

# Bowman Avenue Grade Separation Feasibility Study

Grade Separation of CSX and NS Railroads

PREPARED FOR:

City of Danville

*REVIEW DRAFT*

February 14, 2012



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## INTRODUCTION

This report presents preliminary designs for grade separating the CSX and Norfolk Southern (NS) railroads on Bowman Avenue north and south of Fairchild Street. Conceptual design options for creating a grade separation at each railroad are presented along with their respective direct impacts and estimated costs.

## BACKGROUND

The eastern portion of Danville, where a majority of the city's larger industries are located, is also where the roadway and rail networks intersect. Both the CSX and Norfolk Southern (NS) railroads cross this area. At-grade crossings on arterial roadways such as Bowman Avenue, Main Street, Williams Street, Voorhees Street and Lynch Road are routinely subject to train related delays at the crossings. Approximately 50-60 trains per day travel through Danville on the CSX and NS railroads. On average, this translates to a train every 24 – 28 minutes stopping traffic.

While good access to vehicular and rail transportation is a critical component of a community's economic health and vitality, they can also negatively affect quality of life. When traffic on a road increases beyond the roadway capacity, congestion and delays develop. High volumes of rail traffic impede the movement of local traffic through a community, resulting in delays from waiting on trains and increased response times for emergency services such as police, fire and ambulances.

Danville's street network relies heavily upon north-south arterial roadways to carry both local and regional traffic. These arterials, including streets such as Vermilion Street, Gilbert Street, Bowman Avenue and Lynch Road, provide a mechanism to move people and goods throughout the city and provide a connection with regional routes such as Interstate 74. These roadways service Danville's industries and therefore support the local economy. However, Danville's economic vitality is not reliant solely on the roadway network. Rail service to the city also supports industry by providing an alternate mode of transportation to move materials and goods.

There are two types of rail-roadway intersections. When a roadway intersects a railroad at the same level at a crossing, it is called an "at-grade" crossing. At-grade crossings typically have warning devices such as lights and gates. They can be a source of vehicular delay and there is the potential for vehicle-train collisions at an at-grade intersection. When a roadway passes either over or under a railroad, it is referred to as a "grade separation" or a "grade-separated intersection." Rail and roadway traffic at a grade-separated intersection experiences no delays and there is no conflict between rail and vehicular traffic.

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## STUDY OBJECTIVES

The City has been proactive in managing roadway/rail intersections. The recent Winter Avenue project included the improvement of the existing grade-separation of Winter Avenue under the CSX tracks. Replacement of the Fairchild Street Subway with a new overpass of both the CSX and NS tracks is scheduled to start in 2012. While improvements to Winter Avenue and Fairchild Street will improve existing grade separations, these projects will not reduce the delays encountered by motorists at the other at-grade crossings in the eastern portion of the city.

One of the major north-south arterial roadways that provides direct access to I-74 and areas slated for current and future economic development is Bowman Avenue. Bowman Avenue also has an at-grade crossing of both the CSX railroad (located north of Griggs Street) and the NS railroad (located north of Maple Street). Traffic on Bowman Avenue experiences significant delays from trains at these two at-grade crossings located approximately 0.4 miles apart. In between these crossings is the Bowman Avenue/Fairchild Street signalized intersection. Traffic waiting on trains at either the NS or CSX crossings can backup into the Bowman Avenue/Fairchild Street intersection, which then disrupts east-west traffic on Fairchild Street.

The purpose of this study is to begin to answer the question: “What would it take to grade separate Bowman Avenue at the CSX and NS tracks?” This is a feasibility study, the first step in looking at potential future project. This study examines, on a preliminary and planning level basis, the requirements, direct impacts and potential costs of grade separating Bowman Avenue from the CSX at NS railroad tracks. A feasibility study is a decision making tool. It provides city officials and staff with information and analyses that will assist them in making a decision on whether to pursue funding for the construction of these projects. The study limits extend along Bowman Avenue from north of Williams Street on the south to approximately Brook Street. The limits are depicted on Exhibit 1 in the Appendix.

## EXISTING CONDITIONS

Bowman Avenue is a north-south arterial roadway that extends from Perrysville Avenue, just south of the I-74/Bowman Avenue interchange, north through the City of Danville, and then proceeds on as a County Highway (North 1800 E. Road). Bowman Avenue, with its interchange at I-74 and continuity throughout the City, accommodates both local traffic (traffic originating from, and destined to, locations within the City) as well as regional traffic that begins or ends outside of the City limits and is destined for locations in the City or beyond.

### Roadway Characteristics

From I-74 to Main Street (US Route 136), Bowman Avenue consists of two lanes in each direction in an urban cross-section (curb and gutter with parkway and sidewalks). North of the Main Street intersection at approximately Johnson Street, Bowman Avenue transitions down to one lane in each direction separated by striped center median, which also provides for left-turns

at intersections and driveways. This three-lane section continues past Voorhees Street until north of Crestview Drive where Bowman Avenue transitions down to a two lane road (one in each direction).

Within the study limits, Bowman Avenue has a right-of-way approximately 66- feet wide. The existing typical cross section of Bowman Avenue is shown on Exhibit 2 in the Appendix.

### Traffic Characteristics

Traffic volumes on Bowman Avenue are highest at the I-74 interchange and decrease as Bowman Avenue proceeds north. At I-74 the average daily traffic (ADT), defined as the total two-way volume in a 24-hour period, is approximately 11,400 vehicles per day. Between Main Street and Fairchild Street the ADT volume is approximately 10,700. North of Fairchild Street the ADT volume drops to approximately 8,000. A volume of in excess of 12,000 vehicles per day typically warrants two lanes in each direction (four-lane roadway).

### Land Use

Land uses adjacent to Bowman Avenue are generally residential with single-family homes and some duplexes. The majority of these homes front Bowman Avenue. At major intersections, such as Main Street, Fairchild Street and Voorhees Street, land uses on the intersection quadrants are commercial in nature. Commercial uses are also present near the CSX and NS at-grade crossings. There are also several churches within the Bowman Avenue study corridor.

