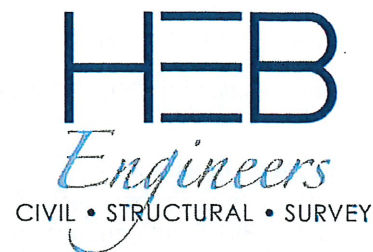


# MEMORANDUM



To: Sean Chamberlin  
Lakes Region Planning Commission  
103 Main Street, Suite #3  
Meredith, NH 03253

Date: November 8, 2022

From: Jordan Pike, PE, PTOE

Email: [jpike@hebengineers.com](mailto:jpike@hebengineers.com)

Re: **On-Call Assignment #1 | Task Order 1 | US-3 Plymouth  
HEB Project #2022-105**

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The Lakes Region Planning Commission (LRPC) has requested HEB Engineers, Inc. (HEB) investigate and provide costs associated for multi-modal improvements on US-3 (Main Street) from Tobey Road to Fairgrounds Road in Plymouth, New Hampshire (see Project Location Plan in Attachment A). The purpose is to provide conceptual drawings with associated cost estimates for consideration of adding improvements at this location to the NHDOT Ten Year Plan (TYP).

HEB reviewed the Transportation Project Proposal prepared by the Town of Plymouth, conducted a field review of the project site, and attended a meeting with Town Officials and Public Works staff to discuss on-going safety concerns. HEB evaluated all the information provided and presented concept drawings and project costs to the LRPC Transportation Technical Advisory Committee (TAC) for improvements on US-3 between Tobey Road and Fairgrounds Road in Plymouth. Below is a summary of our findings.

## Existing Conditions

US-3 (Main Street) from Tobey Road to Fairgrounds Road is a north/south, two-lane, rural major collector highway. It is a non-NHS route, with a posted speed limit of 30 mph which changes to 40 mph in the vicinity of Armory Road. The 2019 Annual Average Daily Traffic of 4,161 vehicles per day. NHDOT collected more recent traffic data in May 2022; however, updated AADT values are currently unavailable.

The project area includes a number of anchor businesses and employers within downtown Plymouth, as well as sites that present opportunities for future economic development. Plymouth benefits from an outdoor recreation economy; however, there is no pedestrian or bicycle infrastructure within the project area to provide connectivity to key businesses and existing destinations.

### Pedestrian Infrastructure

There are narrow shoulders and no sidewalks along US-3 within the project limits. "Herd paths" were observed along much of the roadway corridor, presenting evidence of pedestrian traffic utilizing the roadside instead of the shoulder.

Plymouth State University has student housing and commuter parking along this stretch of Main Street, with university buildings located to the south, requiring students to walk or bike to classes along US-3. This creates safety concerns for students walking between classes, housing, and the commuter lot.

There is affordable housing on Fairgrounds Road; however, there is no pedestrian connection from Fairgrounds Road to downtown Plymouth businesses; approximately 0.7 miles. Residents in affordable housing communities may be less likely to have access to a personal motor vehicle and may require public transportation or non-motorized modes to get around. Non-motorized users are disproportionately affected by motor vehicle crashes. Nation-wide pedestrian fatalities are trending in the wrong direction. NHDOT's 2022 Strategic Highway Safety Plan indicates that over the past 5 years pedestrian fatalities have increased over 20%.



### Bicycle Infrastructure

US-3 has a narrow roadway section, approximately 26 feet wide near Tobey Road. It widens slightly towards the Baker River, but generally paved shoulders are between 1 – 2 feet wide. During the field review, multiple bicyclists were observed riding within the project limits. The observed cyclists were all from the Mt. Prospect Academy; which is approximately 0.25 miles north of Fairgrounds Road. Outdoor recreation is part of their regular program. There is a bicycle shop on Foster Street, and the Town of Plymouth has plans to include a recreational trail connection from Main Street to the Langdon Woods trails along the Baker River as part of a budgeted sewer project.

There are wider shoulders north of Foster Street. Recent re-striping reduced the 3-lane section between the Tenney Mountain Highway ramps to a 2-lane section with wider shoulders and a painted median.

