

## Troy Howard Trail Feasibility Study

**Submitted to:**  
City of Belfast, Maine and Belfast Trails

**Submitted by:**  
Rizzo Associates, Inc.

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## EXECUTIVE SUMMARY

### BACKGROUND

The City of Belfast, Maine contracted with Rizzo Associates to study the feasibility of developing a bicycle/pedestrian facility linking the Troy Howard School on Lincolnville Avenue (Route 52) with Miller Street. The facility, known as the Troy Howard Trail, would cross U.S. 1, linking the Troy Howard School, the Waldo County YMCA and other attractions west of U.S. 1 with points in town east of U.S. 1. This section of U.S. 1 is also known as the U.S. 1 Bypass.

The construction of major trip attractors like the Troy Howard School (a middle school) west of the bypass has made it more difficult to bicycle or walk to and from locations in town because of the need to cross U.S. 1. Belfast Trails, the City's bicycle and pedestrian advisory committee, working with the Belfast City Manager and staff, is interested in evaluating whether a bicycle/pedestrian structure could be built to span over or under U.S. 1 so that bicyclists and pedestrians would not need to cross this busy regional highway.

Belfast Trails and the City of Belfast received funds from the Maine Department of Transportation to study the feasibility of constructing the bicycle/pedestrian trail. This report summarizes the results of the study.

### PUBLIC INVOLVEMENT

Three public meetings are being held for the feasibility study. At the first meeting on December 5, 2001 the public was introduced to the study and provided comments on the study approach and scope. The project team presented initial findings and alternatives to the public on February 14, 2002. Comments received at this meeting were valuable in refining the proposals. Final recommendations on trail location and design and order-of-magnitude cost estimates were presented to the public at a third meeting on April 8, 2002. Notes from this meeting prepared by Belfast Trails are provided at the end of this section.

### STUDY METHODOLOGY

Rizzo Associates coordinated with members of Belfast Trails and City of Belfast staff during the preparation of this study. An extensive tour of the project area was conducted by foot and on bicycle on December 5, 2001. Follow-up field investigations were also conducted.

The City of Belfast provided reports, maps, plans, aerial photography and other data used in the feasibility study. Rizzo Associates subcontracted with Stephen Downey, Land Surveyor of Ellsworth, Maine to conduct a limited land survey along US 1 at the State Route 52 (Lincolnville Avenue) intersection at the farm crossing south of the intersection. Recent traffic counts for the U.S. 1/Route 52 intersection were obtained from Casey and Godfrey Consulting Engineers of Gardiner, Maine.

Cost estimates for the various alternatives were calculated from unit costs for similar projects and from other sources. Both trail and structure unit costs developed by Rizzo Associates for the Downeast Trail and the Auburn Trails Feasibility Study were used as appropriate. These estimated costs for trails and structures were developed in close coordination with the Maine Department of Transportation highway, bridge and multimodal divisions.

### ALTERNATIVES

Trail alternatives that were considered fall into three categories:

1. Bicycle lanes and pedestrian improvements along Lincolnville Avenue
2. Bicycle/pedestrian path along Lincolnville Avenue with grade-separated crossing of U.S. 1
3. A cross country bicycle/pedestrian path with a grade-separated crossing of U.S. 1 at or near the farm crossing, several hundred yards south of Lincolnville Avenue

Six bridge crossings or underpasses were evaluated for this:

- a) Bicycle/pedestrian bridge on north side of the Lincolnville Avenue intersection
- b) Bicycle/pedestrian underpass (tunnel) on north side of the Lincolnville Avenue intersection
- c) Bicycle/pedestrian bridge on south side of the Lincolnville Avenue intersection
- d) Bicycle/pedestrian underpass (tunnel) on south side of the Lincolnville Avenue intersection
- e) Bicycle/pedestrian bridge at the farm crossing
- f) Bicycle/pedestrian underpass (tunnel) at the farm crossing

Key information about the six structure alternatives is presented in the matrix on the next page.



### Summary of Bicycle/Pedestrian Crossing Options

Option	Estimated Cost (US\$)			Length (ft)			
	Structure	Connecting Paths	Total	Structure	Approach East	Approach West	Total
North of Intersection BRIDGE	930,000	291,000	1,221,000	165	350	175	690
North of Intersection TUNNEL	1,580,000	291,000	1,871,000	102	95	230	427
South of Intersection BRIDGE	1,000,000	291,000	1,291,000	185	355	225	765
South of Intersection TUNNEL	1,600,000	291,000	1,891,000	125	102	144	371
Farm Crossing BRIDGE	370,000	256,000	626,000	112	100	480	692
Farm Crossing TUNNEL	1,570,000	256,000	1,826,000	52	210	121	383
Bicycle Lanes with Crosswalk	n/a	n/a	n/a	n/a	n/a	n/a	n/a

### CONCLUSIONS

Bicycle lanes could easily be developed within the existing roadway and shoulders of Lincolnville Avenue between the Troy Howard School and Miller Street. The length of the exclusive pedestrian phase of the traffic signal at the US 1/Lincolnville Avenue intersection could be extended somewhat to allow more time for pedestrian crossings. However, this alternative (Alternative 1), does not provide a grade-separated crossing, which Belfast Trails and City staff believe is needed to serve school-age children and others.

The most direct route for a bicycle path is along Lincolnville Avenue (Alternative 2). However, a grade-separated crossing of US 1 at the Lincolnville Avenue intersection would be expensive. Structures are needed for both approaches to a bicycle/pedestrian bridge to fit with adjoining land uses and minimize impacts on wetlands. A tunnel at this intersection would require lengthy approaches below grade. Persons using the tunnel would not be visible from the road or adjoining land for a considerable distance (350 to 400 feet), which would make many users feel uncomfortable and insecure. A tunnel would be even more expensive than a bridge at the intersection because it would be located below the water table and need special construction to prevent ground water infiltration.

While somewhat longer, a trail using a cross country alignment with a bridge at the existing farm crossing is by far the least expensive alternative (Alternative 3) that meets project objectives. The bridge would be approximately 112 feet long with wing walls on both ends. Fill would be used to provide the necessary approaches. The approach from the west would be a path at 5-percent grade designed as a reverse curve to minimize the volume and impacts of fill. A tunnel at this location would be difficult and expensive due to the high water table. Easements would be required on both sides of this crossing. A relatively direct and visible route for the trail could be established as part of a new street that will connect to Miller Street.

The analyses of trail and structure alternatives are provided in the following two sections.



## NOTES OF PUBLIC MEETING HELD ON APRIL 8, 2002

Prepared by Belfast Trails

### Lincolnton Avenue

The trail should not take kids across the entrances of Shop N'Save, Sears, and the St. Croix Credit Union where they will be exposed to a lot of traffic. (Norman Tinker)

### Route 52

A shared use path would be preferable over bike lanes. (THMS Student Council Reps)

The slow School Zone should begin at the church on Rt. 52 for increased safety around the school. (THMS Student Council Reps)

The YMCA parking lot would not be a safe route for the trail as it leaves Rt. 52 and heads toward THMS because of limited space for additional sidewalks, and the issue of separating bicycles and cars. The YMCA and THMS have plans to work together on constructing a path between the two facilities through the field and across the stream. (Larry Jones)

### Route 1/Route 52 Intersection:

A bridge should be located on the south side of this intersection. The existing at-grade crossing is dangerous: the walk phase of the traffic signal is too short and autos turning right on red may not see pedestrians. (THMS Student Council Reps, Logan Saunders and Sarah)

We should consider the idea of an at-grade crossing with a diagonal crosswalk that would take pedestrians across both streets at once while all traffic is stopped (Charlotte Peters). John Balicki responded that he would take this idea to MDOT's traffic engineers for consideration. How would people feel about using this kind of facility? Answer: the perceived danger would still deter people from using it.

We should consider a diagonal bridge across this intersection with the traffic lights mounted on it. Pedestrians could cross both streets at once, safely. (Logan Saunders)

What is the future of this intersection? Will it need an underpass like the one at Rt. 3 soon? John Balicki (MDOT) and Wayne Marshall answered that the cost of a ramped intersection is so high that it would take a very large increase in traffic volume to warrant such a change. Based on evaluations made by the city during planning for the St. Croix Credit Union, traffic won't grow that much. The first step would be to enhance the intersection design by adding controlled left turning lanes on Rt. 52.

Should we consider moving the bridge to the north of the intersection, add a center support and save construction dollars on two shorter spans rather than one long span? (Mike Hurley). Frank Harrigan (Rizzo Associates) responded that this type of design would incur greater pier costs, which would outweigh savings on the superstructure.