## **FUTURE NEEDS**

### Vehicular Needs

In order to assess the impacts of grade-separating Bowman Avenue at the CSX and NS crossings, an assessment of the future requirements for Bowman Avenue (number of lanes and pedestrian/bicycle accommodations) needs to be made. Based on the traffic volumes identified above, a modest increases in traffic (1-2% per year) on Bowman Avenue between Fairchild Street and Main Street will result in a volume that warrants widening of Bowman Avenue to provide two lanes in each direction in the not too distant future (approximately 6- 10 years). Traffic volumes north of Fairchild Street will reach the 12,000 ADT in approximately 20 years. The typical design horizon for a new facility such as grade separation is a minimum 20 years. Therefore, based on traffic volumes and projected growth, any proposed improvement to Bowman Avenue south of Voorhees Street should be designed to accommodate two lanes of traffic in each direction. This need exists regardless of whether a grade separation is implemented in the future.

### Pedestrian and Bicycle Needs

There are existing sidewalks along Bowman Avenue. The City has been proactive in both the planning and construction of multi-use paths (pedestrians and bicycles) to link schools, parks and other destinations. The proposed Fairchild Street overpass of the CSX and NS tracks will include an 8-foot wide multi-use path from Bowman Avenue west to Section Street. The City's long-range plan includes extending this path west to Danville High School. There are sections of multi-use path planned for other east-west arterial streets. A multi-use path along the west side of Bowman Avenue would provide both a north-south bicycle route and a connection to existing and planned east-west paths. This multi-use path should be included in future improvements to Bowman Avenue, along with a sidewalk on the east side of the road.

### **GRADE SEPARATION CONCEPTS**

Two design concepts have been developed for the CSX and NS at-grade crossings:

- Bowman Avenue over the railroads (overpass concept)
- Bowman Avenue under the railroads (underpass concept)

Each location is independent of the other. Either an underpass or overpass could be constructed or a combination of both. In other words, it is possible to construct an underpass of the CSX tracks and an overpass of the NS tracks and vice versa.

In developing the design concepts, roadway profile grades were limited to five percent (5%) with the exception of the overpass option over the CSX tracks. For the south approach, a grade of approximately 5.67 % is required in order to meet the existing profile grade of Bowman Avenue prior to the Williams Street intersection. Having a roadway approach to a signalized intersection on an incline grade is undesirable from a safety and operations standpoint. The decision to utilize a profile grade of 5% for the design concepts is to meet the provisions of the Americans with Disabilities Act (ADA) for pedestrian and bicycle facilities. Grades in excess of 5% would require periodic flat landing pads along the sidewalk or multi-use path, which increase cost and can result in separate structures for bikes/pedestrians. Grades in excess of 5% on an arterial roadway can also result in increased truck noise from acceleration/deceleration.

### Concept Footprints

Existing traffic volumes and future forecasts indicate that the Bowman Avenue will likely need to be widened to two lanes in each direction with a center median/turn lane. This improvement will require additional right-of-way from properties adjacent to Bowman Avenue regardless of whether an overpass or underpass is constructed at either the CSX or NS crossings. The primary difference between widening of the roadway and the grade-separation concepts is the additional width of right-of-way required for the structures (walls and foundations) and the need to provide alternative access to properties adjacent to Bowman Avenue where the grade of the roadway is either above or below the level of the adjacent properties. There are also other differences such

as changes in the view from existing properties, changes in noise and aesthetic considerations. As this is a preliminary feasibility study, only the direct impacts (property impacts and changes in access) are being considered. If it were decided to pursue grade separating either the CSX or NS crossings, more detailed engineering and environmental studies would be required to assess additional impacts and develop mitigation strategies if required.

In developing the footprint for the overpass and underpass concepts, a preliminary assessment of impacted properties was made. Rather than impact a large number of properties on both sides of the roadway from widening Bowman Avenue equally on both sides, it was determined that the impacts to adjacent properties could be minimized by shifting the roadway to the east to accommodate the widening and overpass/underpass structures. This impacts fewer properties. Typical cross sections for each concept are shown on Exhibits 3 and 4 in the Appendix.

Overpasses are generally less costly to construct, but the required clearance of the roadway over the railroad tracks is typically 30 feet. Overpasses typically do not require any temporary or permanent relocation of the railroad tracks during construction and are therefore less costly.

Underpasses, while more expensive to construct, have a required clearance of 14-18 feet below the railroad tracks which is much less than the 30 feet required to go over the tracks. Therefore, the required approaches to raise the roadway up and over a railroad are longer than what is required to go down and under the tracks. Underpasses cannot be constructed directly beneath operating railroad tracks. Temporary “run-arounds” or “shoo-fly” tracks must be constructed to move rail traffic away from the construction site. Once the underpass structure is completed, the tracks are typically moved back in their original location. Construction of the temporary tracks adds additional expense to the project and may result in property impacts beyond the roadway if the railroad right-of-way is limited. The conceptual footprints of the underpass and overpass options at the CSX and NS grade crossings are depicted on Exhibit 5 in the Appendix. It should be noted that for the underpass concept at the NS tracks, the footprint of the project extends east and west along the NS tracks due to the required temporary railroad tracks that would be required during construction. The NS right-of-way is limited in width and therefore these temporary track relocations would impact additional properties.

#### Preliminary Direct Impacts

Based on the footprints of the overpass and underpass concepts, a preliminary assessment of the impacts to the adjacent properties was developed. As mentioned above, these impacts are preliminary in nature and additional studies and refinements would be required if these projects progress further. The direct impacts have been summarized into two categories:

- Acquisition of an entire property and relocation of the business or residents
- Partial acquisition of property and relocation of access to an adjacent street or alley.

For residential properties that currently have driveways on Bowman Avenue that would be impacted with a grade separation, access would have to be provided via a rear alley. In some instances, this would require modification or replacement of any existing garage structures to place the door on the alley side. If there is no alley present and no ability to provide an alley, full acquisition of a property and relocation would be necessary.

In accordance with Federal and State statutes, if a property is to be acquired in its entirety, the property owner is entitled to fair market value of the property as determined by an independent appraiser and the resident/tenant/business operator is entitled to relocation assistance as defined in State and Federal guidelines.

Table 1 below summarizes the direct impacts to adjacent properties for the overpass and underpass concepts. Full acquisition and access relocations are depicted on Exhibits 6 and 7.

