Account Items					\$2,932,000	C
Design Engineering			% of C	10.0%	\$294,000	D-1
Construction Engineering			% of C	15.0%	\$440,000	D-2
Total Design & Construction Cost					\$3,666,000	D
Utility Relocations			% of D	5.0%	\$184,000	E-1
Contingency (Total Design & Construction Cost)			% of D	15.0%	\$550,000	E-2
Total Project Cost Estimate					\$4,400,000	E

Opinion of Probable Construction Costs

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