### Farm Crossing:

Does the cost estimate for the Farm Crossing include costs for paths leading up to the bridge? (Marianne Williams). Will kids go out of their way to use the Farm Crossing? The right place for a crossing of Route 1 is where people cross Route 1 now, the dangerous intersection at Lincolnton Ave. (Mike Hurley)

A bridge at the Farm Crossing would be out of the way for students going to THMS. The long path would be hard to maintain in winter. Students on this path would be too unsupervised; if someone were hurt, they'd be far from help. (THMS Student Council Reps)

This trail would not be well used in winter. (Terry St. Peter)

The YMCA acts as "bait" luring kids across Rt. 1, and they'll go the shortest route, not through the woods. (Mike Hurley)

This facility would be completely segregated [from car traffic], making it safer and more pleasant to use than a trail along Lincolnton Ave. It would keep kids away from all the traffic turning into and out of businesses along Lincolnton Ave. It may not be much longer at all than a trail along another alignment, and it would serve the whole area of town around Northport Ave quite well. Soon there could be development in the area between Robertson School and Rt. 1 that would mitigate the feeling of being on a remote path. (Wayne Marshall)

### General Comments

Please describe the assessment of need for this project. (Evie Tinker) Answer: This project would allow improved health and healthy habits of physical fitness for residents in one of Maine's least healthy counties. It would also dramatically improve safety for children and adults walking and biking from town to all the facilities outside the bypass on the Rt. 52 corridor. Also, the suggestion for and improved crossing of the bypass came up in interviews that Belfast Trails conducted with many public figures two years ago in response to the question, "What does Belfast need for trails?" When the Troy Howard Middle School Trail was built the need was evident, as there was much controversy about locating a middle school outside the bypass where children could not safely reach it on foot.

The significant carless population in Belfast, including the elderly, and also wheelchair users should have good access to the trail. (Bland Banwell)

We should do this crossing once, and do it right for the safety of children. One fatality at Rt. 1 would be too high a cost for motivating a better solution. Also, kids will take the shortest route to the YMCA; so don't try to make them go out of their way. Heed the history of the Rt. 1/Rt. 3 intersection, which was changed several times before the overpass was constructed, and don't waste money on multiple attempts to fix the Rt1/Rt. 52 intersection. (Phil Crosby)

Are there alternative bridge designs (e.g. narrower, composite construction) that would be cheaper? (Jon Cheston) John Balicki answered that a 10' wide bridge (instead of 12' wide) would not be much cheaper, and that the truss construction suggested in the engineers' drawings is a standard lowest cost option for bridge construction.



## TRAIL ALTERNATIVES

The City of Belfast wanted to investigate alternative bicycle/pedestrian routes from the city to the Troy Howard School. There were three alternatives that were considered feasible for construction.

Alternative 1 is a bicycle lane approach. This alternative continues the proposed bike lanes on Miller Street to Lincolnville Avenue, heading southwest, across U.S. 1 down to the Troy-Howard School.

Alternative 2 is a bicycle path that heads southwest from Miller Street across U.S. 1 to the Troy Howard School. This alternative uses the YMCA parking facility to complete the route to the middle school. The bicycle path would be placed on the eastern side of Lincolnville Avenue. It has a 10-foot-wide travel surface with a 2-foot shoulder. The path would be removed from the edge of the road by a 5-foot separation.

Alternative 3 is called the cross country bicycle path. This path would start as a shared roadway on a proposed street off of Miller Street. This proposed road would head southwest towards U.S. 1 where it would become a bicycle path. The path would approach a bridge crossing over U.S. 1 into farmland near Walsh Field. Continuing to Walsh Field, the path would make a left onto Lincolnville Avenue and head southwest to the YMCA where it would cross Lincolnville Avenue into the parking lot of the YMCA and end at the Troy Howard School.

All bicycle paths were assumed to be 10 feet wide with 2-foot-wide unpaved shoulders. The paths would be constructed of bituminous concrete (asphalt) surface course. The paths would be designed for use by pedestrians, bicycles, skaters and other non-motorized users.

Cost estimates for all alternatives were derived from the Downeast Trail Engineering Feasibility Study performed by Rizzo Associates (2000) and Maine Department of Transportation unit bid price averages.

### ALTERNATIVE 1 – BIKE LANES ALONG LINCOLNVILLE AVENUE (RT. 52)

Rizzo Associates proposes in Alternative 1 to add bike lanes on Lincolnville Avenue (see Figure 1). These lanes would meet the proposed lanes on Miller Street as shown in Figure 2 developed by Olver Associates. Addition of bike lanes on the existing Route 52/Lincolnville Avenue roadway will require new painted bike lane lines along the length of Lincolnville Avenue from Miller Street to Troy Howard School on both sides of the street. The bike lanes will be approximately 4,500 long for both sides, for a total length of 9,000 feet. This will involve the removal of edge lines by grinding and placement of new painted edge lines and bike lane lines. Just south of Miller Street, the bike lanes are offset 4 feet from the edge of the sidewalk curb on the west side of Lincolnville Ave and four feet from the edge of pavement on the east (see Figure 3). This will reduce the travel lanes for cars down to 12 feet in each direction. AASHTO and other transportation agencies consider this an acceptable travel lane width. This lane configuration continues on both sides of Route 52 as it crosses U.S. 1 and goes southwest towards the school (see Figure 4). As the graphics show, there is no impact to right-of-way, utility pole configurations or traffic signal equipment. Near the YMCA, the pavement widens with a 4-foot

shoulder on the west side of Route 52 and a 6-foot shoulder on the east side. As Figure 5 shows, the proposed bike lanes can widen to five feet on either side. After Troy Howard School, the lanes would again become wide shoulders that bicyclists could use. There would be no additional bike lane markings southwest of the school entrance. The road near the Troy Howard School entrance will need added pavement to even the travel surface where the bike lane will be created. The roadway is slightly higher than the shoulder between the school and the YMCA. Consideration needs to be given to grading the pavement properly to prevent ponding. Other minor areas of repaving may need to be considered along the proposed bike lane route.

This alternative is the least costly of the three. Because it involves removal and restriping of existing lane markings and minor repaving, it is estimated that this bike lane alternative would cost approximately \$31,000 (see Table 1).

**Table 1 Alternative 1 - Bike Lanes**

Item	Length (ft)	Other	COST
627.77 4" Lane Marking Removal Both sides of Lincolnville Ave	9000	2970 sq ft	\$4.00
	Subtotal	2970 sq ft	\$11,880.00
627.71 4" Wide Lane Marking	9000		\$0.50
627.72 6" Wide Lane Marking	9000		\$0.50
	Subtotal		\$9,000.00
205.41 Reconstruction of Existing Shoulder Between Troy Howard and YMCA (North Side) 6 foot section by 1300 feet long	1300	870 sq yd	\$12.00
	Subtotal	870 sq yd	\$10,440.00
	Total		\$31,320.00
	<b>SAY</b>		<b>\$31,000.00</b>

### ALTERNATIVE 2 – BIKE PATH ALONG LINCOLNVILLE AVENUE

Alternative 2 involves the construction of a bicycle path along Lincolnville Avenue from the Troy Howard School to Miller Street (see Figure 6). Beginning at Miller Street and moving southwest, the bike path would follow along the eastern edge of Lincolnville Avenue. There would be a 5-foot separation between this road edge and the proposed path to the U.S. 1 intersection. Because of the proposed path layout, four utility poles would be in the middle of the proposed path. Therefore, they need to be relocated away from the path edge (see Figure 7). The utility company may absorb the cost of relocation.

Approaching U.S. 1 would require the minor filling of wetlands and re-grading of driveways where the bike path crosses them. At U.S. 1 the path would either cross over using the proposed bridge or go under U.S. 1 in the proposed tunnel. After exiting the structure, the path continues along Route 52 past



Walsh field to the YMCA parking lot. The hedges at the intersection of U.S. 1 would probably need to be moved back to accommodate the path.

Figure 8 shows that southwest of the U.S. 1 intersection the bike path fits in the right-of-way and does not impact the utility poles located at the edge of the right-of-way. Vegetation would be removed outside the paved shoulder to allow for the new bike path. Impacts would be to lawns and fields. Because the shoulder on the west side of the street is being removed, the travel lanes shift 4 feet to the west. This will allow the travel lanes, separation and bike path with shoulder to fit inside the right-of-way and prevent the relocation of up to 10 utility poles. The shoulder by the YMCA will be removed and replaced with a vegetated 5-foot strip. The pavement will be excavated and new fill will be placed extending 17 feet from the new shoulder width. This will allow for a 5-foot separation, 10-foot-wide bike path and 2-foot shoulder. The shoulder would be graded to meet existing grade at a slope of 2:1. At the YMCA entrance, the pedestrian/bicyclist would use a pedestrian activated signal to cross at a new crosswalk adjacent to the parking lot of the YMCA. The pedestrian/bicyclist would then travel through the parking area following the pavement markings indicating the path to the back of the YMCA lot, leading to the school. This path would be constructed similarly to the path along Route 52/Lincolnville Avenue: a 10-foot-wide path with 2-foot shoulders.