**Table 1**  
**Comparison of Grade Separation Concepts**  
**Direct Property Impacts Requiring Full Acquisition and Relocation**  
**Or Reconfiguration of Access**

Impact	CSX Grade Separation		NS Grade Separation	
	Overpass	Underpass	Overpass	Underpass
Residential Acquisition & Relocation	7	6	16	9
Business Acquisition & Relocation	1	-	1	2
Residential Access Relocation	8	5	11	6
Business Access Relocation	4	4	1	1
Institution access relocation	1	1	-	-
Institution Relocation or Building Reconfiguration	1		-	-

For the CSX overpass concept there would be major impacts to the Greater Shiloh Baptist Church. With this concept, there would also be acquisition of the adjacent residences. The acquisition of these residences could potentially allow for a reconfiguration of the church building. If it were not feasible to modify the church building, acquisition and relocation would be required. While the underpass footprint would be slightly smaller, the transition of Bowman Avenue into the underpass would still impact this church.

Although not directly attributable to either an underpass or an overpass, widening of Bowman Avenue would create impacts to the Methodist Church located north of Fairchild Street. Similarly, residences and businesses along Bowman Avenue outside the limits of either an overpass or underpass would like incur impacts from the widening of Bowman Avenue.

### Preliminary Estimate of Costs

A preliminary estimate of cost for both the overpass and underpass concepts was developed and is presented on Table 2 below:

**Table 2**  
**Comparison of Grade Separation Concepts**  
**Preliminary Estimates of Cost**

Item	CSX Grade Separation Cost Estimate		NS Grade Separation Cost Estimate	
	Overpass	Underpass	Overpass	Underpass
Acquisition & Relocations	\$1,700,000	\$1,600,000	\$2,100,000	\$1,900,000
Access Reconfiguration	\$260,000	\$200,000	\$240,000	\$120,000
Construction & Engineering	\$19,737,600	\$25,587,700	\$14,497,200	\$25,674,900
Contingency (20%)	\$4,339,520	\$5,447,340	\$4,528,000	\$5,538,980
<b>Total</b>	\$26,037,120	\$32,864,040	\$27,168,000	\$33,233,880

As can be seen from a review of Table 1 and 2, the impacts for the overpass concepts are estimated to be greater than the underpass concepts. However, the costs of the overpasses are less than the underpasses. As mentioned earlier, there are other impacts that should be considered in any future engineering studies such as noise, aesthetics and other indirect impacts. The comparisons made in this feasibility study are intended to help make a decision on whether to proceed with grade separations on Bowman Avenue. Exhibit 8 in the Appendix provides a more detail breakdown of the construction and engineering estimates. In the cost estimates, it is assumed that the Fairchild/Bowman Avenue intersection would be improved to accommodate the cross-section of the underpass or overpass (2 lanes in each direction).

### CONCLUSION

This feasibility study presents both underpass and overpass concepts to grade separate Bowman Avenue at the CSX and NS railroads. Both overpass and underpass concepts result in the acquisition of residences and businesses along with other property impacts. Preliminary estimates of cost have been developed as well.

Additional dialogue with the public and city officials will be required before deciding whether to proceed with grade separating either railroad and to decide between overpass and underpass alternatives.



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## APPENDIX

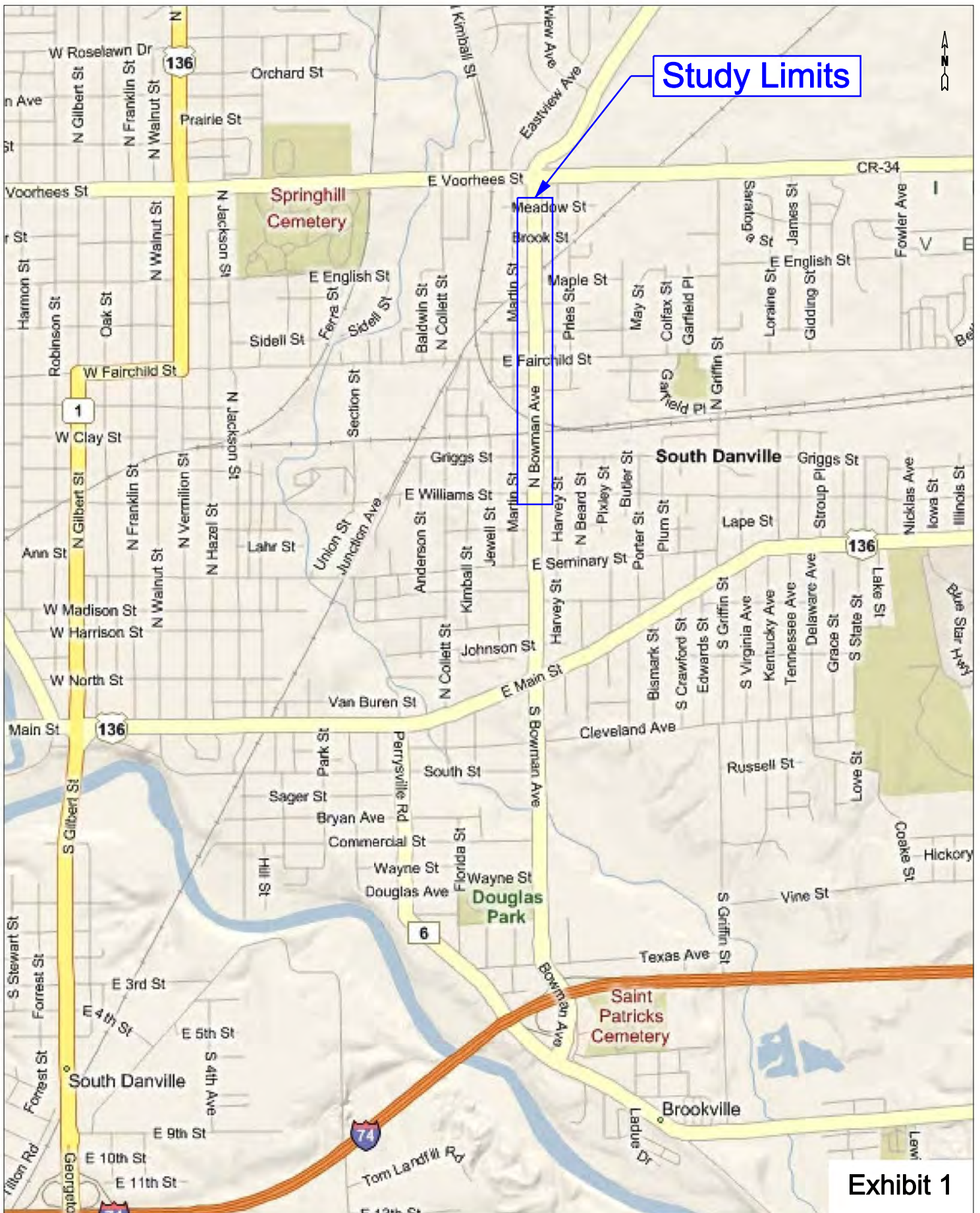


Exhibit 1



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Bowman Avenue Feasibility Study