### Roadway

The New Hampshire Army National Guard has a facility located on Armory Road. Due to limited sight distance the National Guard has truck deliveries utilize a right-in/right-out commuting pattern. Although this delivery practice is safer, it increases fuel consumption and creates unnecessary motor vehicle delay. Intersection sight distance (ISD) was measured during the site walk to be approximately 273 feet, which would be inadequate for a passenger car design speed of 25 mph and inadequate for a single-unit truck design speed of 20 mph. The posted speed limit on US-3 at Armory Road is 40 mph. In reviewing the vertical geometry, HEB believes that the stopping sight distance along this vertical curve is also sub-standard for the roadway (approximated from available LiDAR).

## **Proposed Project Scope**

The purpose of this project is to improve safety for motorized and non-motorized traffic along US-3 (Main Street) between Tobey Road and Fairgrounds Road in Plymouth, NH. Safety improvements for motorized traffic pertain to sub-standard sight distances in the vicinity of Armory Road. Safety improvements for non-motorized traffic include the addition of bicycle and pedestrian facilities within the project limits.

At the Town's request the project was scoped in two phases. Phase 1 includes all roadway work and pedestrian connectivity from Tobey Road to Foster Street. Phase 2 extends the pedestrian connection from Foster Street to Fairgrounds Road. Please see the concept drawings in Attachment B. Below is a narrative that discusses the proposed improvements shown on the concept drawings.

### Phase 1: US-3 from Tobey Road to Foster Street

There is a significant need for non-motorized infrastructure within the project limits. The proposed project scope would include a 5-foot concrete sidewalk along the west side of US-3. The sidewalk would tie in to the existing sidewalk at Tobey Road then continue north to the Baker River Bridge, where there is an existing 5-foot-wide pedestrian walkway across the west side of the bridge. The 5-foot concrete sidewalk would continue on the other side of the Baker River and cross the eastbound ramps for the Tenney Mountain Highway, to a proposed pedestrian crossing on US-3 to Foster Street. This would provide connectivity from downtown Plymouth, along university housing and parking, and terminate at a destination. At the request of the Town, a 4-foot grass buffer strip, also known as a snow shelf, is planned between the sidewalk and the roadway. The snow shelf provides room for snow storage for winter maintenance and additional separation of facilities for pedestrian safety.

Based on observed bicycle traffic, an established bicycle shop on Foster Street, and a future planned trail connection from US-3 to the Langdon Woods recreational trails, it is recommended to add 5-foot-wide shoulders on both sides of US-3 for enhanced bicycle accommodation. This will provide dedicated space for bicyclists, which will enhance safety and use, as well as create additional opportunities for recreation from downtown.



US-3 between Tobey Road and Old Main Street should be reconstructed to meet geometric standards. This work would include correcting the crest vertical curve between Tobey Road and Armory Road to provide SSD that meets design guidance and ISD for truck traffic on Armory Road. This work will result in a large retaining wall near the crest of the vertical curve, to eliminate grading impacts to university parking. It is recommended to shift the alignment of US-3 horizontally away from the parking lot to minimize the size of the retaining wall.

The addition of curbing on the west side of US-3 will require extending the contained drainage system. There is an existing Town maintained system near Tobey Road. For drainage towards Tobey Road, there is a plan to add two additional basins to the existing system. On the Armory Road side of the crest vertical curve, a new State maintained contained drainage system will need to be installed. US-3 is superelevated through the Armory Road intersection, so it is anticipated only two basins would be needed through the sag vertical curve approaching the Baker River Bridge. This system may require a drainage easement to outlet to the west in the vegetated area.

Additional consideration of an appropriate design speed should be investigated in the Preliminary Engineering phase. For scoping purposes, HEB utilized a design speed of 40 mph; however, as land use continues to develop in this area, it could become an extension of the downtown corridor. The anticipated change in land use paired with the addition of multi-modal infrastructure warrants an engineering study to determine an appropriate speed limit and design speed for US-3 in this area. It seems with an increased focus on non-motorized modes within the project limits, reducing speeds should be considered and could ultimately affect the level of geometric improvement at this location.