**Table 2 Alternative 2 - Bike Path**

Item			
On level terrain (12' wide path)			
Bit. Conc. Pavement Structure			\$19.58
Clearing and Grubbing			\$2.00
Side Slope Treatment	Say		\$5.00
Earthwork			\$13.33
	Subtotal		\$39.91
	+35% contingency		\$13.97
			\$53.88
	<b>SAY</b>		\$54.00 /LF
Linear Feet of Bike Path	3750		\$54.00
	Subtotal		\$202,500.00
Linear Feet of Shared Roadway Through YMCA Parking Lot (Lane Lines)	774		\$0.50
	Subtotal		\$387.00
Pedestrian Signal (YMCA / RT 52)	1	each	\$80,000.00
	Subtotal		\$80,000.00
Remove Existing Bit. Pavement SY Between Troy Howard and YMCA (North Side) 6 foot section by 1100 feet long	730	sq yd	\$11.00
	Subtotal		\$8,030.00
<b>Total</b>			\$290,917.00
	<b>SAY</b>		<b>\$291,000.00</b>

This alternative requires earth excavation, lane marking removal and placement and a pedestrian activated signal. Estimated cost to build the path from Miller Street to the YMCA without including the structure at the crossing is \$291,000 (see Table 2). With the bridge structure, the cost increases to \$1.29 million. With the tunnel, it increases to \$1.89 million.

**ALTERNATIVE 3 – CROSS COUNTRY BIKE PATH**

Alternative 3 will incorporate parts of Alternative 2 and create a new path by the ball field leading to U.S. 1, south of the U.S. 1 and Lincolnville Avenue intersection (see Figure 9). This alternative will cross over or go under U.S. 1 and continue to the proposed roadway leading to Miller Street.

From Miller Street, the path will be shared with a proposed new roadway. New bike lane striping can be placed at the time of the road construction, or a separate bike path could be constructed within the new right-of-way. At the end of this road the bike path will continue along a stone wall and extend to the bridge, crossing U.S. 1. Clearing and grubbing to a width of approximately 15 feet needs to occur to accommodate the 10-foot-wide path and shoulders. New fill and sub-base material, along with a 2.5-inch course of bituminous concrete needs to be placed. This type of construction occurs up to the approach of U.S. 1. After crossing U.S. 1, the path moves in a reverse S-curve to minimize the ramp to meet existing grade near Walsh Field (see following section). The new path continues to Walsh Field where it meets an existing path. This will require little or no modification to the path. Striping will delineate the path to Lincolnville Avenue.

After entering Lincolnville Avenue the path continues south towards the YMCA. This will be new construction to build the path on the east side of Route 52. This alternative would follow the same alignment and construction methods mentioned in Alternative 2. The installation of a pedestrian activated signal, pavement marking and lane striping would occur.

This alternative requires earth excavation, lane marking removal and placement and a pedestrian activated signal. Estimated cost to build the path from Miller Street to the YMCA without including the structure at the crossing is \$256,000 (see Table 3). With the bridge structure, the cost increases to \$626,000. With the tunnel, it increases to \$1.82 million.



**Table 3 Alternative 3 - Cross Country Bike Path**

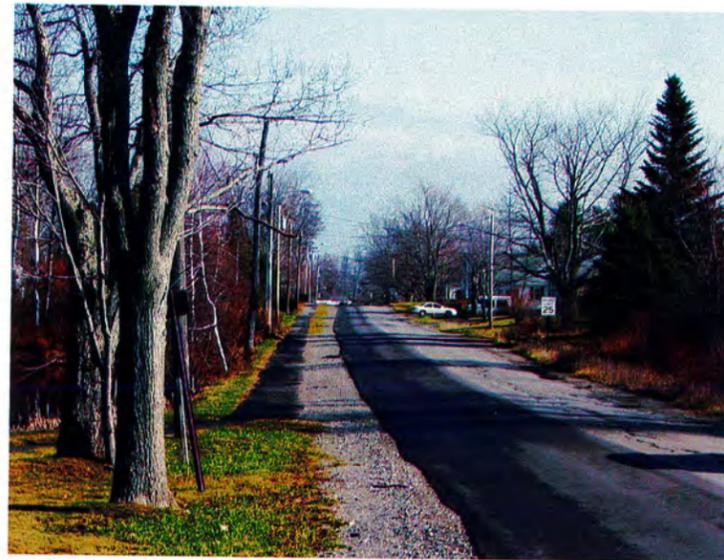
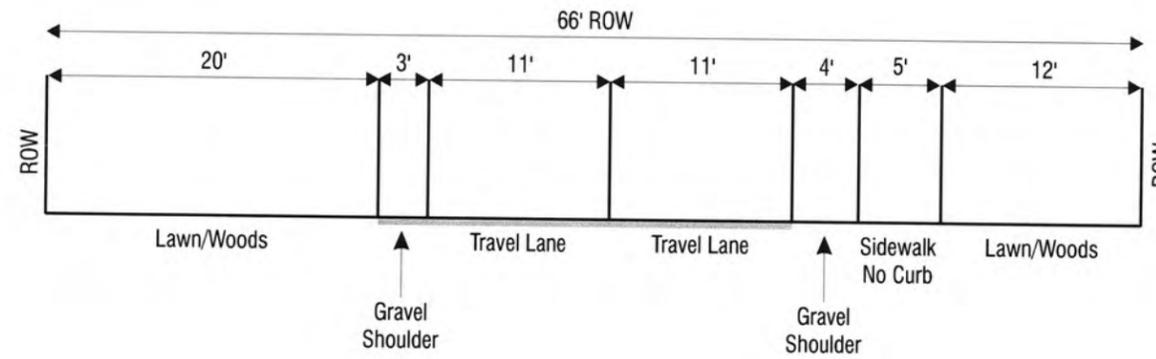
Item			
On level terrain (12' wide path)			
Bit. Conc. Pavement Structure			\$19.58
Clearing and Grubbing			\$2.00
Side Slope Treatment	Say		\$5.00
Earthwork			\$13.33
	Subtotal		\$39.91
	+35% contingency		\$13.97
			\$53.88
	<b>SAY</b>		\$54.00 /LF
Linear Feet of Bike Path	3100		\$54.00
	Subtotal		\$167,400.00
Linear Feet of Shared Roadway Through YMCA Parking Lot (Lane Lines)	774		\$0.50
	Subtotal		\$387.00
Pedestrian Signal (YMCA / 52)	1	each	\$80,000.00
	Subtotal		\$80,000.00
202.12 Remove Existing Bit. Pavement (SY) 7 4 foot section by 1100 feet long	730	per sq yd	\$11.00
	Subtotal		\$8,030.00
<b>Total</b>	<b>TOTAL</b>		<b>\$255,817.00</b>
	<b>SAY</b>		<b>\$256,000.00</b>





