
Highway Alternative Analysis Report

Alternative Analysis For:

*Massasoit Bridge over Long Pond
(BR. N-02-004)*

&

*Ames Avenue Bridge over Hither Creek
(BR. N-02-003)*

Nantucket, MA

Prepared for: **Town of Nantucket**
Nantucket, MA



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I. TASK 1 - FRAME WORK – ALTERNATIVES ANALYSIS PROCESS

1.1 INTRODUCTION

The purpose of this report is to determine the preferred alternative for the two (2) existing Nantucket Madaket bridges and approach roadways for the Massasoit Bridge Road over Long Pond and the Ames Avenue over Hither Creek. This roadway (aka highway) study along with the accompanying bridge structural reports will provide overall recommendations for the construction programming needs of the two (2) Nantucket bridges.

The Town has identified both bridges as candidates for rehabilitation or replacement. This report will focus on the roadway (I.e. highway) alternatives for each bridge, for information relating to the structural alternatives please see the Bridge Type Selection Worksheet and Preliminary Structures Report for each bridge.

An analysis for each alternative evaluates the following categories: constructability, construction cost, environmental impacts, right of way impacts, traffic management, alignment, cross sections, utilities, and safety.

1.2 STUDY PROCESS

The study process is necessary for establishing the roadway geometric designs that supports several bridge construction options at the two (2) Nantucket bridges in need of improvements. The existing conditions of the approaching roadways and surrounding environment were reviewed to understand the needs for both vehicle and pedestrian access, as well as environmental factors.

The design effort for the comparative alternatives analysis is facilitated by completing four (4) study tasks:

- Task 1: Framework – Develop the working process for the study, including goals, objectives, and evaluation criteria.
- Task 2: Evaluation – Evaluate existing conditions for the study area, including land use, environmental, social and economic, utilities and a structural assessment.
- Task 3: Alternative Analysis – Analyze potential alternatives based on the established evaluation criteria in areas of overall safety, service life extension, historical preservation, environmental impacts and right of way impacts.
- Task 4: Recommendations – Develop a recommendation that best satisfies the established evaluation criteria.

1.3 STUDY AREA

The study area includes the Massasoit Bridge over Long Pond and Ames Avenue Bridge over Hither Creek shown in the figures below.

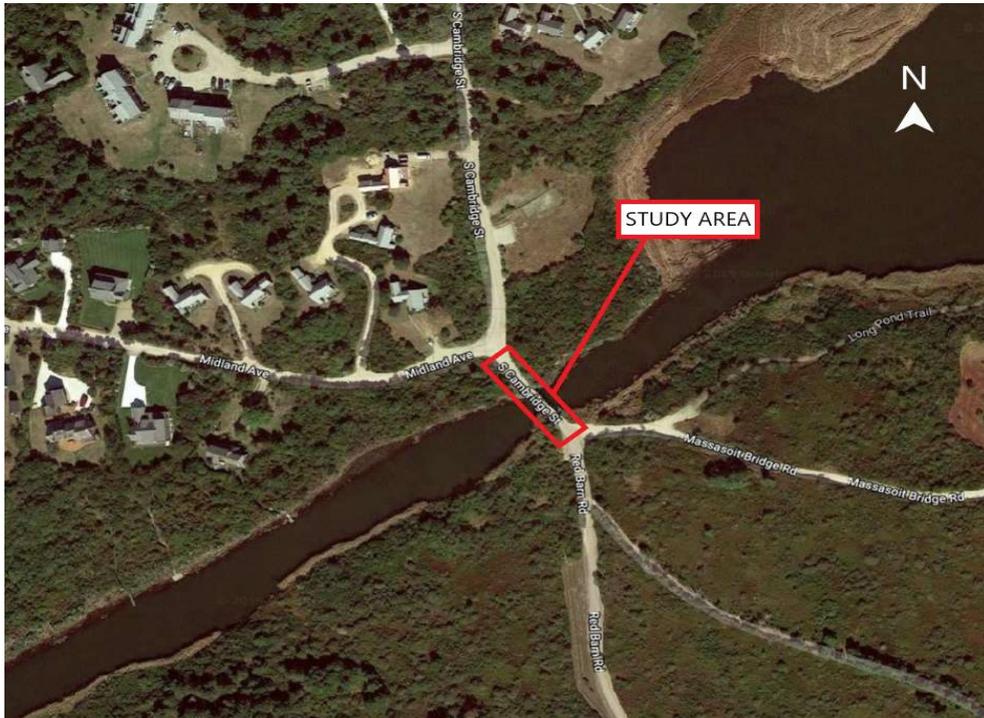


Figure 1: Study Area of Massasoit Bridge over Long Pond



Figure 2: Study Area of Ames Avenue Bridge over Hither Creek.

1.4 GOALS, OBJECTIVES, EVALUATION CRITERIA

Listed below is an outline summary of the goals/objectives for the Massasoit Bridge and Ames Avenue Bridge.

1.4.1 Table 1: Massasoit Bridge

Massasoit Bridge Goals/Objectives	Evaluation Criteria
<p>Goal: Improve overall safety of the bridge</p> <ul style="list-style-type: none"> ➤ Replace existing substandard and non-code compliant traffic safety features on the bridge by implementing two lane traffic, new guardrails and terminal units. ➤ Widen the travel way on approaching roadways ➤ Include a sidewalk on one side of the bridge 	<ul style="list-style-type: none"> ➤ MassDOT Bridge Manual ➤ AASHTO Code Requirements ➤ Complete Streets Guidelines
<p>Goal: Extend the bridge service life and safety</p> <ul style="list-style-type: none"> ➤ Repair and/or replace bridge deficiencies ➤ Replace non-standard guardrail and guardrail end units 	<ul style="list-style-type: none"> ➤ AASHTO Code Requirements
<p>Goal: Increase load carrying capacity of bridge</p> <ul style="list-style-type: none"> ➤ Repair/replace deficiencies limiting members load carrying capacity and provide rehabilitation measures to increase capacity where needed 	<ul style="list-style-type: none"> ➤ AASHTO Code Requirements
<p>Goal: Improve roadway alignment & safety for approaches</p> <ul style="list-style-type: none"> ➤ Realign and improve approaching roadways and create T-intersections between major and minor roads. ➤ Improve the roadway surface and connecting side roads ➤ Add traffic signs at approaching roadways. ➤ Add lighting fixtures to approach roadways. 	<ul style="list-style-type: none"> ➤ MassDOT Highway Design Manual ➤ Town of Nantucket Code ➤ MUTCD
<p>Goal: Limit impacts to environment, social & economic life</p> <ul style="list-style-type: none"> ➤ Determine a traffic management plan that limits impacts to vehicular traffic and pedestrians. ➤ Determine appropriate staging areas for construction activities and equipment. ➤ Maintain existing right of way and minimize impacts as necessary. ➤ Utilize steep slopes behind guardrail to limit existing ground and wetland impacts 	<ul style="list-style-type: none"> ➤ Engineering Design Plans
<p>Goal: Cost Efficiency</p> <ul style="list-style-type: none"> ➤ Improve the safety of the bridge, traffic, and pedestrians while minimizing the overall cost of the project. 	<ul style="list-style-type: none"> ➤ Cost Estimates

1.4.2 Table 2: Ames Avenue Bridge

Ames Avenue Bridge Goals/Objectives	Evaluation Criteria
<p>Goal: Improve overall safety of the bridge</p> <ul style="list-style-type: none"> ➤ Replace existing substandard and non-code compliant traffic safety features on the bridge by implementing new guardrails and maintaining the existing sidewalk. 	<ul style="list-style-type: none"> ➤ MassDOT Bridge Manual ➤ AASHTO Code Requirements
<p>Goal: Extend the bridge service life and safety</p> <ul style="list-style-type: none"> ➤ Repair and/or replace deficiencies ➤ Replace non-standard guardrail and guardrail end units 	<ul style="list-style-type: none"> ➤ AASHTO Code Requirements
<p>Goal: Increase load carrying capacity of bridge</p> <ul style="list-style-type: none"> ➤ Repair/replace deficiencies limiting members load carrying capacity and provide rehabilitation measures to increase capacity where needed 	<p>AASHTO Code Requirements</p>
<p>Goal: Improve roadway alignment & safety for approaches</p> <ul style="list-style-type: none"> ➤ Improve the roadway surface and connecting side roads ➤ Add traffic signs on approaching roadways. 	<ul style="list-style-type: none"> ➤ MassDOT Highway Design Manual ➤ Town of Nantucket Code ➤ MUTCD
<p>Goal: Limit impacts to environment, social & economic life</p> <ul style="list-style-type: none"> ➤ Determine a traffic management plan that limits impacts to vehicular traffic and pedestrians. ➤ Determine appropriate staging areas for construction activities and equipment. ➤ Maintain existing right of way and minimize impacts as necessary. ➤ Utilize steep slopes behind guardrail to limit existing ground and wetland impacts 	<ul style="list-style-type: none"> ➤ Engineering Design Plans
<p>Goal: Cost Efficiency</p> <ul style="list-style-type: none"> ➤ Improve the safety of the bridge, traffic, and pedestrians while minimizing the overall cost of the project. 	<ul style="list-style-type: none"> ➤ Cost Estimates

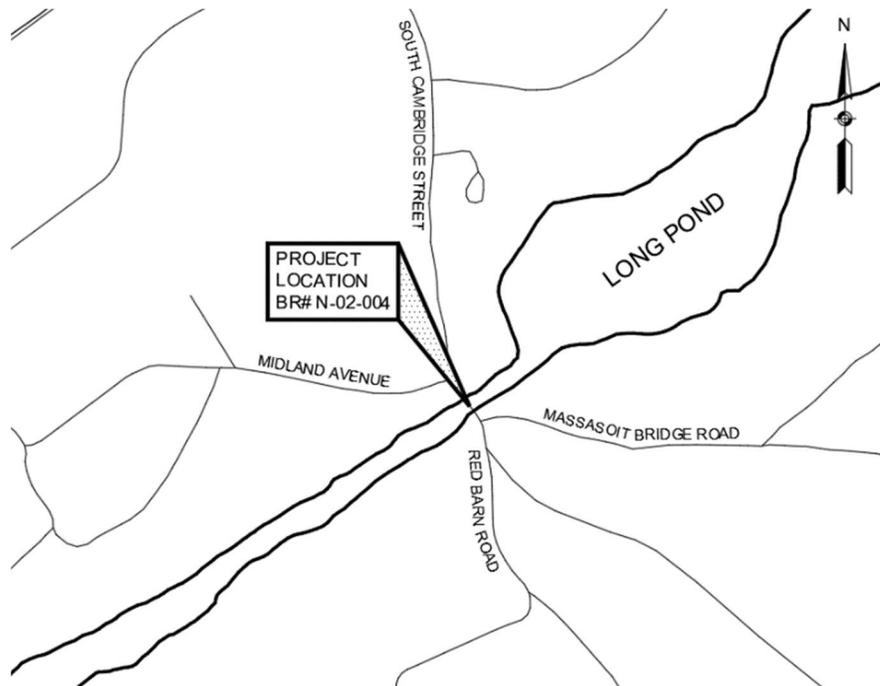
II. TASK 2 – EVALUATION OF EXISTING CONDITIONS

2.1 LAND USE

Massasoit Bridge

The Massasoit Bridge was constructed in 1981 and currently services one-lane of traffic and no sidewalk over Long Pond between the two approach roadway intersections of Midland Avenue and Red Barn Road. The bridge is identified as a timber bridge that connects non-paved roads over a tidal body of water. The roadway approaches are paved to some extent on each side of the bridge, however the limits are not known due to sand covering most of the roadways in this area.

The narrow (10'-6") curb-to-curb width of the bridge has created traffic and pedestrian safety concerns. The bridge currently accommodates one vehicular travel lane and no pedestrian accommodation. On both sides of the bridge, there are intersecting two-way traffic travel lanes with minimal traffic control and undesirable intersecting angles. This poses a concern with traffic and pedestrian safety approaching the bridge and on the bridge. The surface of the approaching roadways consists non-paved dirt and sand roads. There is evidence of segments of pavement approaching the bridge underneath the sand. The land surrounding the roadways within the project limits consists of native shrubs and small trees.