#### Phase 2: US-3 from Foster Street to Fairgrounds Road

The proposed project scope for this phase is a continuation of the sidewalk improvements from the pedestrian crossing at Foster Street north to Fairgrounds Road. This provides a pedestrian connection along the west side of US-3 to Fairgrounds Road. There is a large embankment for US-3 to build up to the overpass bridge over the Tenney Mountain Highway. In order to minimize grading impacts in this area, sidewalk and granite curbing is planned to be along the roadside at the eastbound ramps. As the sidewalk continues north and the turn lanes taper back, the sidewalk should transition from the roadside to the roadway. Sidewalk planned in the roadway will still be 5 feet wide with granite curbing. There is additional pavement available from the reduced roadway section across the Tenney Mountain Highway overpass on US-3. Pavement markings could be revised in this area to reduce the painted island to include the sidewalk across the bridge, and maintain existing shoulder and lane widths. A contained drainage system already exists through this part of the corridor, basins will need to be modified to the new gutter line with the sidewalk improvements.

Constructing the sidewalk from Foster Street to Fairgrounds Road along the east side of US-3 was given strong consideration. Much of the "herd path" along US-3 is on this side of the road and there is existing granite curbing as well as a sidewalk on the east side of the US-3 overpass. Building the sidewalk on the east side of US-3 would be simpler and more cost effective. However, this alternative seems to deviate from the project scope of non-motorized safety and pedestrian connectivity. One of the major driving factors for extending the sidewalk to Fairgrounds Road is to better accommodate pedestrians from affordable housing communities on Fairgrounds Road to downtown locations. The eastern sidewalk alternative would require pedestrians to cross four lanes of pavement at Fairgrounds Road and an additional four lanes of pavement at Foster Street. Providing the sidewalk infrastructure on the west side of US-3 reduces these conflict points and provides a consistent corridor for pedestrians.

## Estimated Project Costs

As requested, HEB has prepared cost estimates for both Phase 1 and Phase 2 based on the concept drawings for Multi-Modal Improvements on US-3 in Plymouth. The estimates include line items for 2023 Construction Cost (CN), 2023 Preliminary Engineering (PE), and 2023 Rights-of-Way (RW). A minor item allowance of 20% was added to the base estimate to account for items too small to quantify during the conceptual design phase. Construction Engineering costs were assumed to be 25% of the Base Estimate. Total Construction Cost (CN) includes the Base Estimate, plus Construction Engineering, plus a 10% contingency. Preliminary Engineering costs were assumed to be 20% of the CN cost; additional effort is anticipated due to scope complexity, potential historic involvement, and potential railroad coordination. This breakdown and quantity estimates are available on the attached spreadsheet.

In order to account for inflation, the Base Estimate was compounded annually at a 2.8% interest rate. Each phase was adjusted for inflation accordingly dependent on the fiscal year monies are anticipated to be obligated. Based on an assumed TYP schedule the phases were inflated to the following years: PE in 2029, RW in 2032, and CN in 2034.

HEB has prepared a preliminary Engineer's Opinion of Probable Costs (see Attachment C). Below is a summary of the proposed improvements with projected costs for each phase on the NHDOT Ten Year Plan.

Proposed Improvements:	2029 PE	2032 RW	2034 CN	Totals
Phase 1	\$ 738,000	\$ 103,000	\$ 3,688,000	\$ 4,529,000
Phase 2	\$ 102,000	\$ 103,000	\$ 679,000	\$ 884,000
Combined Phase 1 & 2	\$ 840,000	\$ 206,000	\$ 4,367,000	\$ 5,413,000

## Recommendations

Although the Town requested looking at these projects as two separate phases due to concerns over funding constraints, HEB feels there is enough purpose and need for non-motorized and geometric improvements within this corridor and that these scoped phases should be combined into one proposed project.

The combined proposed project scope provides safety improvements for all roadway users, creates opportunities for economic development, provides downtown connectivity to affordable housing (potential Environmental Justice communities), and encourages recreation and alternate transportation modes. Plymouth is also a major transportation junction within the region providing an eastern gateway to the Lakes and White Mountain regions, with access to I-93, US-3 and the Tenney Mountain Highway.