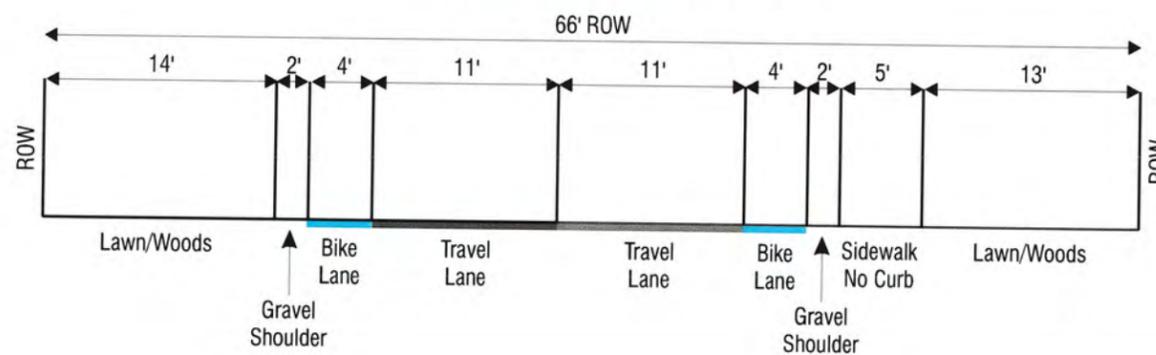


**Existing Miller Street (Typical)**



Miller Street Looking East

**Proposed Miller Street  
 From Olver Plans July 2001**

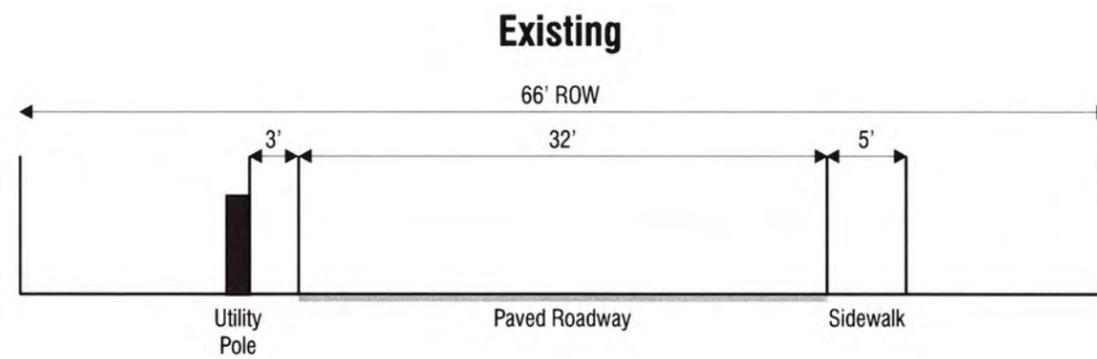




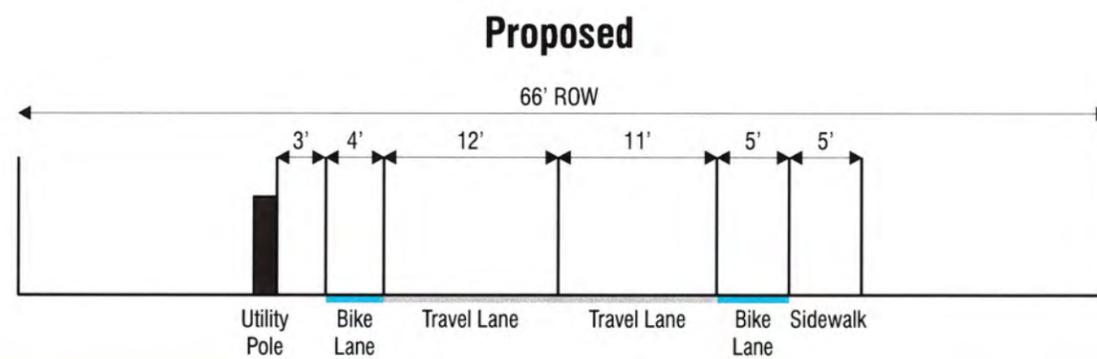
# Alternative 1 - Lincolnville Avenue Bicycle Lane Detail (Between Miller St. and Route 1)

Troy Howard Trail Study • Route 1/Route 52 • Belfast, Maine

## Figure 3

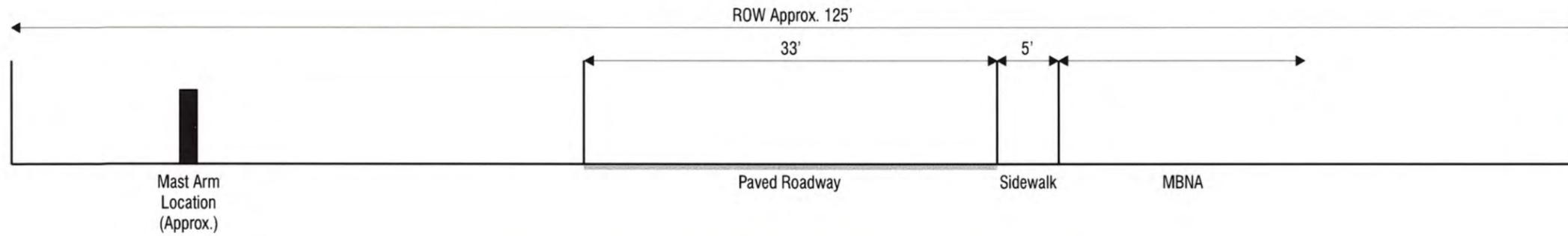


Lincolnville Avenue Looking Southwest



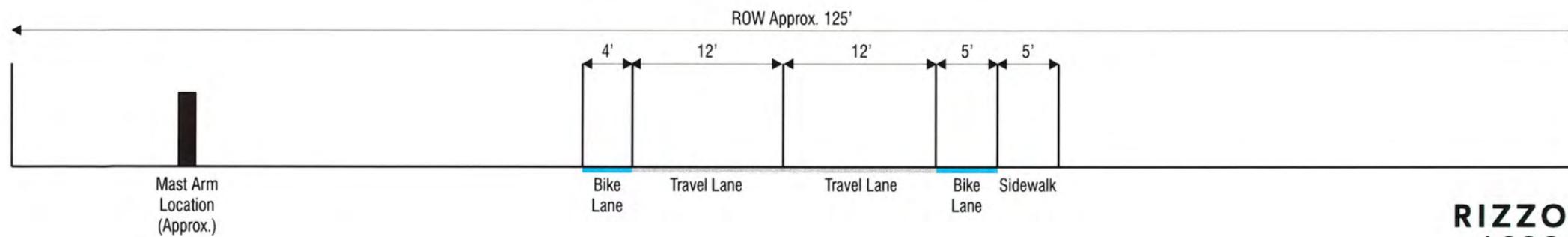


**Existing (Looking Southwest)**



*Lincolnville Avenue Looking Northwest*

**Proposed (Looking Southwest)**

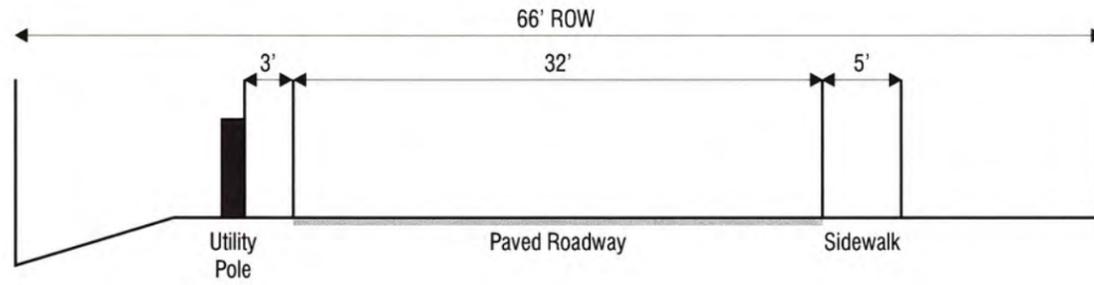






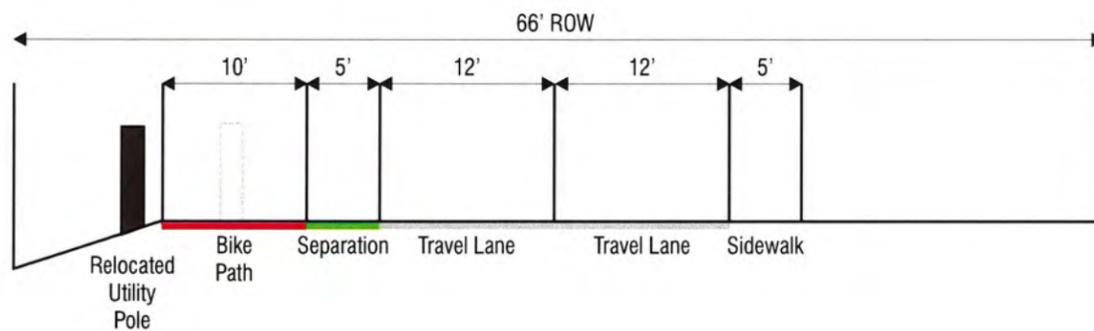


**Existing (Looking Southwest)**



*Lincolnville Avenue Looking Southwest*

**Proposed**





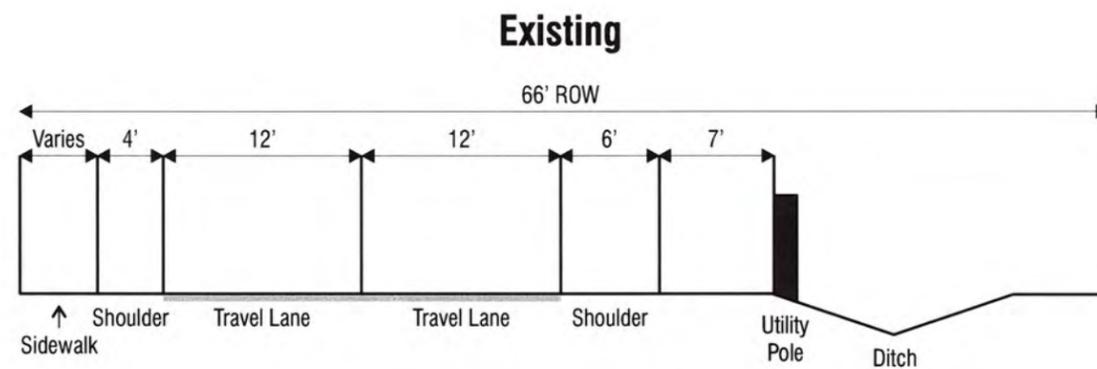
# Alternatives 2 & 3 - Lincolville Avenue Bicycle Path Detail (at Art's Canvas Products)