Locus Map: Massasoit Bridge

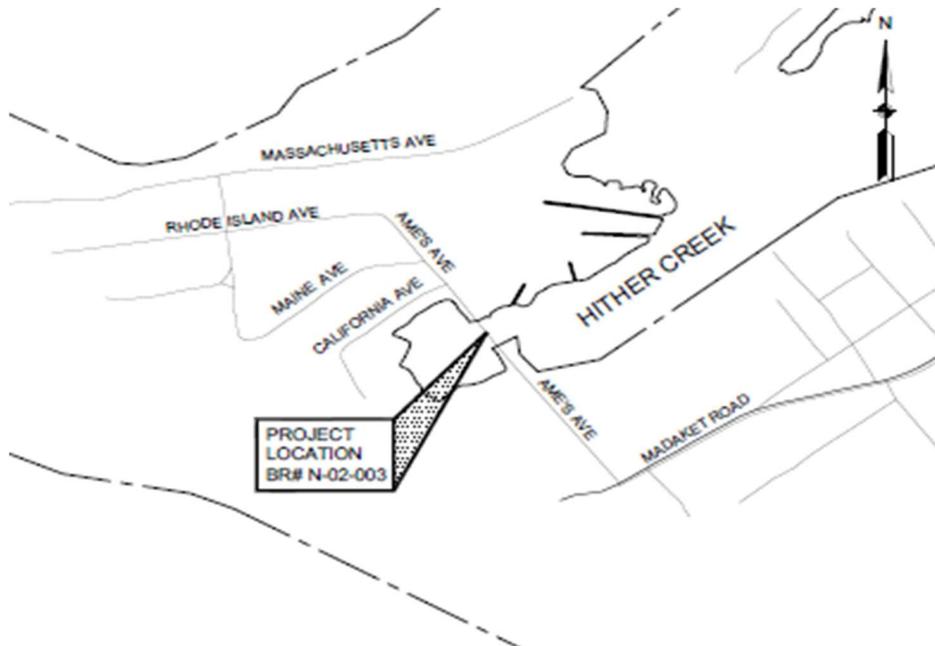
Ames Avenue Bridge

The Ames Avenue Bridge was constructed in 1946 and is identified as a curb-to-curb with of 20-feet (two 10-foot travel lanes) with a 38" sidewalk on the east side. The bridge provides the only access to Smith's Point, a developed residential area. Features surrounding the bridge include Hither Creek, Madaket beach area, residential homes, and restaurants.

There are concerns over erosion at the existing bridge due to a recent extreme weather event in which Madaket beach, which separates the subject bridge from the Atlantic Ocean, was breached, and the ocean flowed directly into Hither Creek carrying significant sand deposits. Recent field investigations indicate that high water events and sand deposits have caused degradation of the shore land and bridge foundation. The Town of Nantucket installed erosion control measures to prevent further damage to the foundation.

In this alternative analysis of Ames Avenue, design options will be presented to address the issues related to the horizontal and vertical geometry of the main road and connecting side roads and driveways. For the proposed design, surface drainage is taken into consideration and new drainage structures are proposed as necessary.

The approach roadways on both sides of the bridge are paved for approximately 100' on each bridge approach. The bridge carries traffic over a tidal body of water (Hither Creek), and the harsh conditions has caused issues with degradation of the pavement of approach roadways.



Locus Map: Ames Avenue Bridge

3.1 SURROUNDING PROPERTIES

Massasoit Bridge

The area surrounding the Massasoit Bridge is occupied by privately owned residences and conservation land. These include the Nantucket Islands Lank Bank, Madaket Conservation Land Trust, and Nantucket Conservation Foundation Incorporated.

Ames Avenue Bridge

The area surrounding Ames Avenue Bridge are residential areas, salt marshes, and town-owned land. Land that abuts the area of work directly include the Massachusetts Audubon Society, John R Pearson Jr., Anne S. Menz Trustee, and the Town of Nantucket.

3.2 ENVIRONMENTAL, SOCIAL AND ECONOMIC ASSESSMENT

2.2.1 Environmental Resources

Massasoit Bridge

There are currently wetlands along the banks of Long Pond that abut the existing bridge. Adjacent to the wetlands are properties owned by the conservation commission. Through field reporting and observation of existing conditions, there is active wildlife residing in natural resources within proximity of the bridge.



Wooden deck & rails, overhead wires & snapping turtles at Massasoit Bridge.

Ames Avenue Bridge

There are wetlands associated with the banks of Hither Creek on each side of the bridge. Additionally, there are salt marshes on the northeastern side of the bridge. Storms over the years have deposited sand into the creek which have affected ecosystems and wildlife living in the area. According to the Nantucket Conservation Foundation, research and monitoring of the sand deposit over the years showed that the ecology, salt marshes, and shrub wetlands have been permanently altered.



Wooden bridge & rails and overhead wires at Ames Avenue Bridge.

2.2.2 Social and Economic Considerations

Massasoit Bridge

There are currently no known social or economic impacts associated with Massasoit Bridge. The bridge has very low traffic counts on a day-to-day basis as a one-lane bridge within a rural area.

The proposed bridge is anticipated to be closed during construction and a detour route will be provided.

Ames Avenue Bridge

Due to recent winter storms, a large sand deposit has covered much of the water from Hither Creek on the west side of the bridge. This change in topography has altered the property and the wildlife within the area of the bridge and is considered a negative effect on the social environment of the bridge area.

The bridge has impacts both economically and socially for the residents that live on Smith's Point and the Town of Nantucket. The Ames Avenue bridge is currently the only access for Smith's Point and closure of the bridge would create a negative impact to residents of Smith's Point ability to access their homes.

The proposed bridge will be constructed in multiple phases, which will allow to maintain one direction of travel for Ames Avenue.

3.3 UTILITIES

Massasoit Bridge

There are existing utilities along the southwestern side of the bridge. These include:

- Overhead wires that consist of telephone and cable that connect from opposing utility poles on each side of the bridge.
- Underground utilities include electric service that run across the approaching roadways to the northeastern side of the bridge.
- There are no lighting fixtures for this bridge.

Ames Avenue Bridge

There are existing utilities that run on the southern side of the bridge. These include:

- Overhead telephone and cable wires
- There is one light fixtures on a utility pole at the northwest corner of the bridge.
- A 4" PVC pipe conduit for telephone and electric service that runs across the south side of the bridge. An underground telephone manhole is located on the southeast quadrant of the bridge, which will be retained and adjusted to match any change in elevation of the top. Any impacted underground utilities will need to be relocated during the bridge construction work.

3.4 STRUCTURAL ASSESSMENT

See Bridge Type Selection Worksheets and Preliminary Structures Reports.

III. TASK 3 - ALTERNATIVE DESIGN OPTIONS

This section identifies different options to accomplish the goals outlined for the project. The options are determined based on available data and information from field investigations.

3.1 MASSASOIT BRIDGE

3.1.1 Option 1 – Replacement

Under Option 1 the existing one-lane bridge will be replaced with a two-lane bridge with a sidewalk on the west side of the bridge. The approach roadways will be realigned to the north and south to create a T-intersection with stop signs at Midland Ave and Red Barn Rd. In addition, the profile of the bridge is proposed to be raised 5-feet vertically due to anticipated sea level rise in the future. The existing bridge rail and roadway guardrail will be replaced with crash tested bridge rail, transitions, guardrail and end treatments.

The preliminary cost estimates for improvements under Massasoit Bridge Option 1 is as follows:

- Highway construction cost = \$625,000
- Bridge construction cost = \$2,715,000
- Total construction cost for Option 1 = \$3,340,000
- Permitting as necessary would be an additional cost.

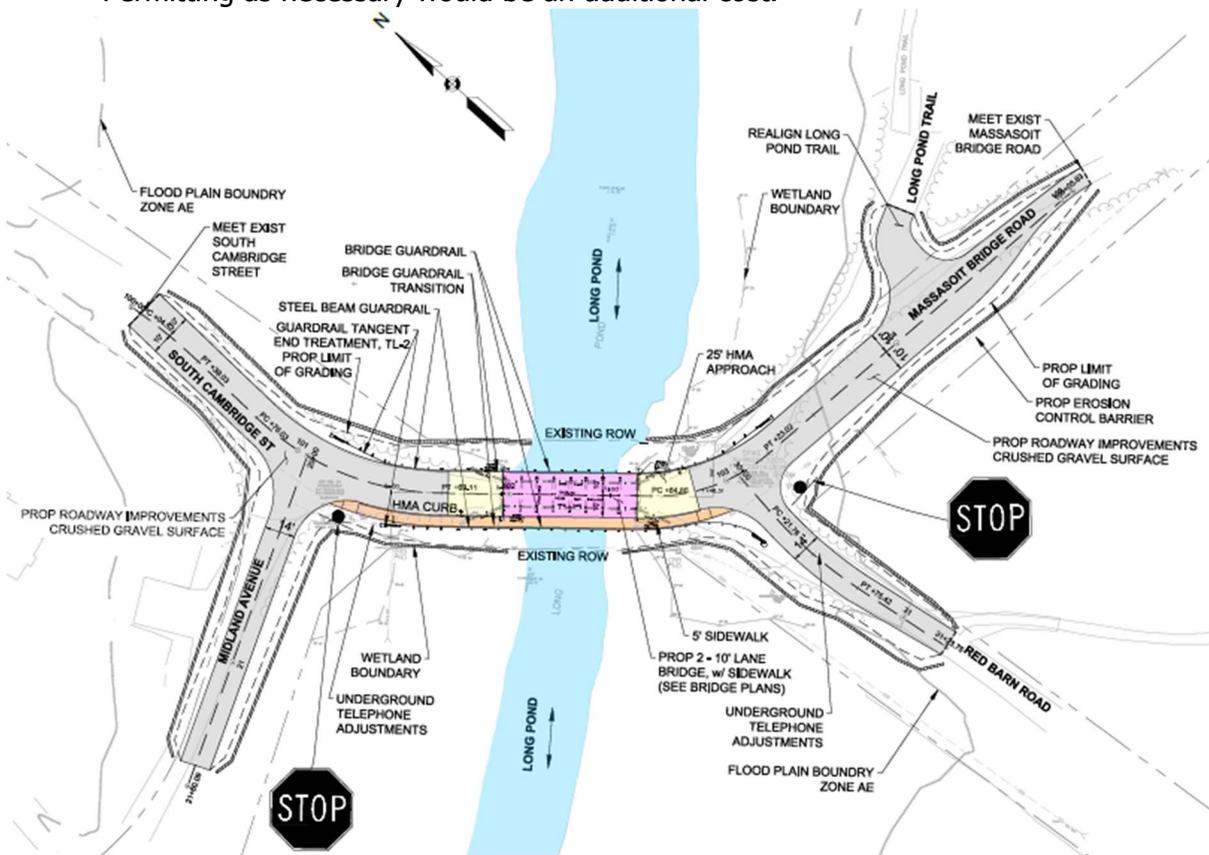


Figure 3: Two-lane Bridge with Sidewalks (Massasoit Bridge)