## EXISTING BOWMAN AVENUE CROSS SECTION

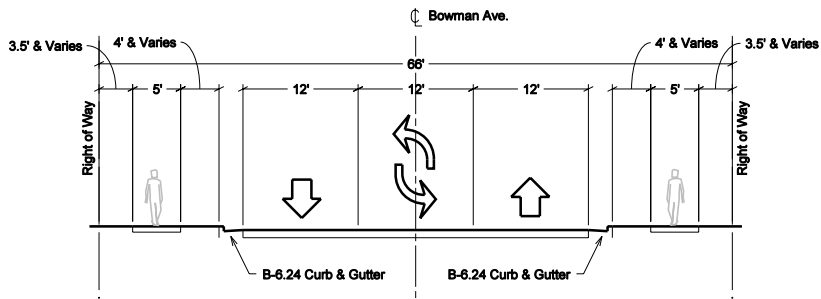


Exhibit 2



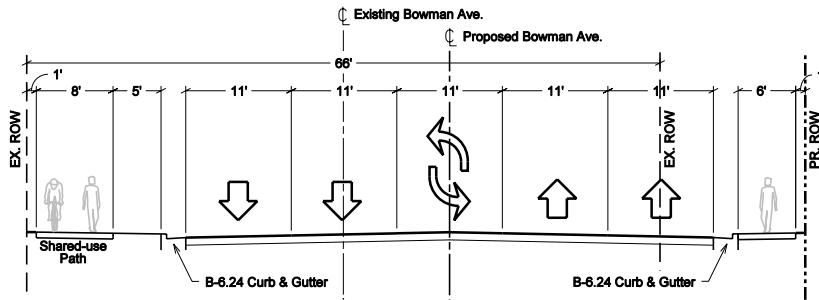
City of Danville



Bowman Avenue Feasibility Study

# BOWMAN AVENUE CONCEPT CROSS SECTIONS

## OVERPASS CONCEPT



Outside of Overpass Limits

Proposed Typical Section  
Bowman Avenue Over Railroads with 5 lanes, path & sidewalk  
(Looking North)

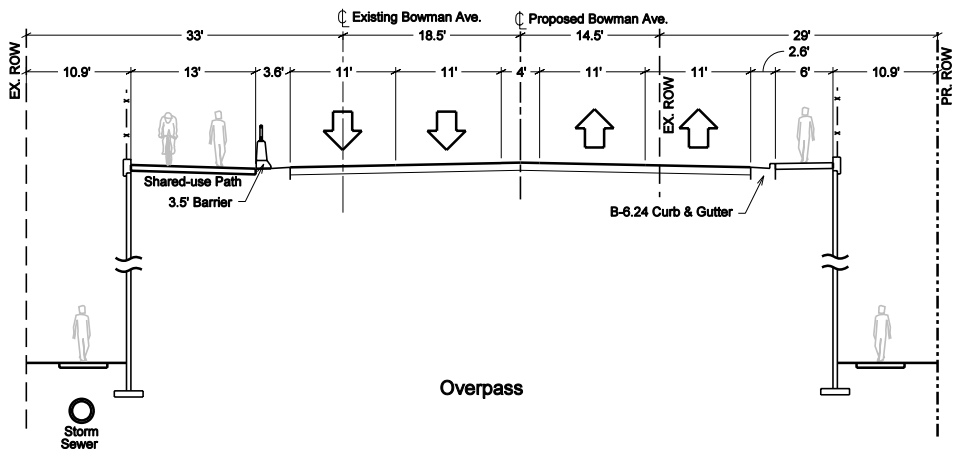
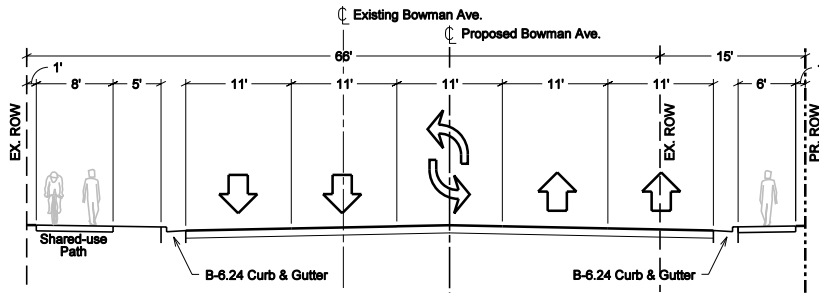


Exhibit 3



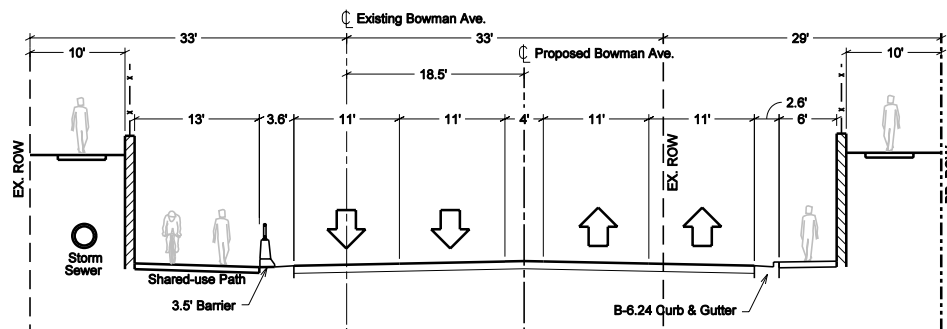
# BOWMAN AVENUE CONCEPT CROSS SECTIONS

## UNDERPASS CONCEPT



Outside of Underpass Limits

Concept Cross Section  
Bowman Avenue Under Railroads with 5 lanes, path & sidewalk  
(Looking North)