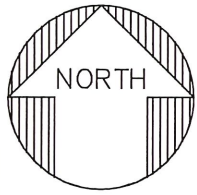
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# **ATTACHMENT A**

## **Project Location Plan**





Campton  
Plymouth

PROJECT LOCATION  
PHASE 2 END

PROJECT LOCATION  
PHASE 1 END  
PHASE 2 BEGIN

PROJECT LOCATION  
PHASE 1 BEGIN

Fairgrounds Rd

Tenney Mountain Hwy

US-3 Main St

I-93 Style Bridges Hwy

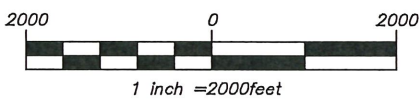
Holderness

Foster St

Old Main St

Armory Rd

Tobey Rd



**HEB**  
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Bridgton, ME 04009

Project Location Plan  
for  
US Route 3  
located in  
Plymouth, New Hampshire  
prepared for  
Lakes Region Planning Commission

**P1.01**

DESIGNED BY	—	PROJECT	2022-105
DRAWN BY	CFX	REVISION	—
CHECKED BY	JDP	DATE	11/08/2022
		SCALE	1"=2000'



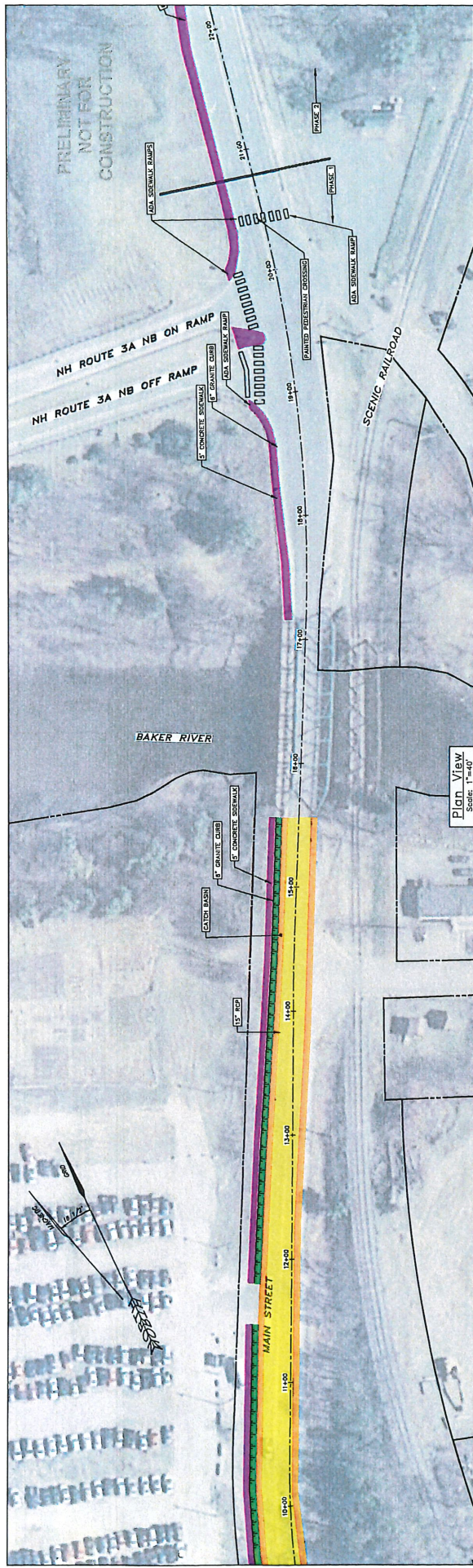
# **ATTACHMENT B**

## **Concept Drawings**

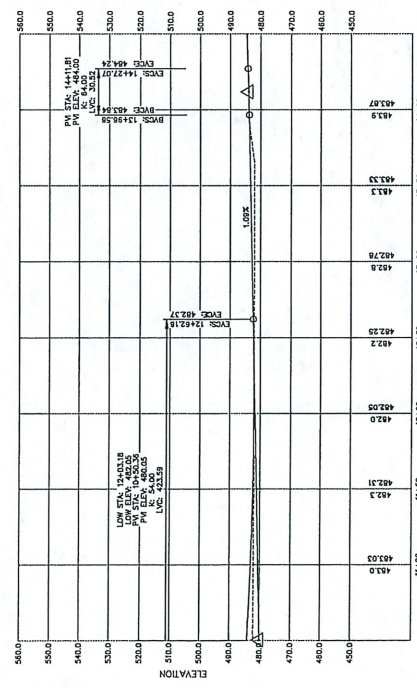








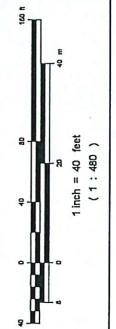
Plan View  
Scale: 1"=40'



Proposed US-3 Profile Sta. 114+00-144+00  
Scale:  
Horizontal: 1"=40'  
Vertical: 1"=20'

**Legend**

Proposed Mill and Overlay	Proposed Full Depth Reconstruction	Proposed Snow Shelf	Proposed Sidewalk
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No.	Revision	DATE	BY

**HEB Engineers, Inc.**  
 www.hebengineers.com  
 100 Main Street, Suite 100  
 North Conway, NH 03860  
 Phone: (603) 893-3333  
 Fax: (603) 893-3334  
 Civil • Structural • Survey

DESIGNED BY	AML
CHECKED BY	CFX/JES
DATE	11/08/2022

Multi-Modal Improvements on US Route 3 located in Plymouth, NH prepared for Lakes Region Planning Commission