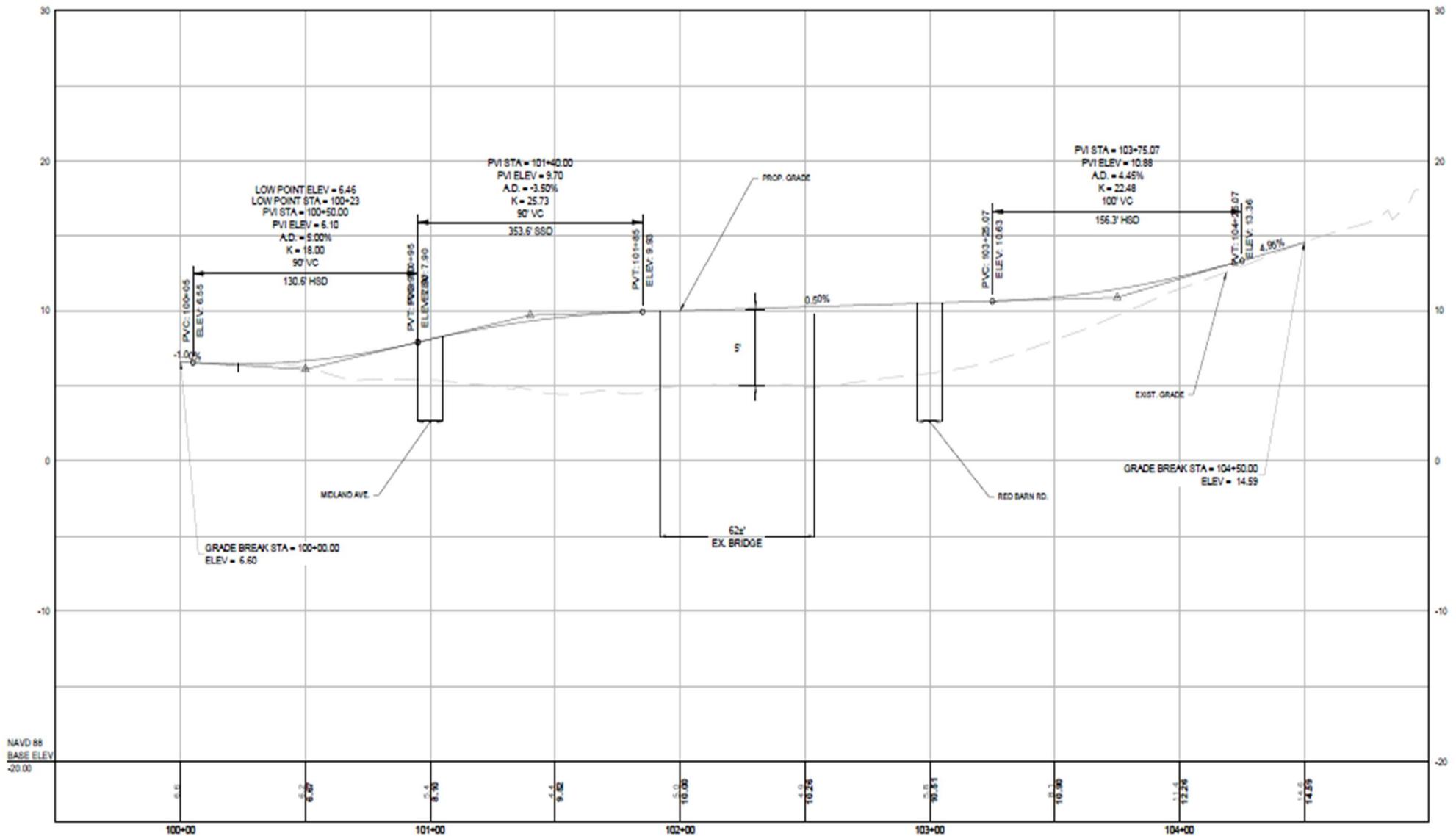


Figure 4: 5-foot Raised Profile of Massasoit Bridge

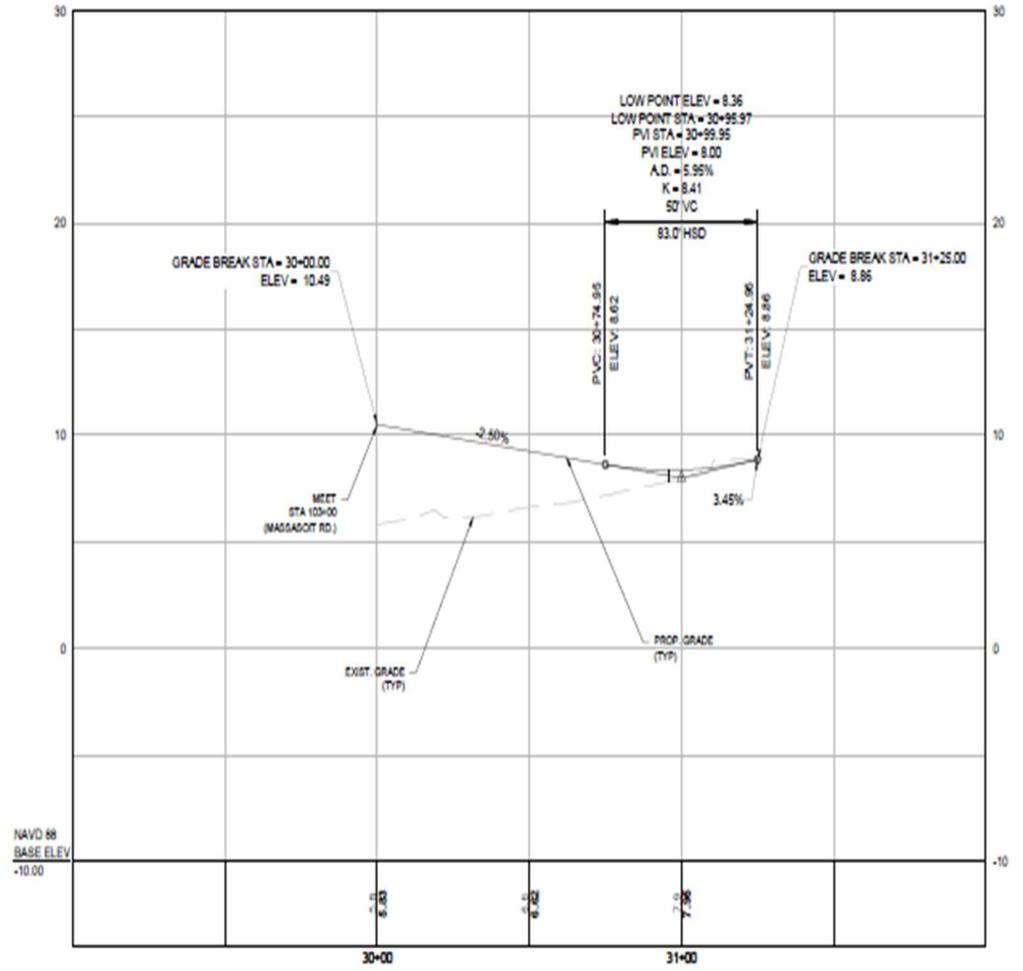
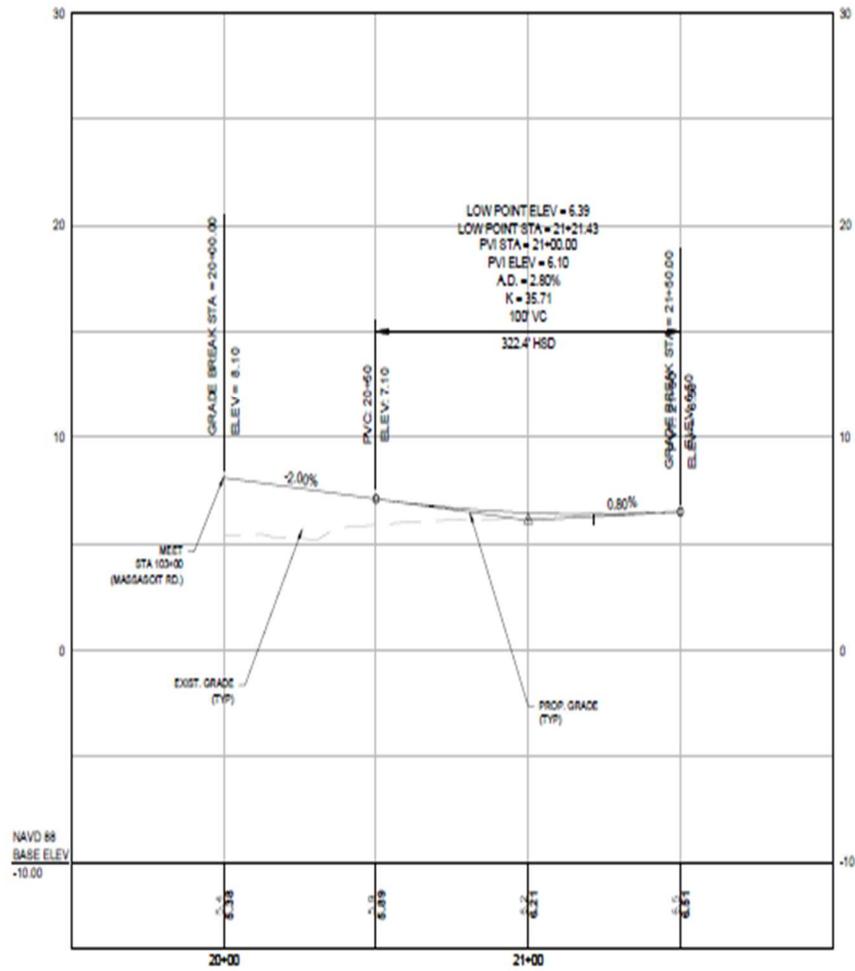


Figure 5: Raised Profile of Midland Avenue (Left) and Red Barn Road (Right)

3.1.2 Option 2a – Rehabilitation without Sidewalk

Option 2a proposes rehabilitation of the existing bridge. South Cambridge Street and Massasoit Bridge Road will be resurface with crushed stone and paved roadway approached and Massasoit Bridge Road will be realigned to bring the roadway back into the Town right-of-way and improve the intersection with Long Pond Trail. The "T"-intersections at Midland Avenue and Red Barn Road will be realigned to improve safety and sight distance. Traffic signs will be added where required for additional roadway safety improvements. The existing bridge rail and roadway guardrail will be replaced with crash tested bridge rail, transitions, guardrail and end treatments.

The preliminary cost estimate for the roadway improvements for Massasoit Bridge Option 2a are broken down as follows:

- Highway construction cost = \$375,000
- Bridge construction cost = \$278,000
- Total Option 2a construction cost = \$653,000
- Permitting costs as necessary would be an additional cost.

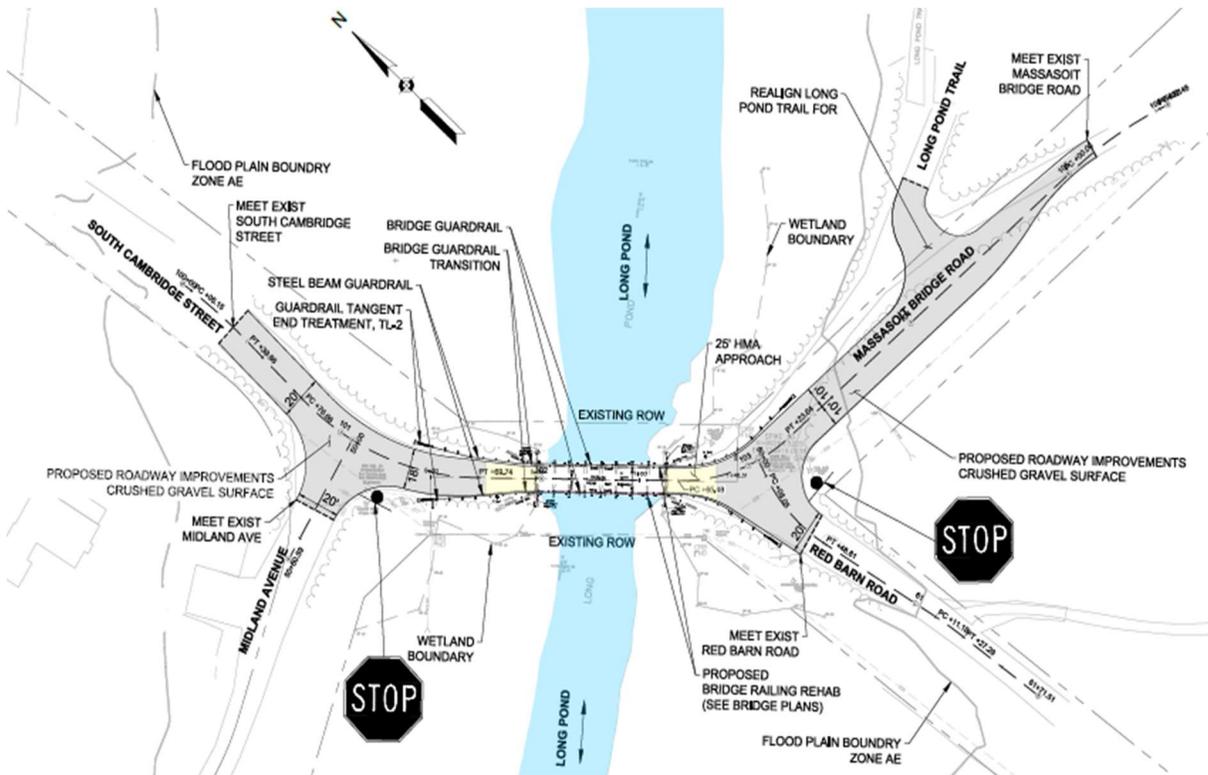


Figure 6: Massasoit Bridge Rehabilitation - Option 2a

3.1.3 Option 2b – Rehabilitation with Sidewalk

Alternative 2b proposes to add guardrails and a cantilevered sidewalk to the existing bridge. The bridge is understood to be in adequate condition structurally due to the recent repairs to its superstructure and should be able to support a 5' sidewalk (See Preliminary Structures Report). Similar to Option 2a, there are proposed improvements to approach roadways to reduce traffic related problems. The existing bridge rail and roadway guardrail will be replaced with crash tested bridge rail, transitions, guardrail and end treatments.