Troy Howard Trail Study • Route 1/Route 52 • Belfast, Maine

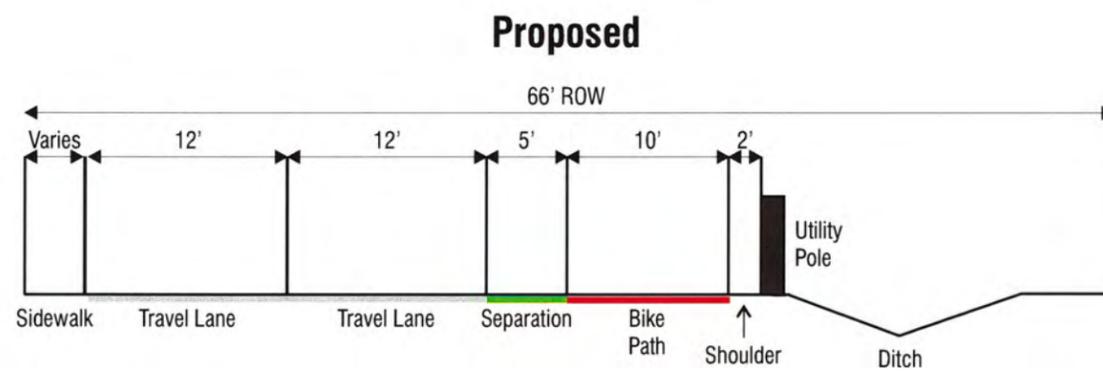
## Figure 8

### Belfast Trails

City of Belfast



Lincolville Avenue Looking Northeast



**RIZZO**  
ASSOCIATES  
A TETRA TECH COMPANY

One Grant Street  
Framingham, MA 01701

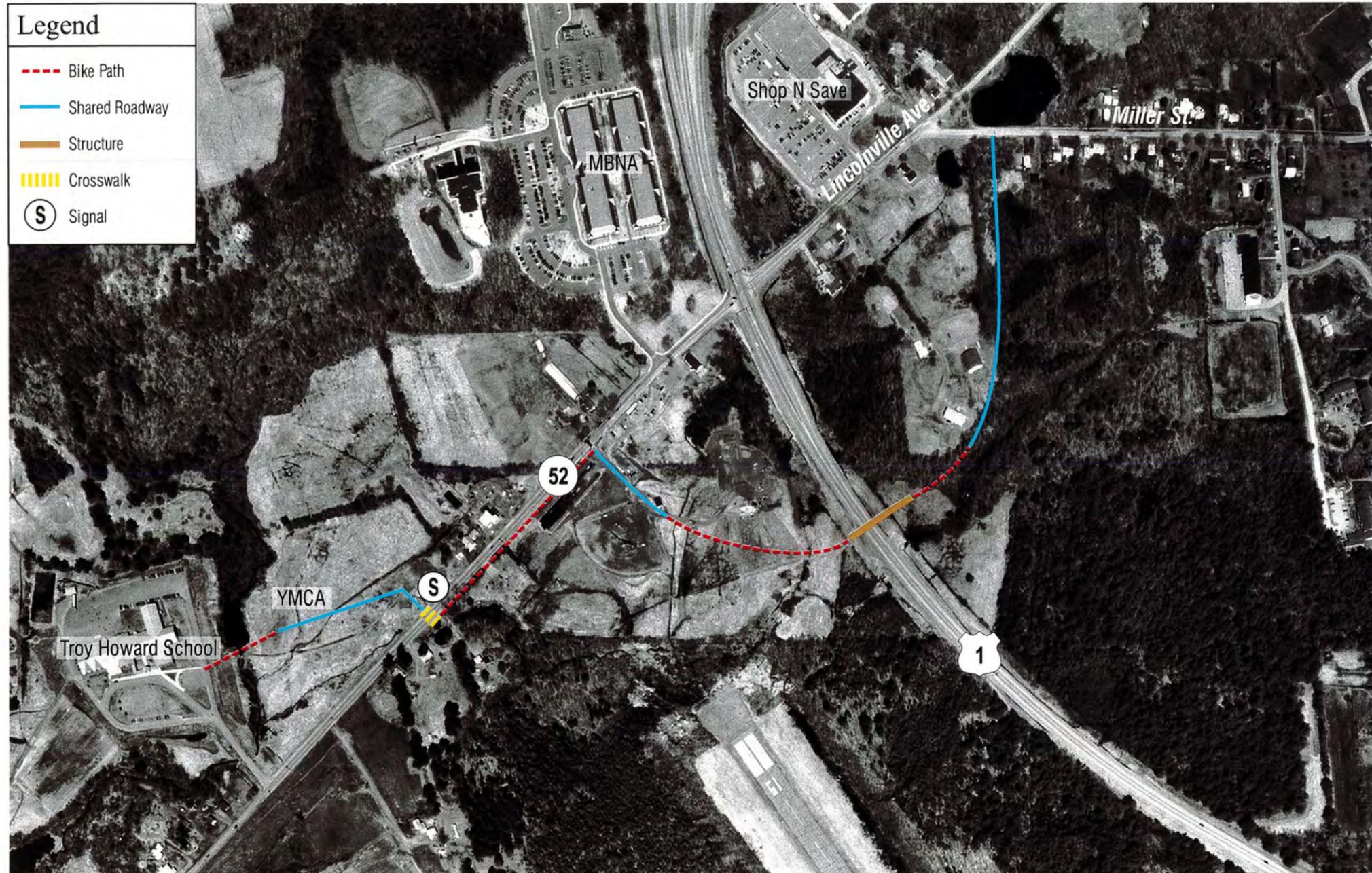
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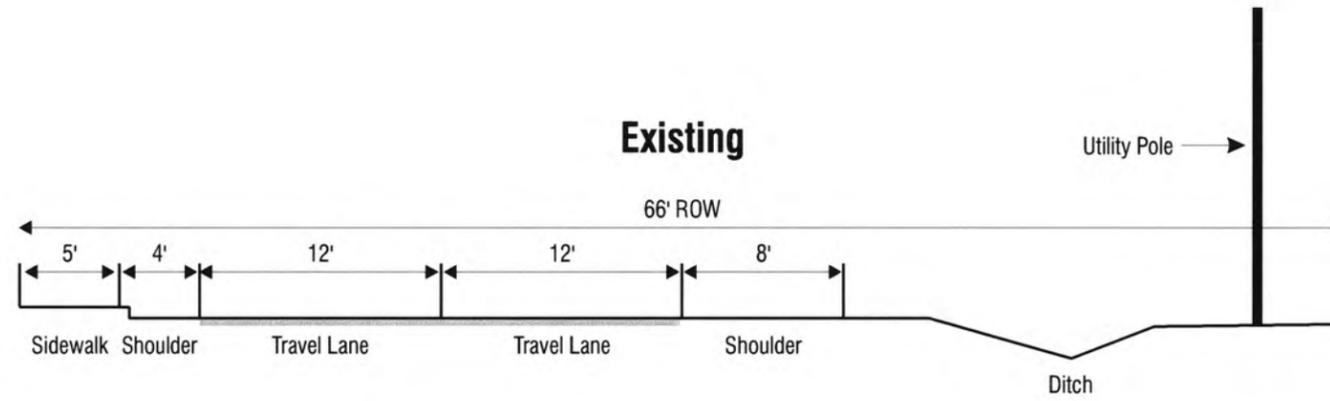
# Alternative 3 - Cross Country Bicycle Path