Underpass

Exhibit 4

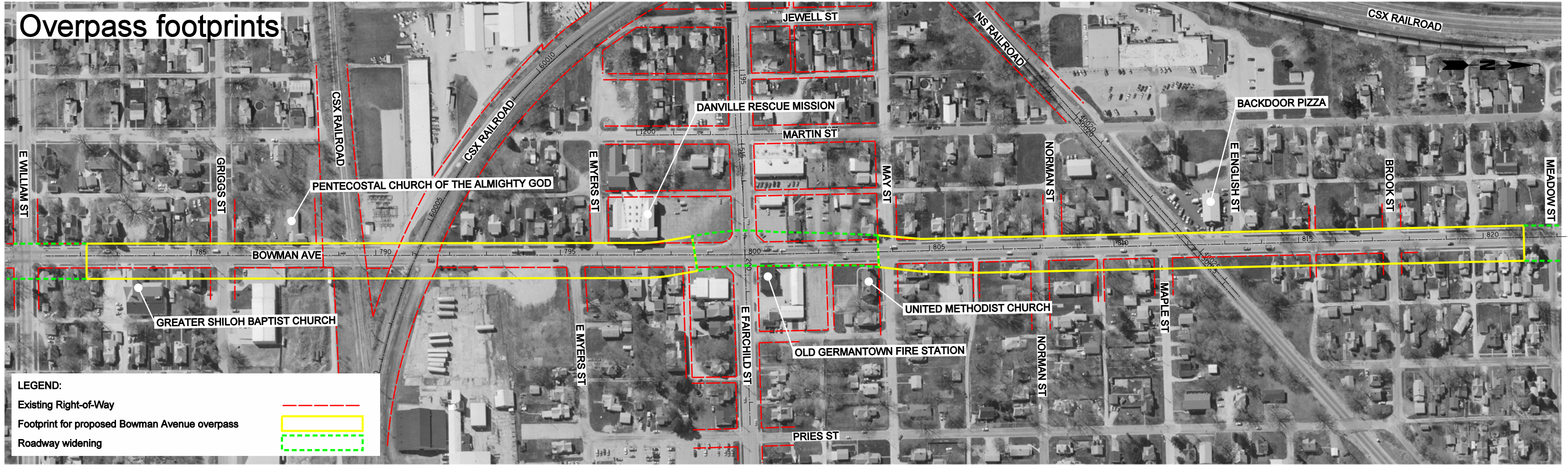


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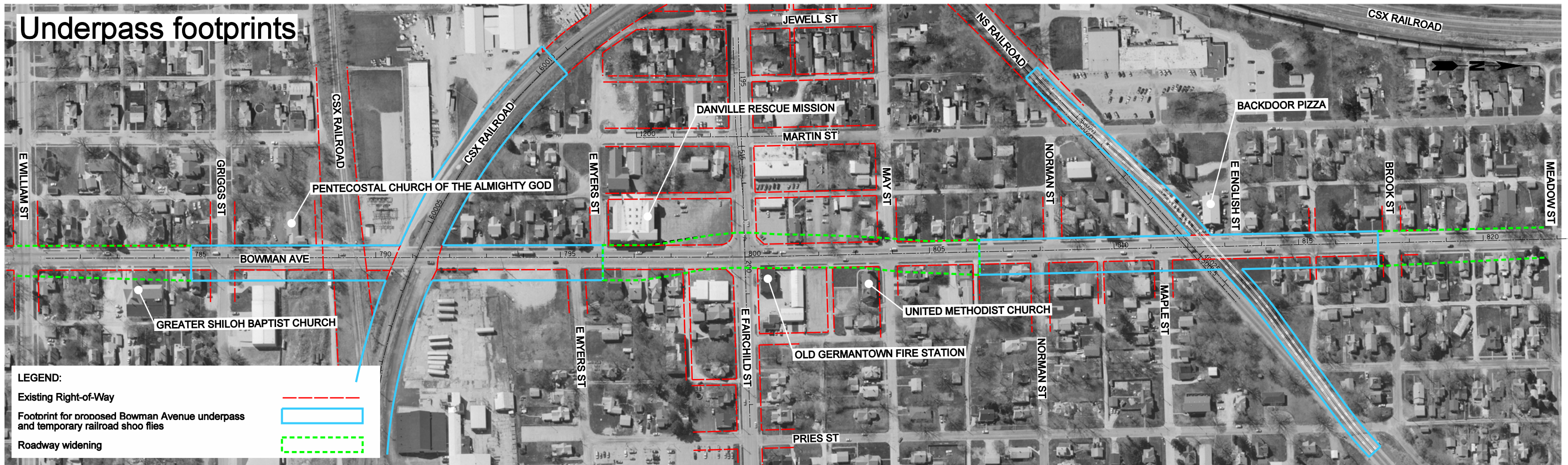


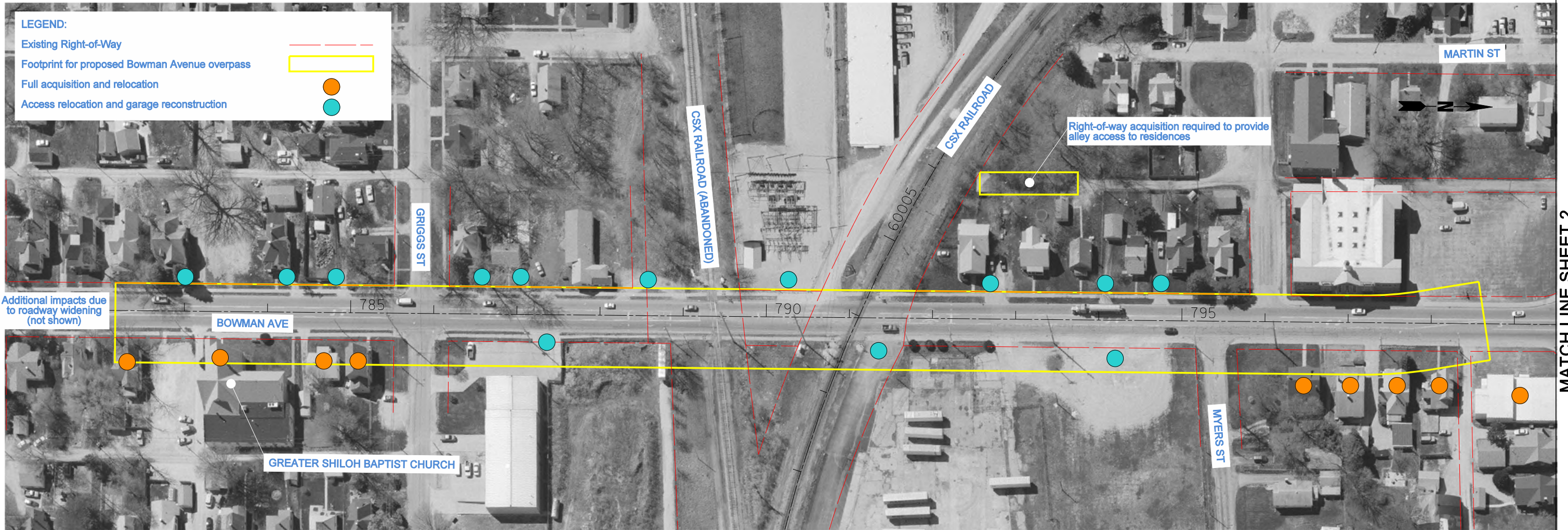
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# Overpass footprints