The preliminary cost estimates for improvements under Massasoit Bridge Option 2b is as follows:

- Highway construction cost = \$425,000
- Bridge construction cost = \$326,000
- Total construction cost for Option 2b = \$751,000
- Permitting as necessary would be an additional cost.

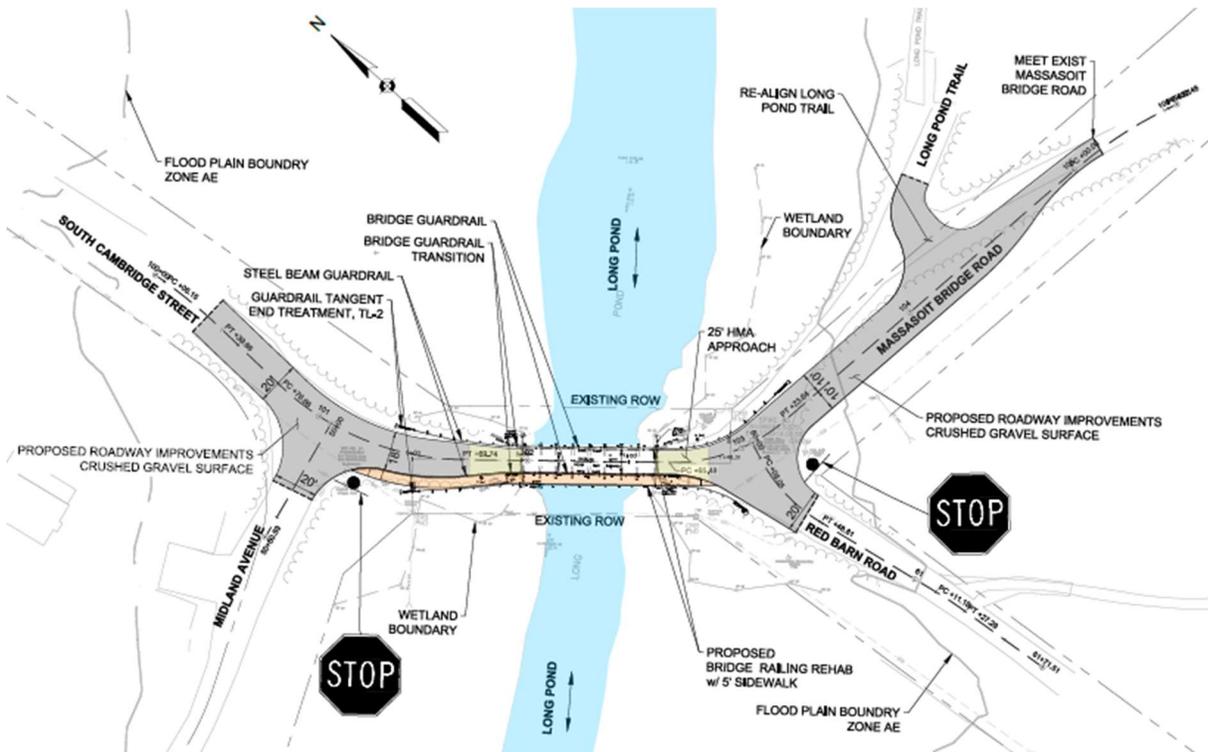


Figure 7: Massasoit Bridge Rehabilitation with Sidewalk - Option 2b

3.2 AMES AVENUE BRIDGE

3.2.1 Option 1 – Rehabilitation

Option 1 proposes to rehabilitate the existing Ames Avenue bridge superstructure along with improvements to the substructure to address noted deficiencies, increase load carrying capacity and extend service life. The bridge will remain a two-lane bridge with 10' wide lanes and a 5' sidewalk. The approach roadway will be resurfaced with HMA pavement.

The preliminary cost estimates for improvements under Ames Avenue Bridge Option 1 is as follows:

- Highway construction cost = \$475,000
- Bridge construction cost = \$1,089,000
- Total construction cost for Option 1 = \$1,564,000
- Permitting as necessary would be an additional cost.

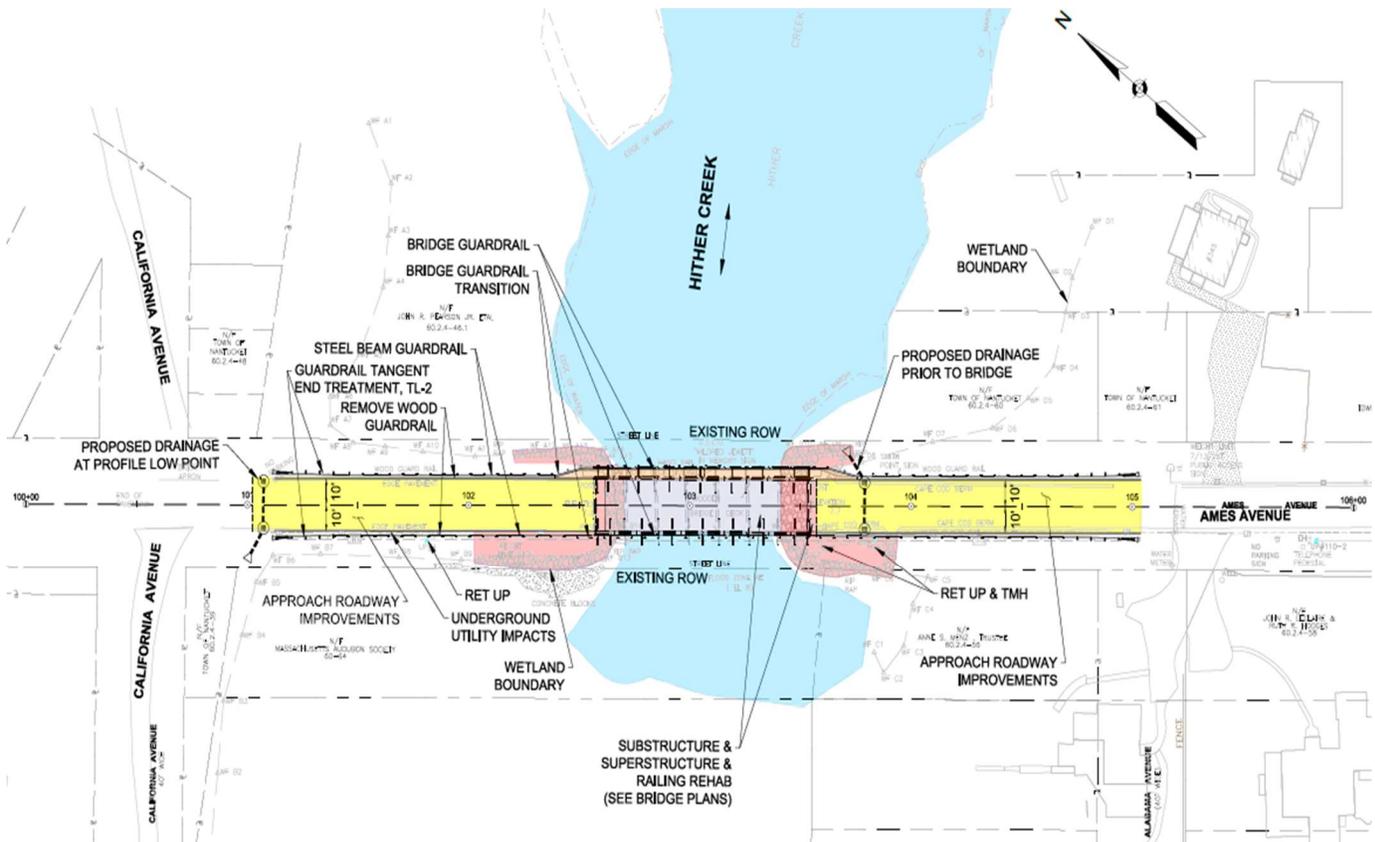


Figure 8: Ames Avenue Bridge Improvements - Option 1

3.2.2 Option 2 – Replacement

Ames Avenue Alternative 2 includes replacing the existing bridge superstructure and substructure. The profile of the road is proposed to be raised by 3-feet to accommodate future sea level rise. The bridge would consist of two 10' travel lanes and a 5' sidewalk. This alternative proposes to realign California Avenue because the existing roadway falls outside the right of way. This will also improve the geometry of the intersection of California Ave and Ames Ave improving sight distance and safety.

The preliminary cost estimates for improvements under Ames Avenue Bridge Option 1 is as follows:

- Highway construction cost = \$875,000
- Bridge construction cost = \$3,702,000
- Total construction cost for Option 1 = \$4,577,000.
- Permitting as necessary would be an additional cost.