Troy Howard Trail Study • Route 1/Route 52 • Belfast, Maine

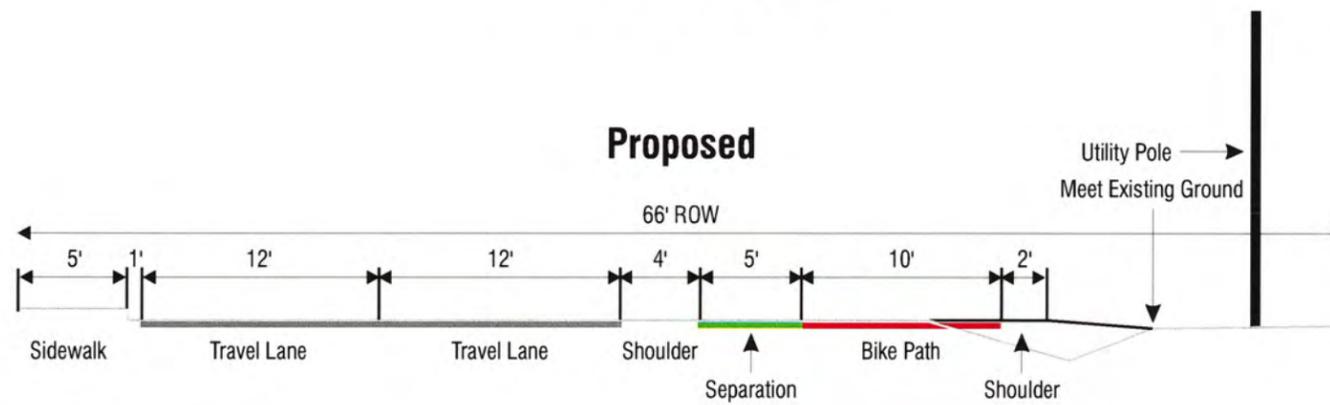
Figure 9







Lincolnville Avenue Looking Northeast





## ANALYSIS OF STRUCTURAL ALTERNATIVES

Six options were considered for the Troy Howard Trail crossing of U.S. 1. Two structure types were considered at each of three locations. Bridge and tunnel crossings were considered north and south of the U.S. 1/Lincolnville Road intersection, and at an existing farm crossing near Walsh Field. Figure 10/11 shows the approximate length of each structure and approaches to each end.

### NORTH BRIDGE AT U.S. 1/LINCOLNVILLE AVE (RT. 52) INTERSECTION

A steel truss bridge structure spanning U.S. 1 aligned adjacent to the back of sidewalk along the northern side of Lincolnville Avenue was investigated. Cast-in-place concrete bridge abutments and precast concrete modular walls retain fill for each approach ramp sloped 1:12 with landings 5 feet long spaced at 30 feet. Chain link fence and ADA compliant handrails were included along both sides of the ramps and bridge.

### SOUTH BRIDGE AT U.S. 1/LINCOLNVILLE AVE (RT. 52) INTERSECTION

A steel truss bridge structure spanning U.S. 1 aligned adjacent to the back of sidewalk along the southern side of Lincolnville Avenue was investigated. Cast-in-place concrete bridge abutments and precast concrete modular walls retain fill for each approach ramp sloped 1:12 with landings 5 feet long spaced at 30 feet. Chain link fence and ADA compliant handrails were included along both sides of the ramps and bridge.

### FARM CROSSING BRIDGE

A steel truss bridge structure spanning U.S. 1 was investigated. The trail was assumed to extend from the existing walkway at Walsh Field across U.S. 1 to a proposed future road east of U.S. 1. Cast-in-place concrete bridge abutments and wing walls retain fill with 2:1 side slopes for each approach ramp sloped at 1:20. An elevation and section of a bicycle/pedestrian bridge at this location are shown on Figure 12.

### NORTH TUNNEL AT U.S. 1/LINCOLNVILLE ROAD (RT. 52) INTERSECTION

A cast-in-place box culvert tunnel aligned adjacent to the back of sidewalk along the northern side of Lincolnville Avenue was considered. Cast-in-place integral slabs and retaining walls comprised both approach ramps, sloped 1:12 with landings 5 feet long spaced at 30 feet. Construction included steel sheeting and tremie concrete infill for the full length of the structure. Also included was lighting and a pump station for dewatering, as well as a temporary bridge to maintain two lanes of traffic on U.S. 1 during construction.

### SOUTH TUNNEL AT U.S. 1/LINCOLNVILLE AVE (RT. 52) INTERSECTION

A cast-in-place box culvert tunnel aligned adjacent to the back of sidewalk along the southern side of Lincolnville Avenue was considered. Cast-in-place integral slabs and retaining walls comprised both approach ramps, sloped 1:12 with landings 5 feet long spaced at 30 feet. Construction included steel sheeting and tremie concrete infill for the full length of the structure. Also included was lighting and a pump station for dewatering, as well as a temporary bridge to maintain two lanes of traffic on U.S. 1 during construction.

### FARM CROSSING TUNNEL

A cast-in-place box culvert tunnel crossing beneath U.S. 1 was considered. The trail was assumed to extend from the existing walkway at Walsh Field across U.S. 1 to a proposed future road east of U.S. 1. Cast-in-place integral slabs and retaining walls comprised both approach ramps, sloped 1:12 with landings 5 feet long spaced at 30 feet. Construction included steel sheeting and tremie concrete infill for the full length of the structure. Also included was lighting and a pump station for dewatering, as well as a temporary bridge to maintain two lanes of traffic on U.S. 1 during construction. An elevation and section of a bicycle/pedestrian tunnel at this location are shown on Figure 13.

## SUMMARY

Table 4 is a matrix summarizing basic data on design, impacts and costs of each of the six structure alternatives. Detailed cost estimates for the six structures are shown in Tables 5-10. The bridge at the farm crossing is least expensive. The estimated cost, not including easement cost, is \$370,000. A bicycle/pedestrian bridge on either the north or south side of the US 1/Lincolnville Avenue intersection is estimated to cost \$900,000 to \$1 million due to the added cost of structures for the bridge approaches. Tunnels at the three locations studied would cost approximately \$1.6 million, due primarily to a high water table.



**Table 4 Summary Data for Six Structure Alternatives**

Location	Structure Type	Structure Length (ft)	East Approach Length (ft)	West Approach Length (ft)	Impacts	Cost
Intersection of Routes 1 and 52, North of Route 52	Tunnel	102	95	230	Underground Utility Relocation  Approaches Impact Wetlands West Approach May Impact Monumental Trees	\$1,580,000
Intersection of Routes 1 and 52, South of Route 52	Tunnel	125	102	144	Approaches Impact Wetlands  West Approach Impacts Hedge	\$1,600,000
Farm Road Crossing	Tunnel	52	210	121	Approaches Impact Wetlands	\$1,570,000
Intersection of Routes 1 and 52, North of Route 52	Bridge	165	350	175	Approaches on Retained Fill  Underground Utility Relocation Approaches Impact Wetlands Approaches May Hinder Sight Lines at Intersection West Approach Impacts Hedge West Approach May Impact Monumental Trees	\$930,000
Intersection of Routes 1 and 52, South of Route 52	Bridge	185	355	225	Approaches on Retained Fill  Approaches Impact Wetlands East Approach Crosses Driveway  West Approach Impacts Hedges and Possibly Existing Structure  Approaches Impact Wetlands	\$1,000,000
Farm Road Crossing	Bridge	112	100	480	Approaches On Fill West Approach Winds and Impacts Large Surrounding Area  Approaches Impact Wetlands	\$370,000



**Table 5 Tunnel North of Intersection**

Item No.	Description	Qty.	Unit	Unit Price	Cost
203.22	Unclassified Excavation	102	CY	\$ 7	\$ 714
203.26	Gravel Borrow	122	CY	\$ 13	\$ 1,586
502.21	Str Conc Abut & Ret Wall	122	CY	\$ 470	\$ 57,340
503.14	Epoxy Coat Rein Steel Fab&Del	20000	LBS	\$ 1	\$ 20,000
504.71	Str Steel Erection	1	LS	\$ 4,500	\$ 4,500
530.01	Steel Pedestrian Bridge	1	LS	\$225,000	\$ 225,000
507.0961	Aluminum Pedestrian Handrailing	1050	LF	\$ 36	\$ 37,800
607.09	Woven Wire Fence - Metal Posts	1050	LF	\$ 47	\$ 49,350
611.161	Segmental Retaining Wall	6300	SF	\$ 50	\$ 315,000
634.xx	Relcoation of Utilities	1	AL	\$ 30,000	\$ 30,000
				Subtotal:	\$ 741,290
				Contingency: 25%	\$ 185,323
				Total:	\$ 926,613
				<b>Say:</b>	<b>\$ 930,000</b>