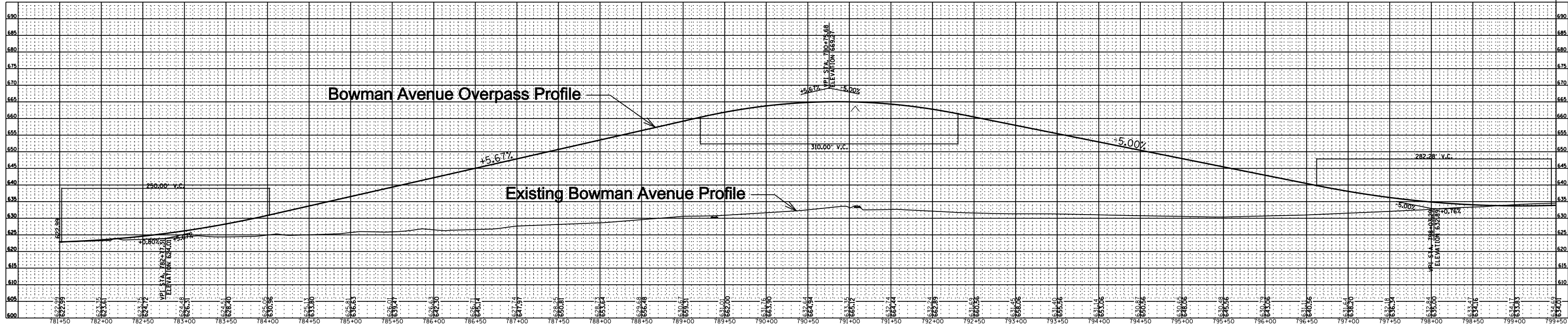


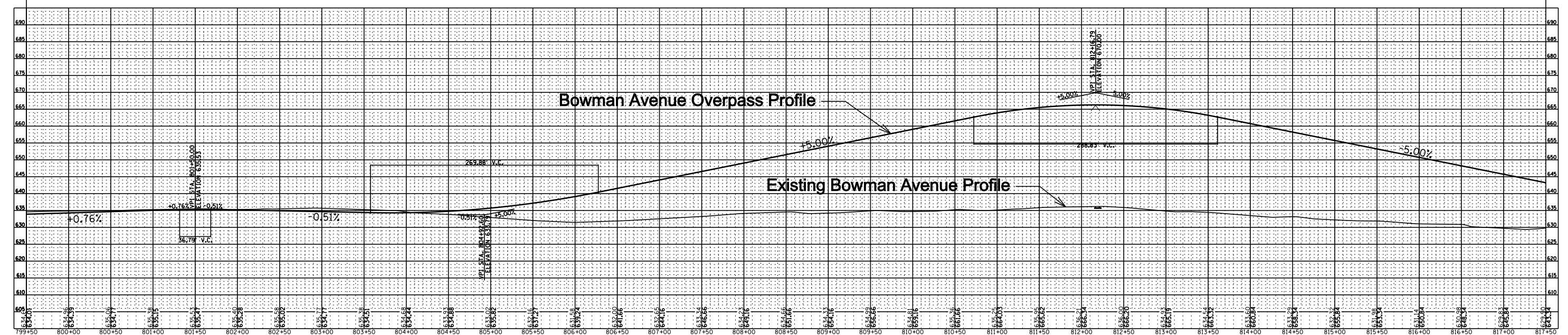
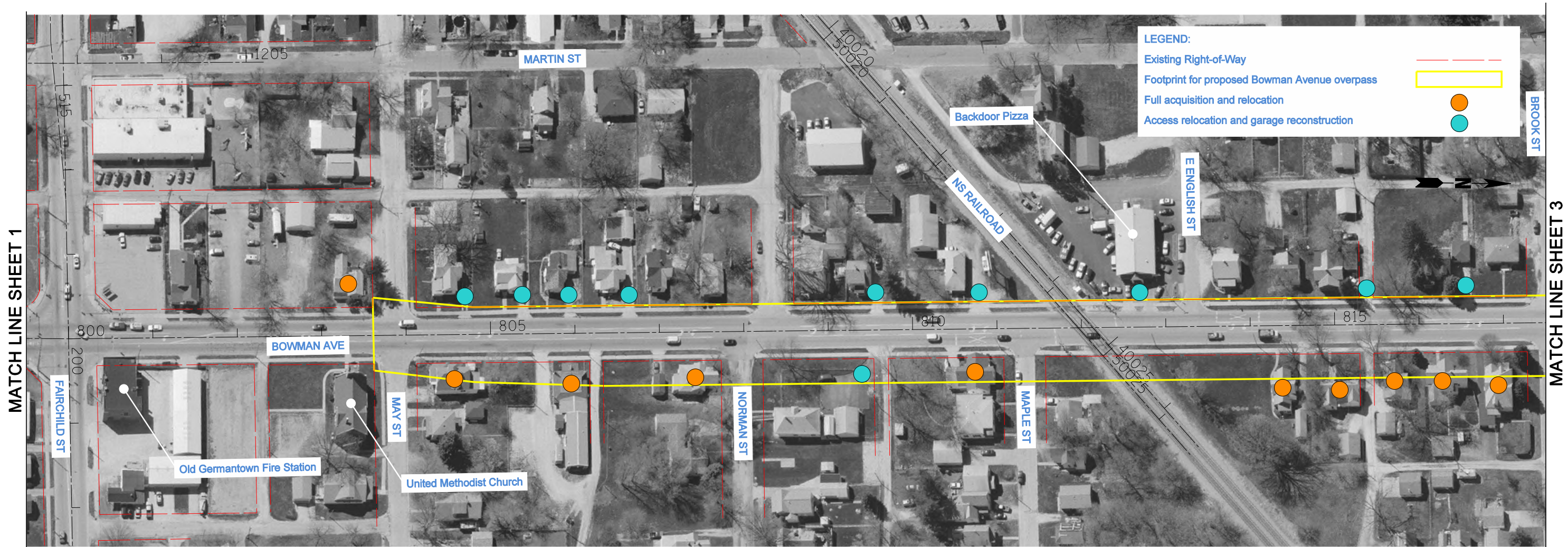
# Underpass footprints