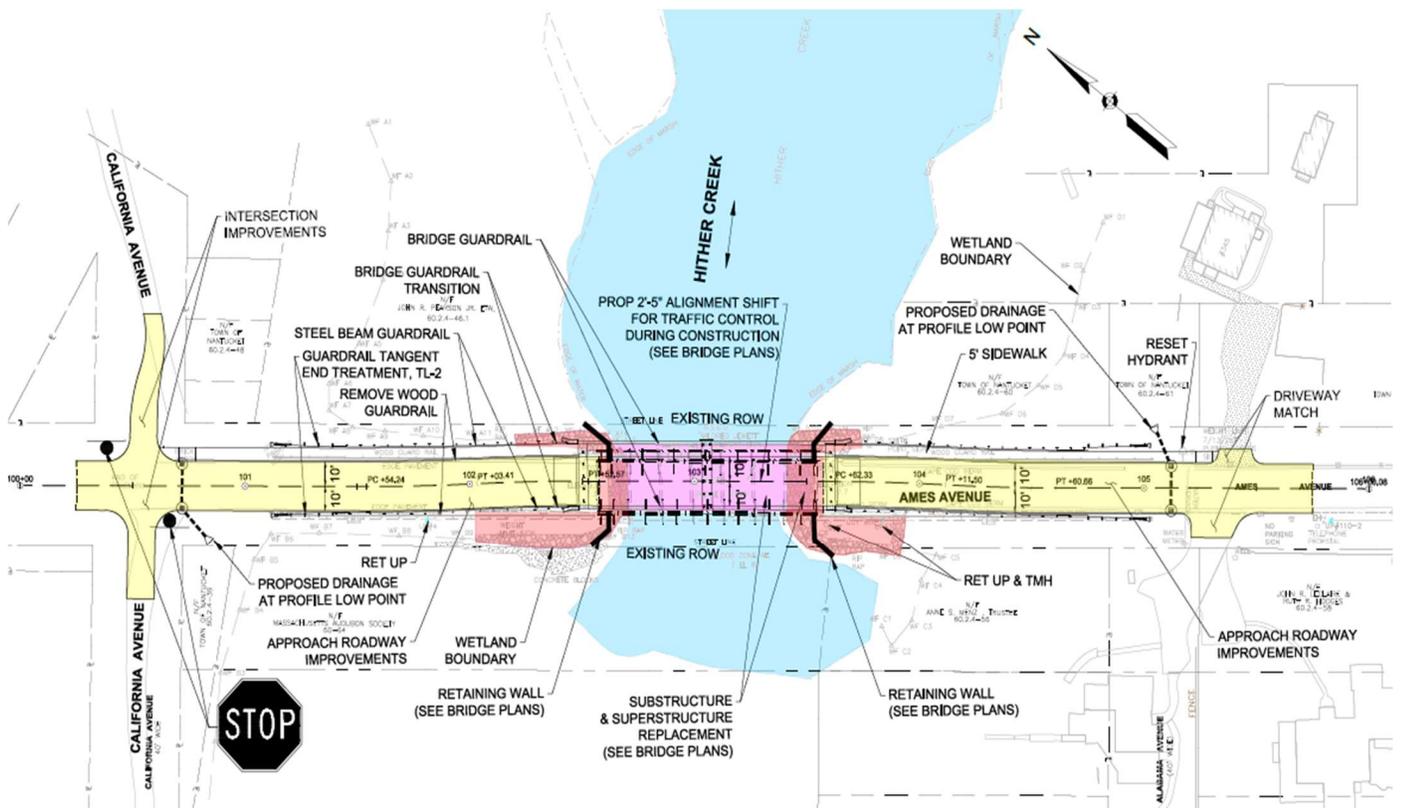


Figure 9: Replacement Alternative for Ames Avenue Bridge - Option 2

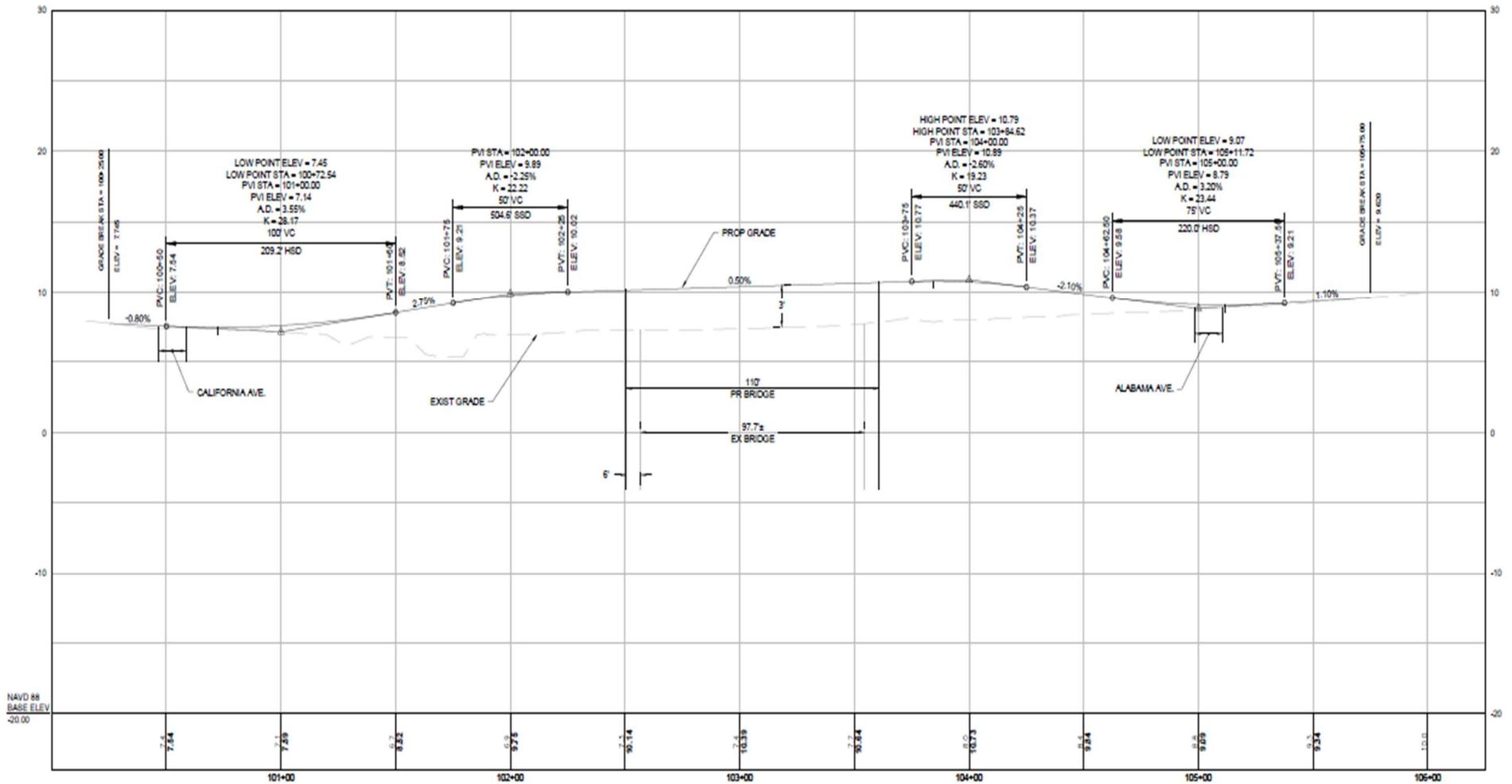


Figure 10: 3-foot Raised Profile of Ames Avenue Bridge - Option 2

IV. TASK 4 - ALTERNATIVE ANALYSIS

4.1 Constructability

Massasoit Bridge

The constructability of the Massasoit Bridge Road has overhead wires that will need to be considered for any bridge repair and roadway improvement option. Temporary construction easements areas have been defined approximately 20' beyond the Town right-of-way to accommodate construction activities.

Replacing the existing bridge under Option 1 will create greater wetland and Right-of-way impacts and increase the construction cost and timeline of completing the project. Replacing the existing bridge would result in a design life of 75 years. Massasoit Bridge Road will be closed during construction and a detour will be posted for vehicle traffic.

Option 2a & 2b where the existing bridge is rehabilitated, would keep the bridge relatively in its own footprint, and reduce wetland impacts and construction costs. It is anticipated that the existing bridge has a remaining service life of 25-years due to the timber piles. This time frame allows for the Town to prepare for the bridge's replacement in the future.

All three (3) alternatives (Options 1, 2a, 2b) propose to:

- Utilize a road closure with a detour during construction.
- Limit impacts from the side slopes to right-of-way and wetlands by using 1.5 slope slopes where possible.

Ames Avenue Bridge

Option 1 to rehabilitate the existing bridge substructure and superstructure and leave travel way width and pedestrian patterns the same. There is currently no possible detour route for Ames Avenue Bridge, thus the bridge would need to be constructed in phases to accommodate traffic and construction requirements. The construction costs will be less as this option will be repairing damages that have affected the bridge and not replacing it. Bridge rehabilitation would aim to extend the bridge service life for 25 years. There will be minimal impacts associated with the wetlands and right-of-way under this Option 1.

Option 2 would replace the existing bridge superstructure and substructure. This option would accommodate anticipated sea level rise by raising the profile by 3-feet. The costs are higher and wetland impacts would be greater for this option. Increased wetland impacts, right-of-way slope easements and temporary construction easements are needed for replacement Option 2.

- Bridge would be reduced to a single lane of alternating traffic during construction.
- Limit impacts from the side slopes to right-of-way and wetlands by using 1.5 slope slopes where possible.
-

4.2 Environmental Impacts

Massasoit Bridge

Option 1 bridge replacement with a 5-foot vertical raise involves construction activities to the substructure and superstructure for the Massasoit Bridge that will create approximately 700 sf of impacts to wetlands of Long Pond and clearing and grubbing of approximately 0.1 Acre of conservation lands. Slope impacts beyond the right-of-way will necessitate permanent slope easements of approximately 2,500 sf.

Option 2a bridge rehabilitation will not have any permanent wetland impacts of Long Pond. The conservation land impacts will be similar to Option 2 with approximately 0.1 Acre. The rehabilitation Option 2b which includes a cantilevered 5' sidewalk and a bituminous sidewalk along the approach roadways to the intersections on each side will create approximately 250 sf of wetland impacts.



Land Bank Sign



Nantuket Conservation Sign



Vegetation removed for road re-alignment

Ames Avenue Bridge

A portion of Hither Creek is currently covered by sand deposits to the west of the bridge resulting from recent large storms that affected the ecology and natural vegetation within the project area. (See aerial photos below). According to a report from the Town of Nantucket, the creek has been permanently altered and cannot be brought back into its natural landscape.

Replacing the bridge under alternative Option 1 and raising the bridge profile by 3-feet would have approximately 3,000 sf impacts to the wetland resource areas. Slope impacts outside the right-of-way would need approximately 4,500 sf of permanent slope easements.

Under Option 2 to rehabilitate the bridge, there will be no permanent right-of-way impacts, and will create wetland impacts of approximately 2,000 sf.



Figure 11: Hither Creek at Ames Avenue Bridge in 2017



Figure 12: Hither Creek at Ames Avenue Bridge in 2018

4.3 Right of Way Impacts

Massasoit Bridge

Existing Town right-of-way is 50-feet wide for Ames Avenue and Massasoit Bridge Road.

Under Option 1, bridge replacement with a 5-foot vertical raise involves construction activities to the substructure and superstructure for the Massasoit Bridge that will create approximately slope impacts beyond the right-of-way will necessitate permanent slope easements of approximately 2,500 sf. Temporary construction easements of approximately 19,000 sf would be necessary 20-feet beyond the right-of-way for construction equipment and activity.

Options 2a & 2b bridge rehabilitation will not require any permanent right-of-way easements.

Ames Avenue Bridge

Replacing the bridge under alternative Option 1 and raising the bridge profile by 3-feet would create slope impacts outside the right-of-way would need approximately 4,500 sf of permanent slope easements.

Under Option 2 to rehabilitate the bridge there will be no permanent right-of-way impacts. Temporary construction easements of approximately 10,000 sf would be necessary 20-feet beyond the right-of-way for construction equipment and activity.

4.4 Alignment

Massasoit Bridge

The horizontal alignment for the Massasoit Bridge approaching roadways under all three (3) options (1, 2a, 2b) will be adjusted to create more standard 90-degree "T" intersections with stop signage added. Both Midland Avenue to the southwest and Red Barn Road to the southeast will be formalized into a "T" intersection with a stop sign. To improve the intersection with Long Pond Trail, Massasoit Bridge Road will be shifted south back into the Town right-of-way and Long Pond Trail will be formalized into a "T" intersection.

Ames Avenue Bridge

The alignment for Ames Avenue Bridge will not change for the bridge rehabilitation Option 1. Roadway approach improvements will include up to the limits of the guardrail work.

The alignment for the replacement Option 2 will need to shift the center of road over the bridge by 2'-5" to the north. This alignment shift is required to construct enough of the roadway in phase 1 to be able to shift traffic and provide construction barrier while accommodating one (1) lane of alternating traffic for the second phase of construction. The bridge replacement will need extended pavement construction and will include the re-alignment and improvement of California Ave to the west and two (2) driveways to the east.

4.5 Typical Cross Sections

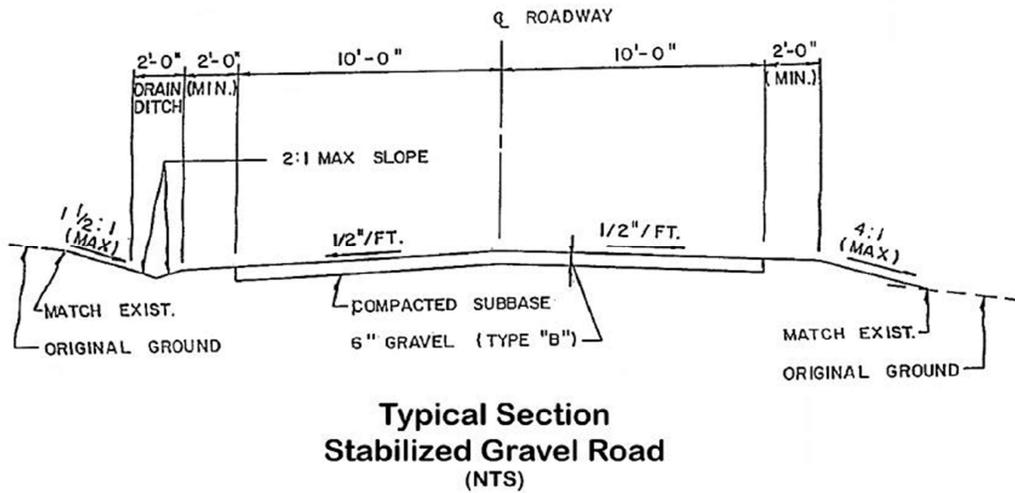


Plate No. 6

Figure 13: Typical Roadway Section Per Nantucket Town Code

Massasoit Bridge

The approaching roadways for the Massasoit Bridge will conform to the specifications of Type 8 Pavement, Stabilized Gravel Road from Section 5.08 of the Town of Nantucket's regulations (Figure 13). The bridge is identified to be in a rural location, which falls under the policy for rural roads in the Town of Nantucket. A 25' approach section of full depth bituminous pavement will be constructed at both ends of the bridge.