**Table 6 Bridge South of Intersection**

Item No.	Description	Qty.	Unit	Unit Price	Cost
203.22	Unclassified Excavation	102	CY	\$ 7	\$ 714
203.26	Gravel Borrow	122	CY	\$ 13	\$ 1,586
502.21	Str Conc Abut & Ret Wall	122	CY	\$ 470	\$ 57,340
503.14	Epoxy Coat Rein Steel Fab&Del	20000	LBS	\$ 1	\$ 20,000
530.01	Steel Pedestrian Bridge	1	LS	\$262,000	\$ 262,000
504.71	Str Steel Erection	1	LS	\$ 4,500	\$ 4,500
507.0961	Aluminum Pedestrian Handrailing	1200	LF	\$ 36	\$ 43,200
607.09	Woven Wire Fence - Metal Posts	1200	LF	\$ 47	\$ 56,400
611.161	Segmental Retaining Wall	7000	SF	\$ 50	\$ 350,000
Subtotal:					\$ 795,740
Contingency: 25%					\$ 198,935
Total:					\$ 994,675
<b>Say:</b>					<b>\$ 1,000,000</b>

**Table 7 Bridge at Farm Crossing**

Item No.	Description	Qty.	Unit	Unit Price	Cost
203.22	Unclassified Excavation	200	CY	\$ 7	\$ 1,400
203.26	Gravel Borrow	180	CY	\$ 13	\$ 2,340
203.24	Common Borrow	13600	CY	\$ 10	\$ 136,000
504.71	Str Steel Erection	1	LS	\$ 4,500	\$ 4,500
530.01	Steel Pedestrian Bridge	1	LS	\$150,000	\$ 150,000
Subtotal:					\$ 294,240
Contingency: 25%					\$ 73,560
Total:					\$ 367,800
<b>Say:</b>					<b>\$ 370,000</b>



Table 8 Tunnel North of Intersection

Item No.	Description	Qty.	Unit	Unit Price	Cost
203.22	Unclassified Excavation	4400	CY	\$ 7	\$ 30,800
203.26	Gravel Borrow	870	CY	\$ 13	\$ 11,310
403.07	Hot Bit Pave, Grad B	17	TN	\$ 46	\$ 782
403.08	Hot Bit Pave, Grad C	38	TN	\$ 40	\$ 1,520
301.09	Plant Mix Bit Base Crs Grad B	69	TN	\$ 33	\$ 2,277
501.3	Steel Sheet Piling	21000	SF	\$ 15	\$ 315,000
502.21	Str Conc Abut & Ret Wall	320	CY	\$ 470	\$ 150,400
502.4	Str Conc Box Culv	180	CY	\$ 450	\$ 81,000
502.49	Str Conc Piers (Placed Under Water)	1200	CY	\$ 130	\$ 156,000
503.14	Epoxy Coat Rein Steel Fab&Del	88000	LBS	\$ 1	\$ 88,000
507.096	Aluminum Pedestrian Handrailing	670	LF	\$ 36	\$ 24,120
526.31	Permanent Conc Barrier Type II	60	LF	\$ 68	\$ 4,080
530.xx	Temporary Bridge	1	LS	\$ 240,000	\$ 240,000
607.09	Woven Wire Fence - Metal Posts	670	LF	\$ 47	\$ 31,490
634.xx	Relcoation of Utilities	1	AL	\$ 30,000	\$ 30,000
801.xx	Drainage Pumping Station	1	LS	\$ 60,000	\$ 60,000
806.xx	Pedestrian Tunnel Lighting	1	LS	\$ 30,000	\$ 30,000
Subtotal:					\$1,256,779
				Contingency: 25%	\$ 314,195
				Total:	\$1,570,974
				<b>Say:</b>	<b>\$1,580,000</b>



**Table 9 Tunnel South of Intersection**

Item No.	Description	Qty.	Unit	Unit Price	Cost
203.22	Unclassified Excavation	4700	CY	\$ 7	\$ 32,900
203.26	Gravel Borrow	1100	CY	\$ 13	\$ 14,300
403.07	Hot Bit Pave, Grad B	21	TN	\$ 46	\$ 966
403.08	Hot Bit Pave, Grad C	47	TN	\$ 40	\$ 1,880
301.09	Plant Mix Bit Base Crs Grad B	85	TN	\$ 33	\$ 2,805
501.3	Steel Sheet Piling	25000	SF	\$ 15	\$ 375,000
502.21	Str Conc Abut & Ret Wall	240	CY	\$ 470	\$ 112,800
502.4	Str Conc Box Culv	220	CY	\$ 450	\$ 99,000
502.49	Str Conc Piers (Placed Under Water)	1400	CY	\$ 130	\$ 182,000
503.14	Epoxy Coat Rein Steel Fab&Del	81000	LBS	\$ 1	\$ 81,000
507.0961	Aluminum Pedestrian Handrailing	500	LF	\$ 36	\$ 18,000
526.31	Permanent Conc Barrier Type II	60	LF	\$ 68	\$ 4,080
530.xx	Temporary Bridge	1	LS	\$240,000	\$ 240,000
607.09	Woven Wire Fence - Metal Posts	500	LF	\$ 47	\$ 23,500
801.xx	Drainage Pumping Station	1	LS	\$ 60,000	\$ 60,000
806.xx	Pedestrian Tunnel Lighting	1	LS	\$ 30,000	\$ 30,000
				Subtotal:	\$1,278,231
				Contingency: 25%	\$ 319,558
				Total:	\$1,597,789
				<b>Say:</b>	<b>\$1,600,000</b>



Table 10 Tunnel at Farm Crossing

Item No.	Description	Qty.	Unit	Unit Price	Cost	
203.22	Unclassified Excavation	4400	CY	\$ 7	\$ 30,800	
203.26	Gravel Borrow	1900	CY	\$ 13	\$ 24,700	
403.07	Hot Bit Pave, Grad B	12	TN	\$ 46	\$ 552	
403.08	Hot Bit Pave, Grad C	25	TN	\$ 40	\$ 1,000	
301.09	Plant Mix Bit Base Crs Grad B	46	TN	\$ 33	\$ 1,518	
501.3	Steel Sheet Piling	22000	SF	\$ 15	\$ 330,000	
502.21	Str Conc Abut & Ret Wall	370	CY	\$ 470	\$ 173,900	
502.4	Str Conc Box Culv	120	CY	\$ 450	\$ 54,000	
502.49	Str Conc Piers (Placed Under Water)	1200	CY	\$ 130	\$ 156,000	
503.14	Epoxy Coat Rein Steel Fab&Del	90000	LBS	\$ 1	\$ 90,000	
507.0961	Aluminum Pedestrian Handrailing	670	LF	\$ 36	\$ 24,120	
526.31	Permanent Conc Barrier Type II	60	LF	\$ 68	\$ 4,080	
530.xx	Temporary Bridge	1	LS	\$240,000	\$ 240,000	
607.09	Woven Wire Fence - Metal Posts	670	LF	\$ 47	\$ 31,490	
801.xx	Drainage Pumping Station	1	LS	\$ 60,000	\$ 60,000	
806.xx	Pedestrian Tunnel Lighting	1	LS	\$ 30,000	\$ 30,000	
					Subtotal:	\$1,252,160
					Contingency: 25%	\$ 313,040
					Total:	\$1,565,200
					<b>Say:</b>	<b>\$1,570,000</b>