2022-105  
SK-2  
SHEET 2 OF 3







# **ATTACHMENT C**

## **Engineer's Opinion of Probable Costs**

Engineer's Opinion of Probable Cost

Roadway & Pedestrian Improvements on US-3  
Plymouth, New Hampshire

HEB Project #: 2022-105  
Date: 11/09/22  
Compiled by: JDP

NHDOT Item #	Description	Unit	Unit Cost	Phase 1: Tobey Road to Foster Street		Phase 2: Foster Street to Fairgrounds Rd.	
				Quantity	Total Cost	Quantity	Total Cost
<b>Earthwork</b>							
201.1	Clearing and Grubbing	Acre	\$ 25,000.00		\$ 12,500.00		\$ -
203.1	Common Excavation	CY	\$ 18.00	8,200	\$ 147,600.00	111	\$ 2,000.00
203.2	Rock Excavation	CY	\$ 90.00	1,000	\$ 90,000.00	5	\$ 450.00
214	Fine Grading	Unit	\$ 25,000.00	1	\$ 25,000.00	1	\$ 2,500.00
<b>Base Courses</b>							
304.1	Sand	CY	\$ 30.00	1,333	\$ 40,000.00	0	\$ -
304.2	Gravel	CY	\$ 35.00	1,333	\$ 46,666.67	0	\$ -
304.3	Crushed Gravel	CY	\$ 40.00	1,542	\$ 61,666.67	222	\$ 8,888.89
<b>Pavements</b>							
403.11	Hot Bituminous Pavement, Machine Method	Ton	\$ 90.00	1,334	\$ 120,060.00	0	\$ -
403.12	Hot Bituminous Pavement, Hand Method	Ton	\$ 200.00	30	\$ 6,000.00	60	\$ 12,000.00
410.22	Asphalt Emulsion for Tack Coat	Gal	\$ 8.00	860	\$ 5,280.00	40	\$ 320.00
417	Cold Planing Bituminous Surfaces	SY	\$ 5.00	1,250	\$ 6,250.00	0	\$ -
<b>Structures</b>							
	Retaining Wall	SF	\$ 150.00	3,500	\$ 525,000.00	0	\$ -
<b>Incidental Construction</b>							
603.00215	18" R.C. Pipe 20'00'	LF	\$ 100.00	360	\$ 36,000.00	400	\$ 40,000.00
604.124	Catch Basin, Type B, 4'-Diameter	EA	\$ 4,000.00	3	\$ 12,000.00	2	\$ 8,000.00
604.4	Reconstructing/Adjusting Catch Basins	LF	\$ 750.00	2	\$ 1,500.00	2	\$ 1,500.00
604.62	Drainage Manhole Cover and Frames	EA	\$ 700.00	3	\$ 2,100.00	2	\$ 1,400.00
605.10001	31" W-Beam Guardrail with 8" Offset Block (Steel Post)	LF	\$ 45.00	250	\$ 11,250.00	50	\$ 2,250.00
606.92	Anchorage for Beam Guardrail	EA	\$ 4,000.00	2	\$ 8,000.00	1	\$ 4,000.00
608.24	4" Concrete Sidewalk (F)	SY	\$ 70.00	860	\$ 60,300.00	889	\$ 63,000.00
608.54	Detachable Warning Plates	SY	\$ 500.00	8	\$ 4,000.00	3	\$ 1,500.00