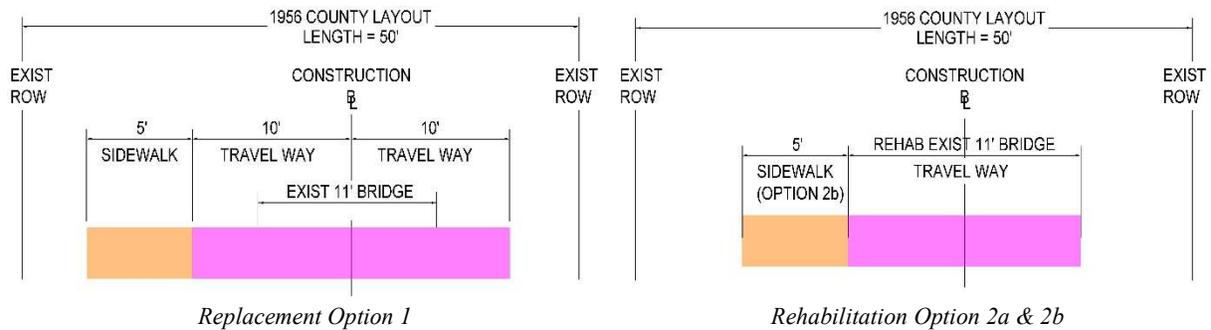


Figure 14. Typical Bridge Section Improvements for Massasoit Bridge

Ames Avenue Bridge

The approach roadway for the Ames Avenue Bridge would be designed in conformance with Town standards for pavement. Due to the storms in recent years, the Ames Avenue roadway surface has shown partial damage from sand and harsh climate conditions.

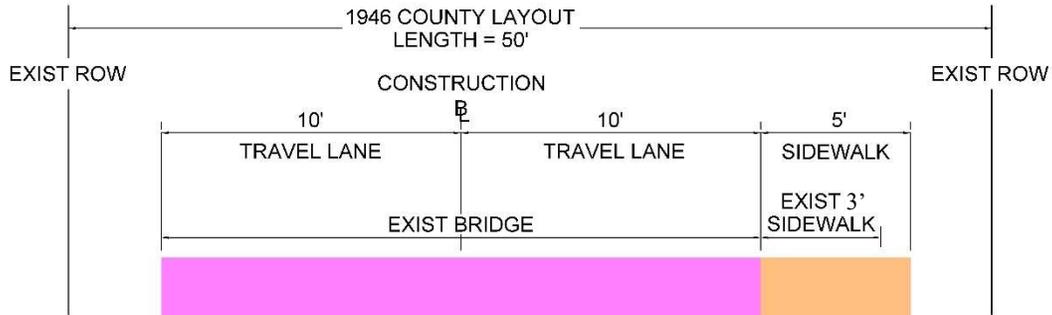


Figure 15: Typical Bridge Section for Ames Avenue Bridge

4.6 Traffic Management

Massasoit Bridge

The Town of Nantucket is limited in terms of roadway crossings over bodies of water due to environmental and conservation constraints. Construction of the Massasoit Bridge will require a closure of the existing bridge and a detour route using Massasoit Bridge Road to Madaket Road as shown in Figure 16 below.

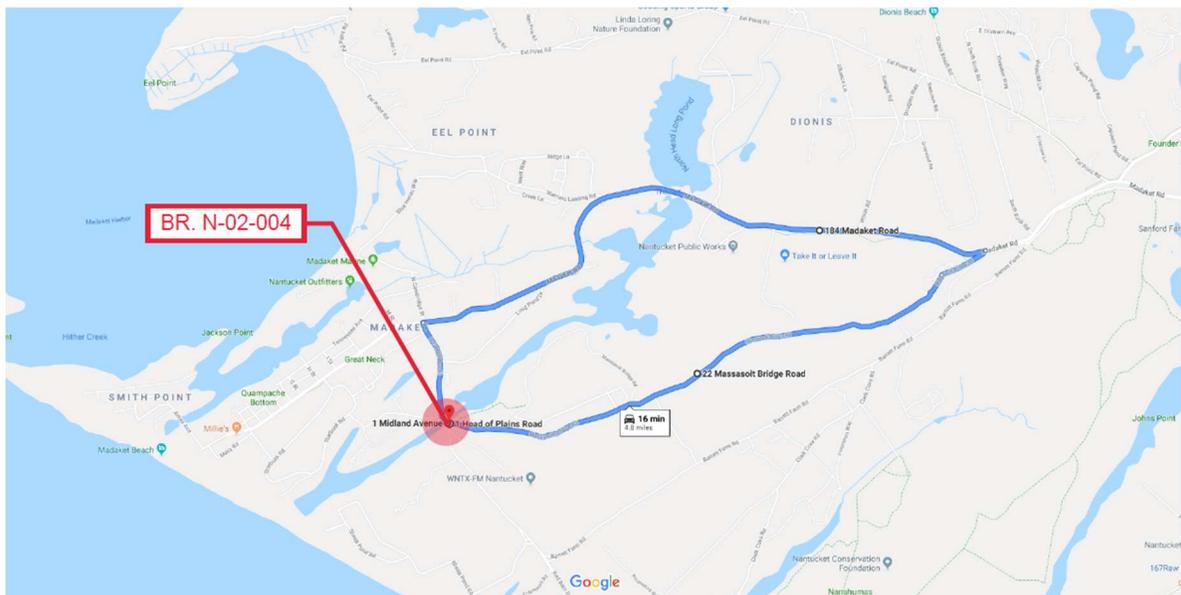


Figure 16: Massasoit Bridge Detour Route

Ames Avenue Bridge

Ames Avenue Bridge over Hither Creek does not have any possible detour route to facilitate the bridge construction, and the bridge is the only way to access Smith's Point. The bridge construction for both the rehabilitation and replacement options will utilize an alternating 1-lane of traffic to allow for the bridge to be built in 2 phases. (See Bridge Reports for more information)

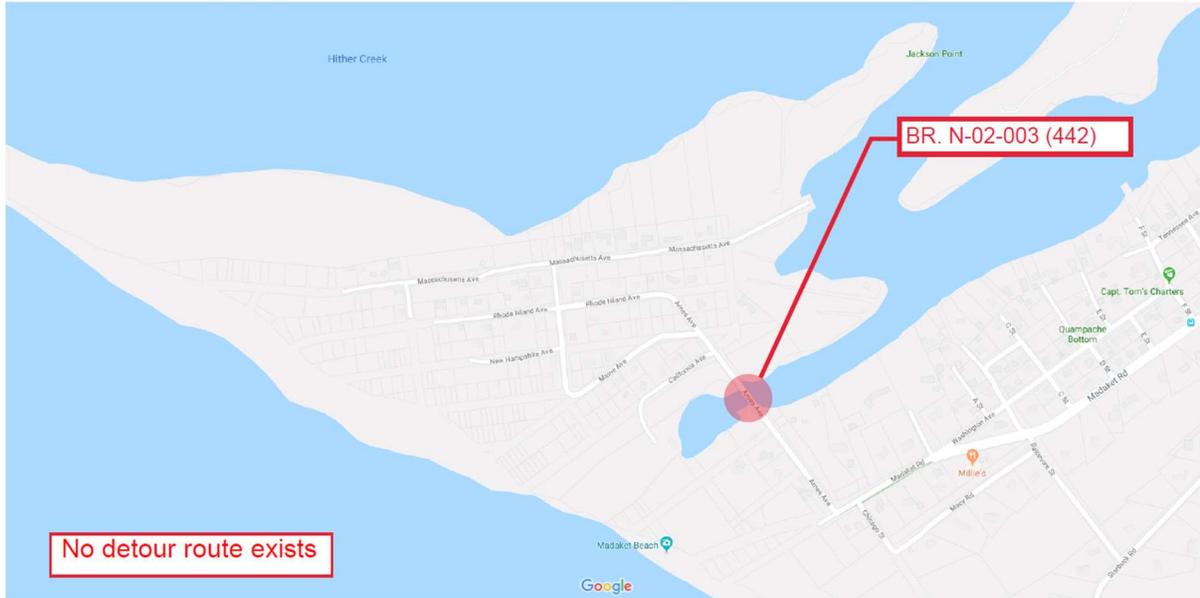


Figure 17: Ames Avenue Bridge Detour Route

4.7 Utilities

Massasoit Bridge

All utilities will be retained during construction. If in the event a utility pole or underground utility is in the way of construction, they will be removed and relocated. Per town regulation, power lines and telephone lines shall be placed underground in conduits. Further coordination with utility companies will be scheduled before addressing any utility impacts of the project.

There is existing underground telephone conduit and pull boxes in the Massasoit Bridge area, and it is assumed adjustments and/or relocations will be necessary. A cost has been included in the options cost estimates.

Ames Avenue Bridge

There will be coordination with utility companies to determine where utilities will be placed in the Ames Avenue bridge replacement option. Per Town rules and regulations utilities should be placed underground in conduits.

There is existing underground telephone conduit and pull boxes in the Ames Avenue Bridge project area. It is assumed adjustments and/or relocations will be necessary and a cost has been included in the options cost estimates.

4.8 Safety

Massasoit Bridge

The roadway surfaces within the project limits are proposed to be improved from beach sand to crushed gravel for better durability with the weather demands of the changing seasons. All bridge rail, rail transitions, roadway guardrail and terminal end treatments on the bridge and the roadway approaches will be replaced per current design standards.

The existing horizontal geometry of Massasoit Bridge Road and the intersecting side roads can be improved with minor modifications of the roadway alignments. To the west Midland Avenue can be formalized into a 90 degree intersection with a stop sign. To the east Red Barn Road and Long Pond Trail both intersect with Massasoit Bridge Road at skewed angles and in addition, Massasoit Bridge Road turns north into private property and creates more of a skew angle. These skew angles creates a safety issue with turning decisions and priorities and all three options propose to formalize Red Barn Road and Long Pond Trail into 90 degree intersections with a stop sign at Red Barn Road.

Light fixtures can be installed at each end of the bridge to improve safety and visibility for vehicles and pedestrians. A 5' sidewalk is proposed in Option 2b for pedestrian safety and access.

The bridge replacement option 1 will improve safety conditions by raising the bridge 3-feet to allow for anticipated increase in sea level elevations of Long Pond.

Ames Avenue Bridge

All bridge rail, rail transitions, roadway guardrail and terminal end treatments on the bridge and the roadway approaches will be replaced per current design standards.

Ames Avenue Bridge will retain its current lighting fixtures and sidewalk.