MATCH LINE SHEET 2





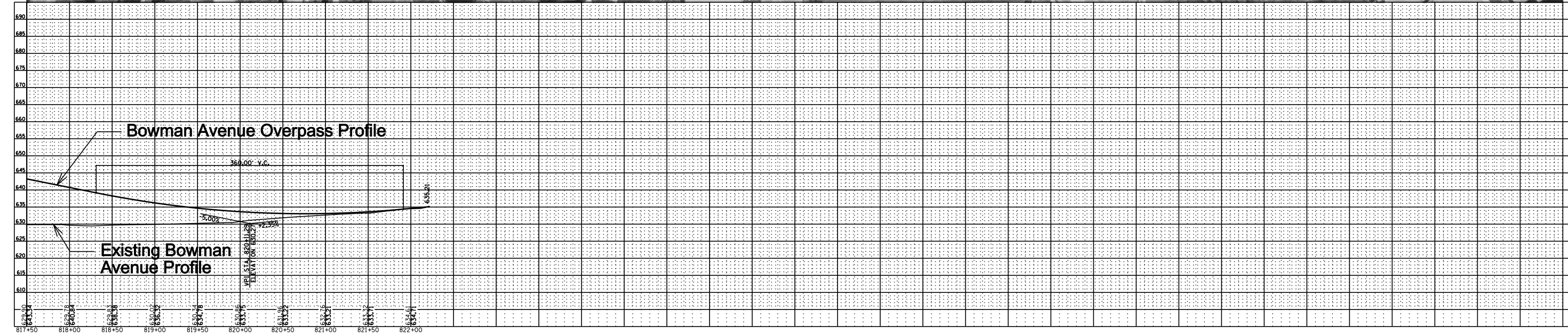




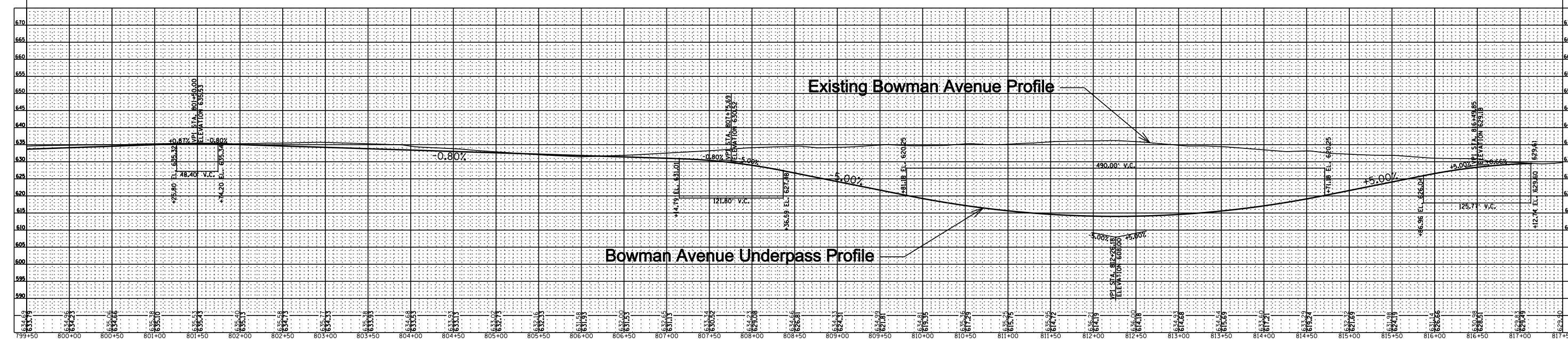
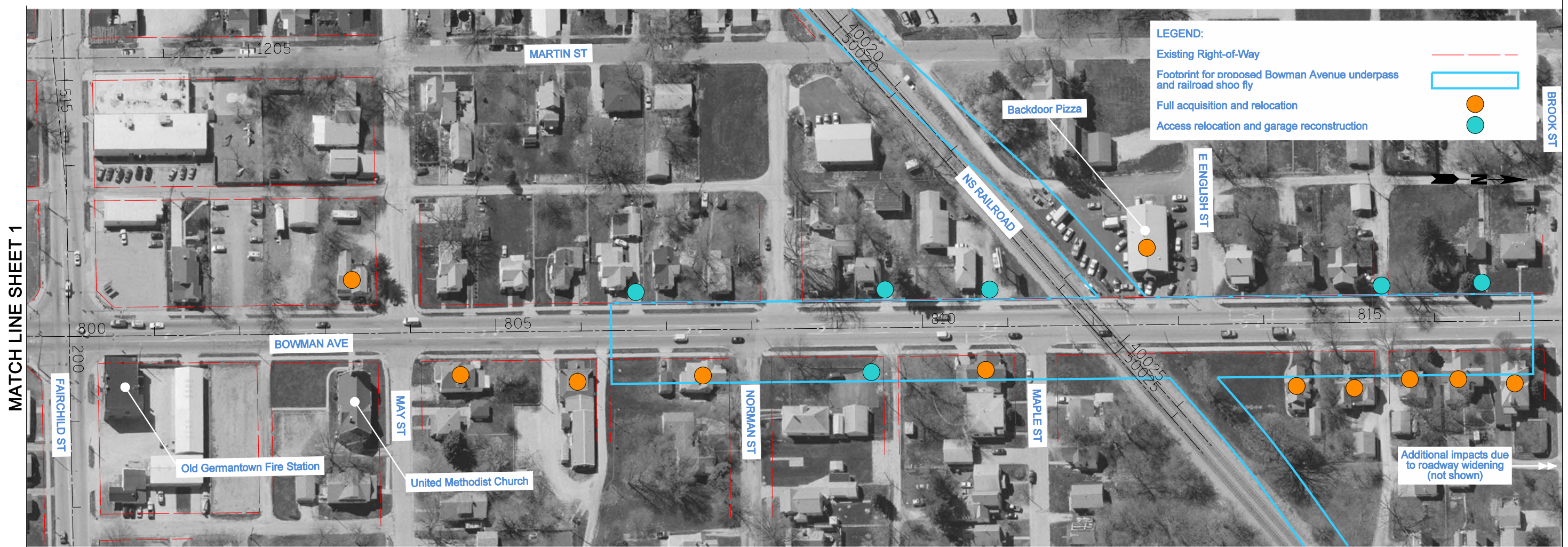
MATCH LINE SHEET 3