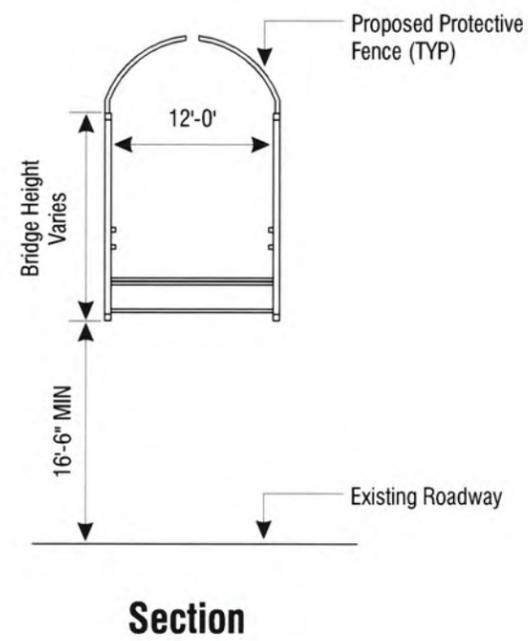
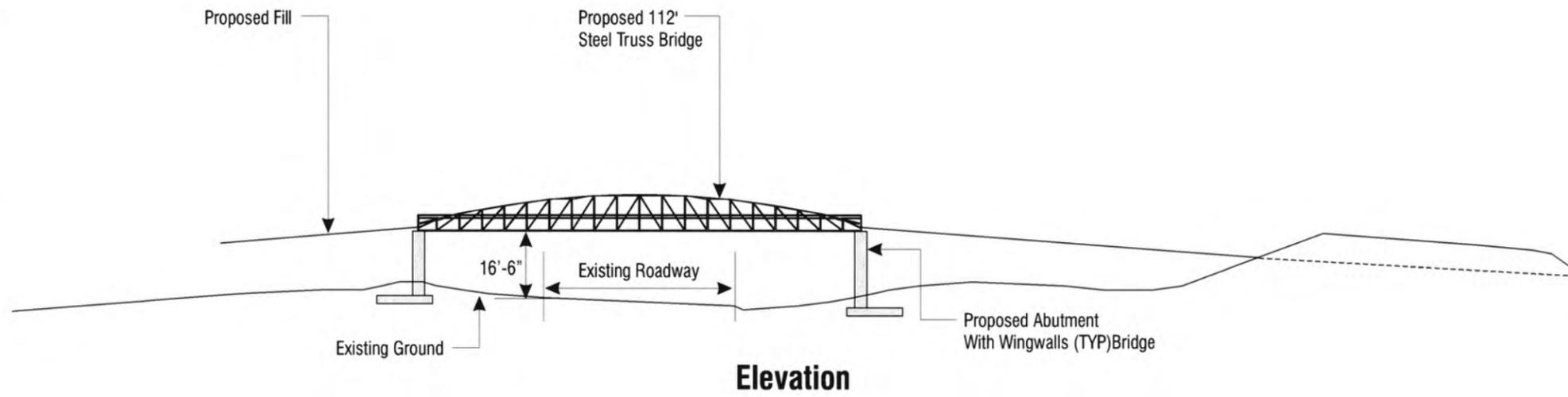
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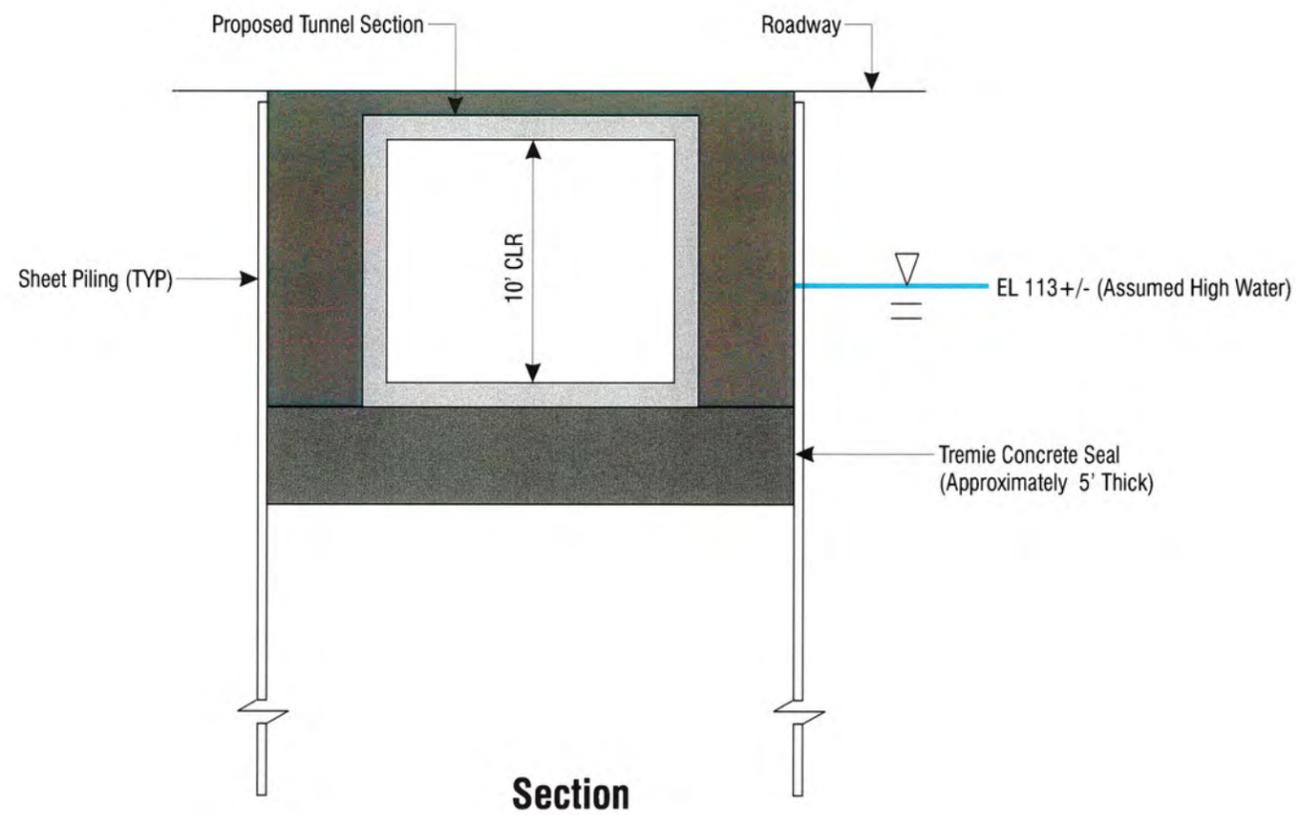
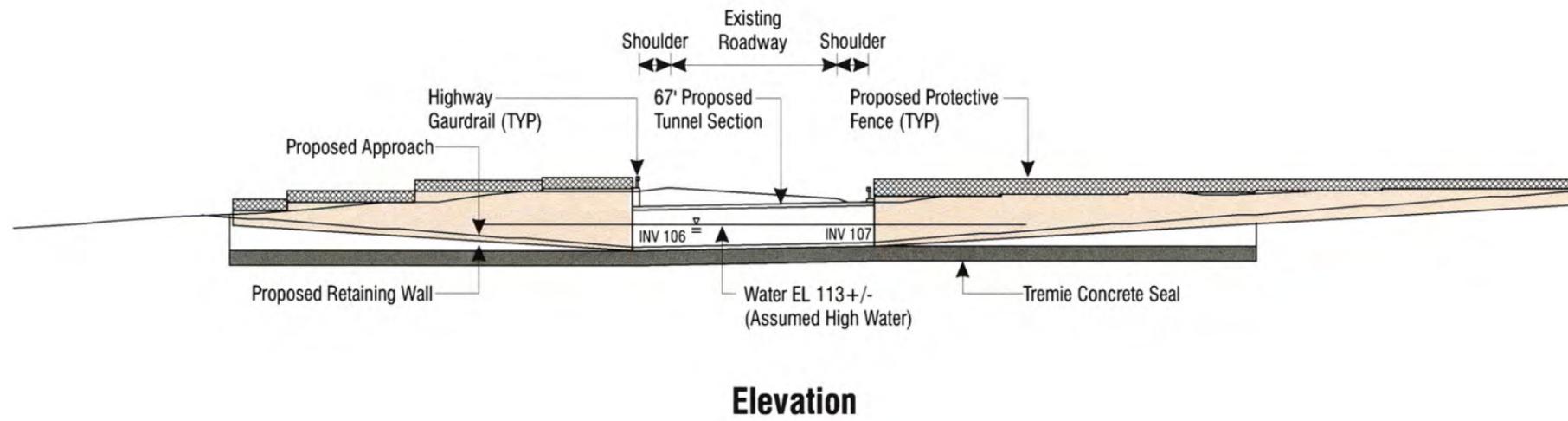
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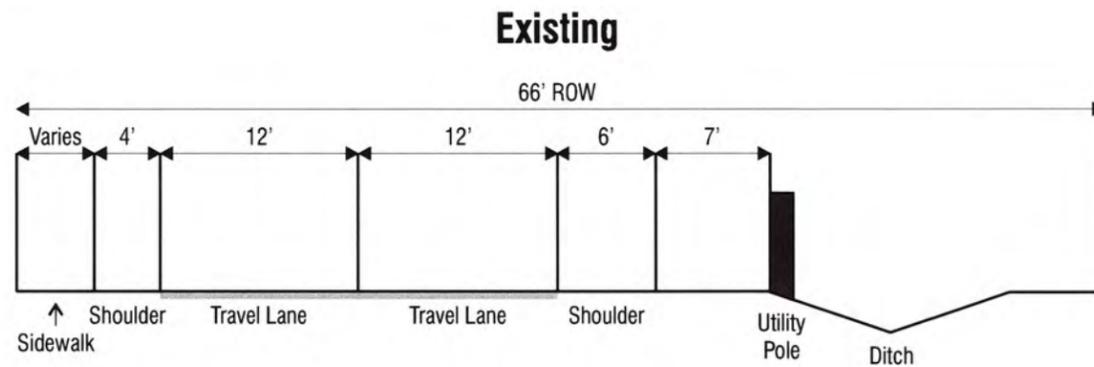




# Alternative 1 - Lincolnville Ave. Bicycle Lane Detail (Northeast of Troy Howard School)

Troy Howard Trail Study • Route 1/Route 52 • Belfast, Maine

Figure 5



Route 52 Looking Northeast



Route 52 Looking Northeast