**Prelim. Highway Construction Estimate
Massasoit Bridge Replacement
w/ Sidewalk
Option 1**

146 Dascomb Road, Andover, MA 01810
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Massasoit Bridge Road Reconstruction
Location: Nantucket, MA
Title: Preliminary Highway Cost Estimate
Estimated By: ADC

Project No.: T0863
Date: 6/17/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 8,000	\$ 8,000
Earthwork, Clearing & Grubing, Fine Grading	1	LS	\$ 75,000	\$ 75,000
Roadway Crushed Gravel Surface	1700	SY	\$ 55	\$ 93,500
Full Depth Pavement (Approaches)	120	SY	\$ 115	\$ 13,800
HMA Curb Type 3	130	LF	\$ 50	\$ 6,500
HMA Sidewalk	80	SY	\$ 75	\$ 6,000
Guardrail	150	LF	\$ 55	\$ 8,250
Guardrail Tangent End Unit	4	EA	\$ 2,000	\$ 8,000
Loam & Seed	100	SY	\$ 15	\$ 1,500
Subtotal				\$ 220,550
10% Traffic Management & Detour				\$ 33,083
Subtotal - Construction Items				\$ 253,633
Apply Cost Swell Factor of 2.0				\$ 507,265
Contingencies				
15% Construction				\$ 76,090
Contingencies Subtotal				\$ 76,090
Utility Relocation				
Underground Telephone Adjustments	1	LS	\$ 20,000	\$ 20,000

Total **\$ 603,355**

Say \$ 625,000



**Prelim. Highway Construction Estimate
Massasoit Bridge Rehabilitation
w/o Sidewalk
Option 2a**

146 Dascomb Road, Andover, MA 01810
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Massasoit Bridge Road Reconstruction
Location: Nantucket, MA
Title: Preliminary Highway Cost Estimate
Estimated By: ADC

Project No.: T0863
Date: 6/17/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 5,000	\$ 5,000
Earthwork, Clearing & Grubing, Fine Grading	1	LS	\$ 30,000	\$ 30,000
Roadway Crushed Gravel Surface	1200	SY	\$ 55	\$ 66,000
Full Depth Pavement (Approaches)	120	SY	\$ 115	\$ 13,800
Guardrail	150	LF	\$ 55	\$ 8,250
Guardrail Tangent End Unit	4	EA	\$ 2,000	\$ 8,000
Subtotal				\$ 131,050
10% Traffic Management & Detour				\$ 13,105
Subtotal - Construction Items				\$ 144,155
Apply Cost Swell Factor of 2.0				\$ 288,310
Contingencies				
15% Construction				\$ 43,247
Contingencies Subtotal				\$ 43,247
Utility Relocation				
Underground Telephone Adjustments	1	EA	\$ 20,000	\$ 20,000

Total \$ **351,557**

Say \$ **375,000**



**Preliminary Cost Estimate
Massasoit Bridge Rehabilitation
w/Sidewalk
Option 2b**

146 Dascomb Road, Andover, MA 01810
169 Ocean Blvd., Hampton, NH 03842
978-794-1792 "TheEngineeringCorp.com"

Project: Massasoit Bridge Road Reconstruction
Location: Nantucket, MA
Title: Preliminary Highway Cost Estimate
Estimated By: ADC

Project No.: T0863
Date: 6/17/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 6,000	\$ 6,000
Earthwork, Clearing & Grubing, Fine Grading	1	LS	\$ 40,000	\$ 40,000
New Roadway Crushed Gravel Surface	1200	SY	\$ 55	\$ 66,000
Full Depth Pavement (Approaches)	120	SY	\$ 115	\$ 13,800
HMA Curb Type 3	130	LF	\$ 50	\$ 6,500
HMA Sidewalk	80	SY	\$ 75	\$ 6,000
Guardrail	150	LF	\$ 55	\$ 8,250
Guardrail Tangent End Unit	4	EA	\$ 2,000	\$ 8,000
Subtotal				\$ 154,550
10% Traffic Management & Detour				\$ 15,455
Subtotal - Construction Items				\$ 170,005
Apply Cost Swell Factor of 2.0				\$ 340,010
Contingencies				
15% Construction				\$ 51,002
Contingencies Subtotal				\$ 51,002
Utility Relocation				
Underground Telephone Adjustments	1	LS	\$ 10,000	\$ 10,000

Total **\$ 401,012**

Say \$ 425,000



146 Dascomb Road, Andover, MA 01810
 169 Ocean Blvd., Hampton, NH 03842
 978-794-1792 "TheEngineeringCorp.com"

Prelim. Highway Construction Estimate

Ames Avenue Bridge Rehabilitation Option 1

Project: Ames Ave Bridge
Location: Nantucket, MA
Title: Preliminary Highway Cost Estimate
Estimated By: ADC

Project No.: T0863
Date: 6/17/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 6,000	\$ 6,000
Earthwork, Clearing & Grubing, Fine Grading	1	LS	\$ 25,000	\$ 25,000
Full Depth Pavement	700	SY	\$ 105	\$ 73,500
Steel Beam Guardrail	350	LF	\$ 55	\$ 19,250
Guardrail Tangent End Unit	4	EA	\$ 2,000	\$ 8,000
New HMA Sidewalk	175	SY	\$ 105	\$ 18,375
Drainage Modifications	1	LS	\$ 30,000	\$ 30,000
Loam & Seed	75	SY	\$ 15	\$ 1,125
Traffic Signing & Markings	1	LS	\$ 4,000	\$ 4,000
Subtotal				\$ 185,250
10% Traffic Management				\$ 18,525
Subtotal - Construction Items				\$ 203,775
Apply Cost Swell Factor of 2.0				\$ 407,550
Contingencies				
15% Construction				\$ 61,133
Contingencies Subtotal				\$ 61,133
Utility Relocation				
Underground Telephone Adjustments	1	EA	\$ 20,000	\$ 20,000
Total				\$ 468,683
Say		Highway Total		\$ 475,000



146 Dascomb Road, Andover, MA 01810
 169 Ocean Blvd., Hampton, NH 03842
 978-794-1792 "TheEngineeringCorp.com"

Prelim. Highway Construction Estimate

Ames Avenue Bridge Replacement Option 2

Project: Ames Ave Bridge
Location: Nantucket, MA
Title: Preliminary Highway Cost Estimate
Estimated By: ADC

Project No.: T0863
Date: 6/17/2020
Sheet: 1 of 1
Checked By:

Item	Quantity	Units	Unit Price	Total
Mobilization / General Conditions	1	LS	\$ 10,000	\$ 10,000
Earthwork, Clearing & Grubing, Fine Grading	1	LS	\$ 90,000	\$ 90,000
Full Depth Pavement	1000	SY	\$ 105	\$ 105,000
Modified Rock Fill Slope	575	CY	\$ 80	\$ 46,000
				\$ -
HMA Curb Type 3	130	LF	\$ 50	\$ 6,500
HMA Sidewalk	80	SY	\$ 75	\$ 6,000
Steel Beam Guardrail	350	LF	\$ 55	\$ 19,250
Guardrail Tangent End Unit	4	EA	\$ 2,000	\$ 8,000
Drainage Modifications	1	LS	\$ 30,000	\$ 30,000
Loam & Seed	75	SY	\$ 15	\$ 1,125
Traffic Signing & Markings	1	LS	\$ 5,000	\$ 5,000
Subtotal				\$ 326,875
10% Traffic Management				\$ 32,688
Subtotal - Construction Items				\$ 359,563
Apply Cost Swell Factor of 2.0				\$ 719,125
Contingencies				
15% Construction				\$ 107,869
Contingencies Subtotal				\$ 107,869
Utility Relocation				
Underground Telephone Adjustments	1	EA	\$ 30,000	\$ 30,000
Total				\$ 856,994
Say				\$ 875,000

V. TASK 5 - RECOMMENDATION

The recommendation from a roadway design perspective for the Town for Ames Avenue is Option 2, bridge replacement. With this option the roadway profile would be raised over Hither Creek by 3-feet for more hydraulic capacity and improve the roadway geometry by re-aligning California Avenue to the west and two (2) driveways to the east.

The recommendation from a roadway design perspective for the Town for Massasoit Bridge Road is Option 2a, rehabilitation with a sidewalk. This option proposes to rehabilitate the bridge railing and approach guardrail, and improve the intersecting roadways of Midland Avenue to the west, and Red Barn Road and Long Pond Trail to the east. Under Option 2b, a sidewalk would be added to the rehabilitated bridge to enhance pedestrian safety. The added cost of the sidewalk would be weighed against the increase in pedestrian safety.

See Bridge Reports for detailed study and bridge focused recommendations for both the Ames Avenue Bridge and Massasoit Bridge.

HIGHWAY CONCEPT PLANS

NANTUCKET, MA
 MASSASOIT ROAD
 TITLE & INDEX
 SHEET 1 OF 4

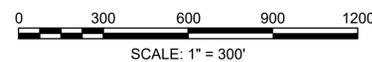
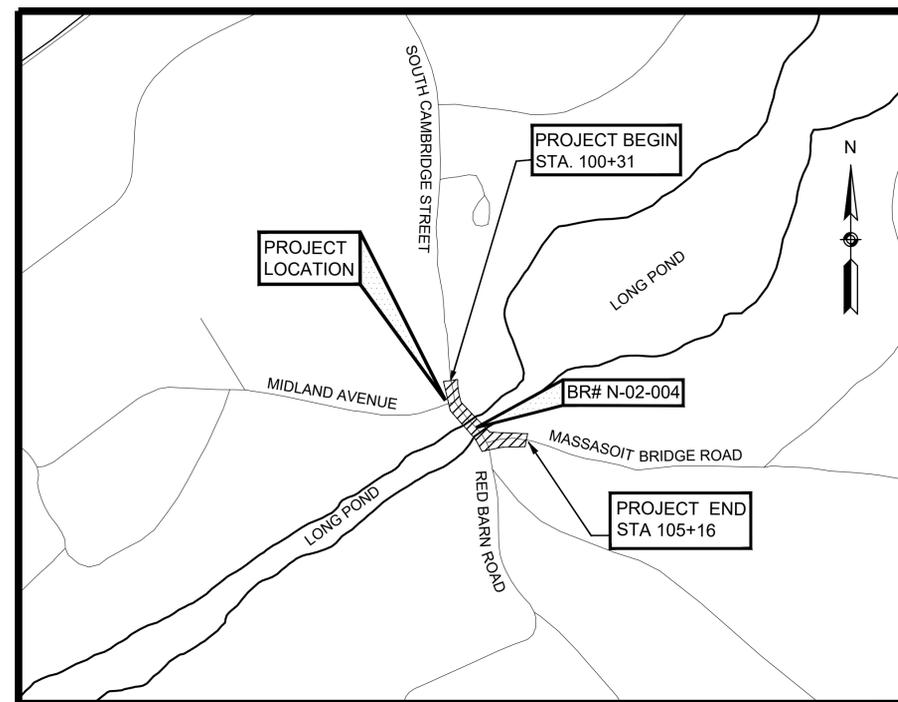
PLAN AND PROFILE OF MASSASOIT BRIDGE REHABILITATION - OPTION 2a (BRIDGE NO. N-02-004)

IN THE TOWN OF
 NANTUCKET, MA
 NANTUCKET COUNTY

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

ALTERNATIVE ANALYSIS REPORT - APPENDIX 1

INDEX	
SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2	TYPICAL SECTIONS
3	CONSTRUCTION PLAN
4	PROFILE



LENGTH OF PROJECT = 485 FEET = 0.092 MILES

DESIGN DESIGNATION

DESIGN SPEED 20 MPH
 FUNCTIONAL CLASSIFICATION LOCAL

DATE	DESCRIPTION	REV #
6/23/20	25% HIGHWAY DESIGN	0

DATE	DESCRIPTION	REV #
6/23/20	25% HIGHWAY DESIGN	0

TEC, Inc.

146 Dascomb Road Andover, MA 01810 978-794-1792	311 Main Street 2nd Floor Worcester, MA 01608 508-868-5104	169 Ocean Blvd, Unit 3 PO Box 249 Hampton, NH 03842 603-601-8154
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www.TheEngineeringCorp.com