609.01	Straight Granite Curb	LF	\$ 60.00	1,600	\$ 96,000.00	1,600	\$ 96,000.00
615.024	Rebarbed Traffic Sign Type B	EA	\$ 600.00	6	\$ 3,600.00	6	\$ 3,600.00
615.0201	Traffic Sign Type B, Breakaway Mounts	SF	\$ 180.00	6	\$ 1,080.00	0	\$ -
616.7	Flags	HR	\$ 55.00	840	\$ 46,200.00	0	\$ -
619.1	Maintenance of Traffic	Unit	\$ 1.00	73,623	\$ 73,623.00	13,480	\$ 13,480.00
628.2	Sawed Bituminous Pavement	LF	\$ 4.00	760	\$ 3,040.00	1,600	\$ 6,400.00
632.0104	Retroreflective Paint Pavement Marking, 4" Line	LF	\$ 0.50	6,400	\$ 3,200.00	0	\$ -
632.0124	Retroreflective Paint Pavement Marking, 24" Line	LF	\$ 0.75	512	\$ 384.00	0	\$ -
645.631	Silt Fence	LF	\$ 5.00	3,000	\$ 15,000.00	500	\$ 2,500.00
646.31	Turf Establishment with Mulch and Tackifiers	SY	\$ 7.00	4,000	\$ 28,000.00	40	\$ 280.00
692	Mobilization	Unit	\$ 1.00	131,171	\$ 132,000.00	24,270	\$ 24,270.00
698.13	Field Office Type C	Mo.	\$ 2,000.00	9	\$ 18,000.00	4	\$ 8,000.00
699	Miscellaneous Temporary Erosion and Sediment Controls	\$	\$ 30,000.00	1	\$ 30,000.00	1	\$ 5,000.00
	Utility Pole Relocations	EA	\$ 15,000.00	1	\$ 15,000.00	0	\$ -
<b>Phase 1: Tobey Rd. to Foster St.</b>							
<b>Phase 2: Foster St. to Fairgrounds Rd.</b> (Sidewalk & Curbings)							
	Minor Item Allowance (20%)		\$ 336,000.00				\$ 62,000.00
	2023 Base Estimate		\$ 2,015,000.00				\$ 370,000.00
	2034 Base Estimate		\$ 2,731,000.00				\$ 502,000.00
	2023 Construction Engineering (25%)		\$ 504,000.00				\$ 93,000.00
	2034 Construction Engineering (25%)		\$ 683,000.00				\$ 126,000.00
	Contingency		10%				10%
	2023 Construction Cost (CN)		\$ 2,721,000.00				\$ 500,000.00
	2034 TYP Construction Cost (CN)		\$ 3,686,000.00				\$ 679,000.00
	2023 Prelim. Engineering (20% PE)		\$ 545,000.00				\$ 75,000.00
	2029 TYP Prelim. Engineering (20% PE)		\$ 738,000.00				\$ 102,000.00
	2023 Right-of-way (RW)		\$ 80,000.00				\$ 80,000.00
	2032 Right-of-way (RW)		\$ 103,000.00				\$ 103,000.00
	2023 Total Project Cost		\$ 3,346,000.00				\$ 655,000.00
	NHDOT TYP Total Project Cost		\$ 4,629,000.00				\$ 884,000.00