**LEGEND:**

- Existing Right-of-Way ---
- Footprint for proposed Bowman Avenue overpass
- Full acquisition and relocation ●
- Access relocation and garage reconstruction ●







**Overpass Design Concept: Bowman Avenue over CSX Railroad**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL COST
Roadway Removal	1,970	Ft	\$ 70	\$ 137,900
Proposed Roadway Items	1,665	Ft	\$ 515	\$ 857,475
Drainage	1,970	Ft	\$ 150	\$ 295,500
Major intersections	1	Each	\$ 500,000	\$ 500,000
Minor Intersections	2	Each	\$ 150,000	\$ 300,000
Signals & Lighting	1	Each	\$ 200,000	\$ 200,000
Grade Separation Structure (Bowman over CSX RR)	23,547	Sq Ft	\$ 250	\$ 5,886,750
MSE Retaining Walls (Bowman over CSX RR)	124,500	Sq Ft	\$ 60	\$ 7,470,000
Furnished Embankment (Bowman over CSX RR)	40,000	Cu Yd	\$ 20	\$ 800,000
			Subtotal	\$ 16,448,000
			Design and Construction Engineering (20%)	\$ 3,289,600
			Subtotal Construction and Engineering	\$ 19,737,600

**Overpass Design Concept: Bowman Avenue over Norfolk Southern Railroad**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL COST
Roadway Removal	2,130	Ft	\$ 70	\$ 149,100
Proposed Roadway Items	2,030	Ft	\$ 515	\$ 1,045,450
Drainage	2,130	Ft	\$ 150	\$ 319,500
Major intersections	-	Each	\$ 500,000	\$ -
Minor Intersections	4	Each	\$ 150,000	\$ 600,000
Lighting	1	Each	\$ 50,000	\$ 50,000
Grade Separation Structure (Bowman over NS RR)	7,475	Sq Ft	\$ 250	\$ 1,868,750
MSE Retaining Walls (Bowman over NS RR)	118,800	Sq Ft	\$ 60	\$ 7,128,000
Furnished Embankment (Bowman over NS RR)	46,000	Cu Yd	\$ 20	\$ 920,000
			Subtotal	\$ 12,081,000
			Design and Construction Engineering (20%)	\$ 2,416,200
			Subtotal Construction and Engineering	\$ 14,497,200

**Underpass Design Concept: Bowman Avenue under CSX Railroad**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL COST
Roadway Removal	1,750	Ft	\$ 70	\$ 122,500
Proposed Roadway Items	1,750	Ft	\$ 515	\$ 901,250
Drainage	1,750	Ft	\$ 150	\$ 262,500
Major intersections	1	Each	\$ 500,000	\$ 500,000
Minor Intersections	2	Each	\$ 150,000	\$ 300,000
Signals & Lighting	1	Each	\$ 200,000	\$ 200,000
Grade Separation Structure (CSX RR over Bowman)	80	Track Ft	\$ 25,000	\$ 2,000,000
Retaining Walls (CSX RR over Bowman)	123,840	Sq Ft	\$ 100	\$ 12,384,000
Temporary Retaining Walls (CSX RR over Bowman)	6,200	Sq Ft	\$ 60	\$ 372,000
Temporary Railroad Shoo Fly (CSX RR, single track) plus signal costs @ \$500,000	1,400	Track Ft	\$ 250	\$ 850,000
Excavation (CSX RR over Bowman)	171,500	Cu Yd	\$ 20	\$ 3,430,000
Subtotal				\$ 21,322,250
Design and Construction Engineering (20%)				\$ 4,264,450
Total				\$ 25,586,700

**Underpass Design Concept: Bowman Avenue under Norfolk Southern Railroad**

ITEM	QUANTITY	UNIT	UNIT COST	TOTAL COST
Roadway Removal	1,850	Ft	\$ 70	\$ 129,500
Proposed Roadway Items	1,850	Ft	\$ 515	\$ 952,750
Drainage	1,850	Ft	\$ 150	\$ 277,500
Major intersections	1	Each	\$ 500,000	\$ 500,000
Minor Intersections	2	Each	\$ 150,000	\$ 300,000
Signals & Lighting	1	Each	\$ 200,000	\$ 200,000
Grade Separation Structure (NS RR over Bowman)	80	Track Ft	\$ 25,000	\$ 2,000,000
Retaining Walls (NS RR over Bowman)	123,840	Sq Ft	\$ 100	\$ 12,384,000
Temporary Retaining Walls (NS RR over Bowman)	6,200	Sq Ft	\$ 60	\$ 372,000
Temporary Railroad Shoo Fly (CSX RR, single track)+signal costs \$500,000	1,400	Track Ft	\$ 250	\$ 850,000
Excavation (CSX RR over Bowman)	171,500	Cu Yd	\$ 20	\$ 3,430,000
Subtotal				\$ 21,395,750
Design and Construction Engineering (20%)				\$ 4,279,150
Total				\$ 25,674,900