DESIGNED BY ADC	CHECKED BY ADC	DATE 6/12/20
DRAWN BY SQN	APPROVED BY LSA	PROJECT NO. T0863

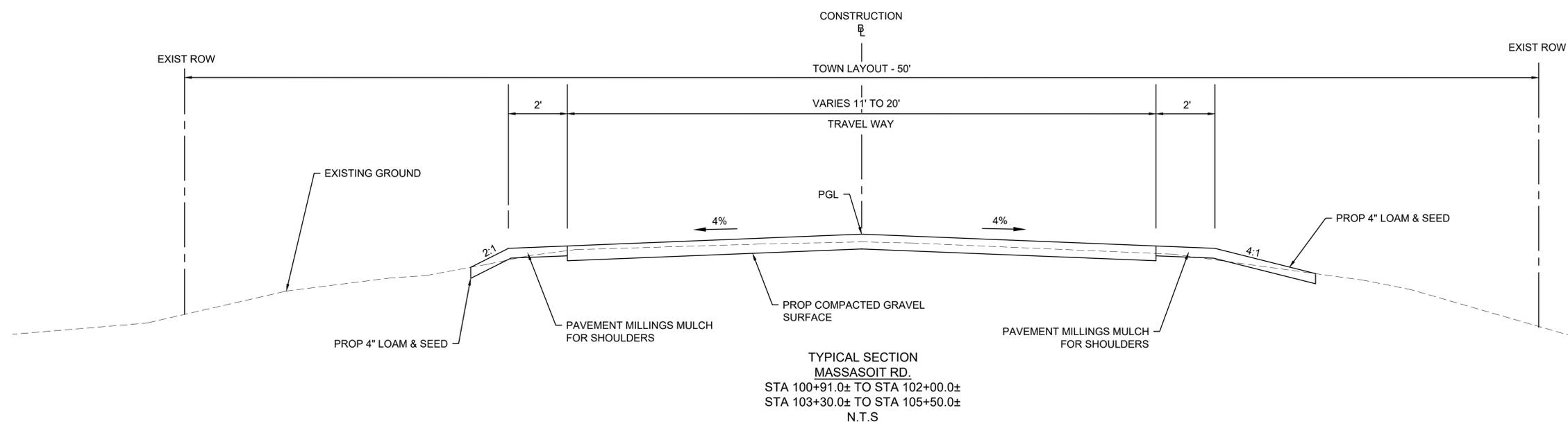
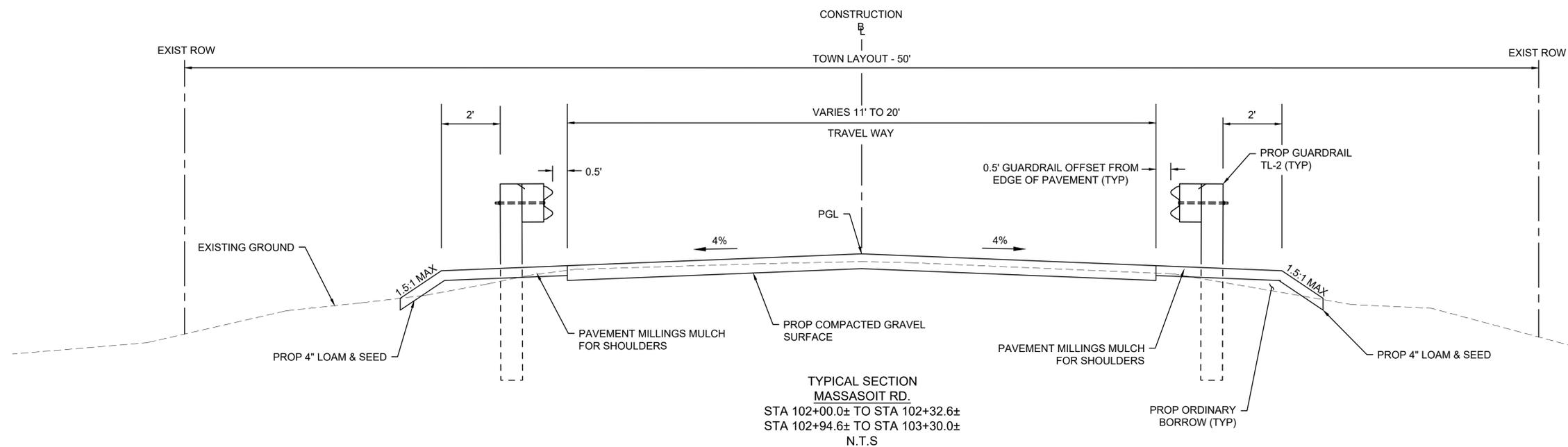
ROADWAY NOTES

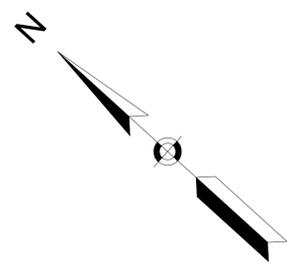
PROPOSED STABILIZED GRAVEL ROADWAY

SURFACE: 6" DENSE GRADED CRUSHED GRAVEL (COMPACTED)

GENERAL NOTES:

- * GEOTEXTILE FABRIC FOR STABILIZATION SHALL BE PLACED ON 2:1 SLOPES





PROJECT BEGIN
STA 100+30.82
N99506.9064
E1726786.8509

PROJECT END
STA 105+15.49
N99253.0020
E1727120.1248

SOUTH CAMBRIDGE
STREET

MIDLAND AVENUE

LONG POND TRAIL

MASSASOIT BRIDGE
ROAD

RED BARN ROAD

LONG POND

LONG POND

LIMIT OF WORK
STA 100+66
MEET EXIST

LIMIT OF WORK
STA 50+35
MEET EXIST

MEET EXIST

RE-ALIGN LONG
POND TRAIL

REMOVE ROADWAY MATERIAL
REPLACE W 4" LOAM & SEED

PROP EROSION
CONTROL BARRIER
(TYP)

MEET EXIST

MEET EXIST ROAD

PROP CRUSHED
GRAVEL SURFACE

EXISTING ROW

PROP GUARDRAIL
TERMINAL UNIT (TYP)

PROP GUARDRAIL
TYPE TL-2 (TYP)

PROP 25' HMA
APPROACH

PROP BRIDGE
RAILING REHAB
(SEE BRIDGE PLANS)

PROP 25' HMA
APPROACH

REM W5-2
PROP W5-3
PC +65.48

EXISTING ROW

REM W5-2
PROP W5-3

EXISTING ROW

STA 101+72.4
PROP LIMIT
GRAVEL SURFACE

PROP LIMIT
OF GRADING
(TYP)

STA 102+94.6
BRIDGE LIMIT
PROP LIMIT OF
GRAVEL SURFACE

EXISTING ROW

FLOOD PLAIN
BOUNDARY

LIMIT OF WORK
STA 60+42
MEET EXIST

FLOOD PLAIN
BOUNDARY

CLEAR SHRUB/BRUSH
TO SLOPE LINE
AREA = 0.1 AC ±

PROP CRUSHED
GRAVEL SURFACE

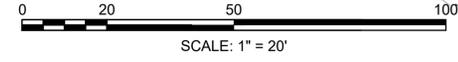
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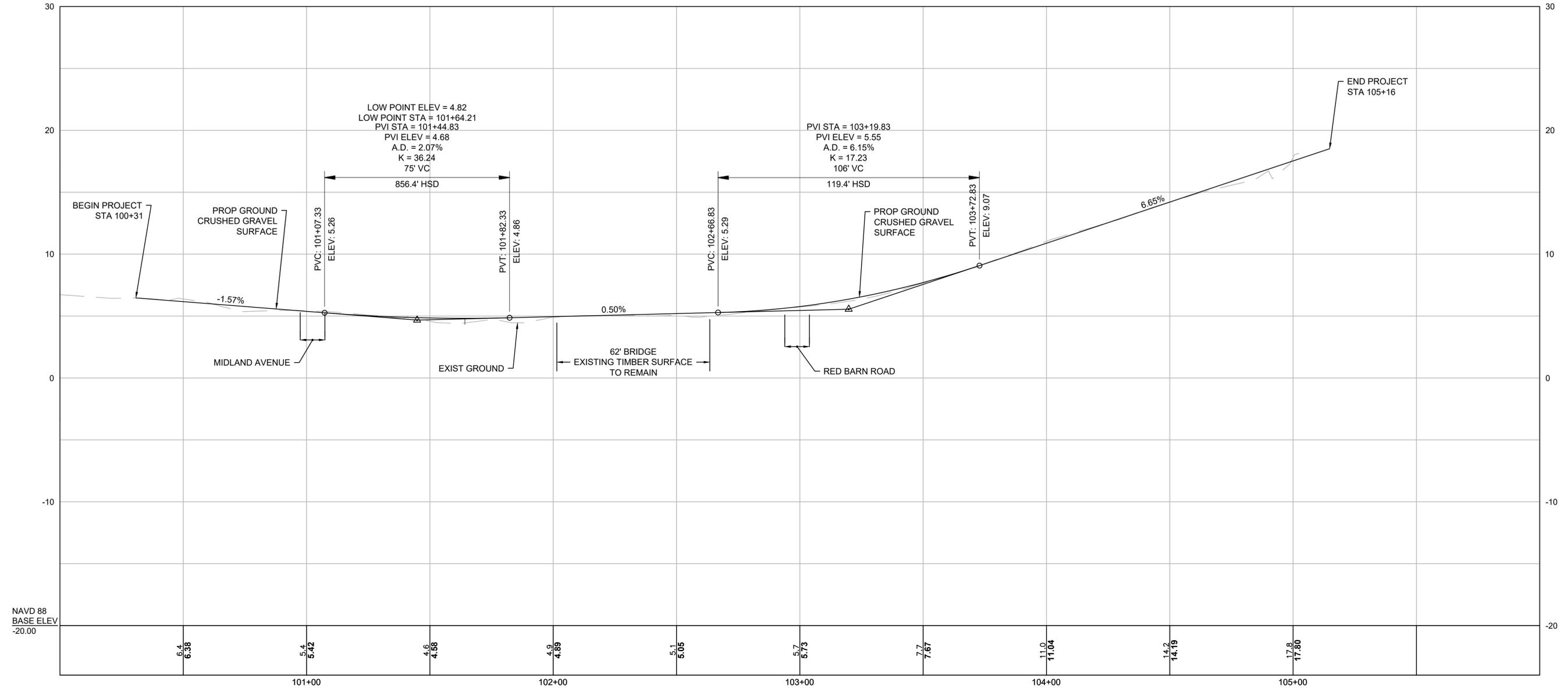
RET "LAND
BANK" SIGN
PROP R1-1
SIGN

RET UP

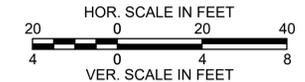
RET UP

RET UP





NAVD 88
 BASE ELEV
 -20.00



HIGHWAY CONCEPT PLANS

NANTUCKET, MA
AMES AVENUE
TITLE SHEET & INDEX
SHEET 1 OF 8

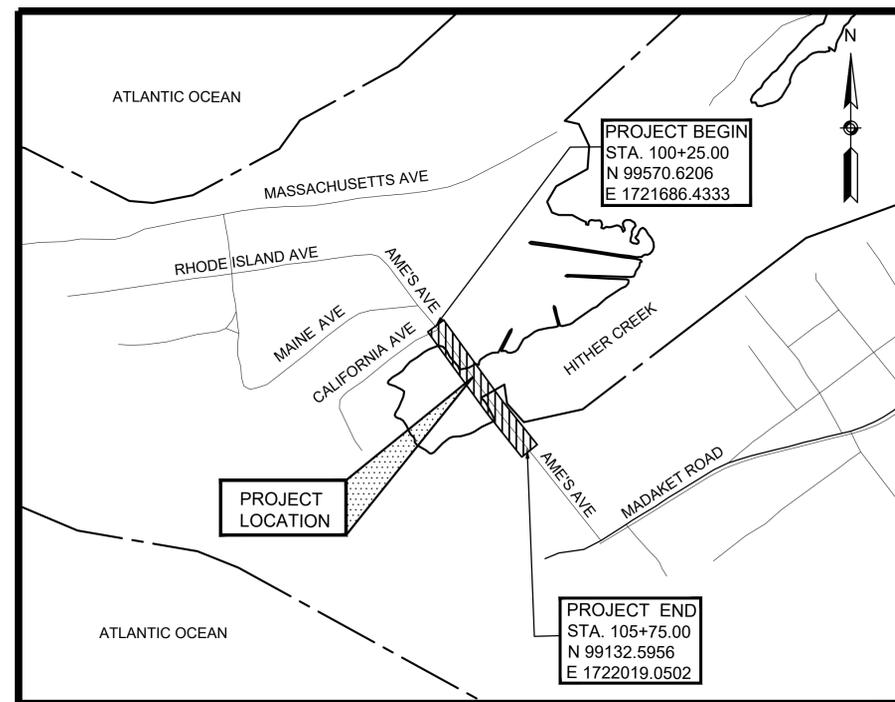
PLAN AND PROFILE OF AMES AVENUE BRIDGE REPLACEMENT OPTION 2 (BRIDGE NO. N-02-003)

IN THE TOWN OF
NANTUCKET
NANTUCKET COUNTY

THESE PLANS ARE SUPPLEMENTED BY THE OCTOBER 2017 CONSTRUCTION STANDARD DETAILS, THE 2015 OVERHEAD SIGNAL STRUCTURE AND FOUNDATION STANDARD DRAWINGS, MASSDOT TRAFFIC MANAGEMENT PLANS AND DETAIL DRAWINGS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK.

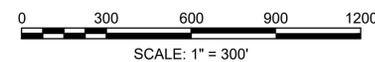
ALTERNATIVES ANALYSIS REPORT - APPENDIX 2

INDEX	
SHEET NO.	DESCRIPTION
1	TITLE SHEET & INDEX
2 - 3	TYPICAL SECTIONS
4	CONSTRUCTION PLAN
5	PROFILE
6 - 8	CROSS SECTIONS



DESIGN DESIGNATION (STREET/RTE # OR NAME)

DESIGN SPEED 25 MPH
FUNCTIONAL CLASSIFICATION LOCAL ROAD



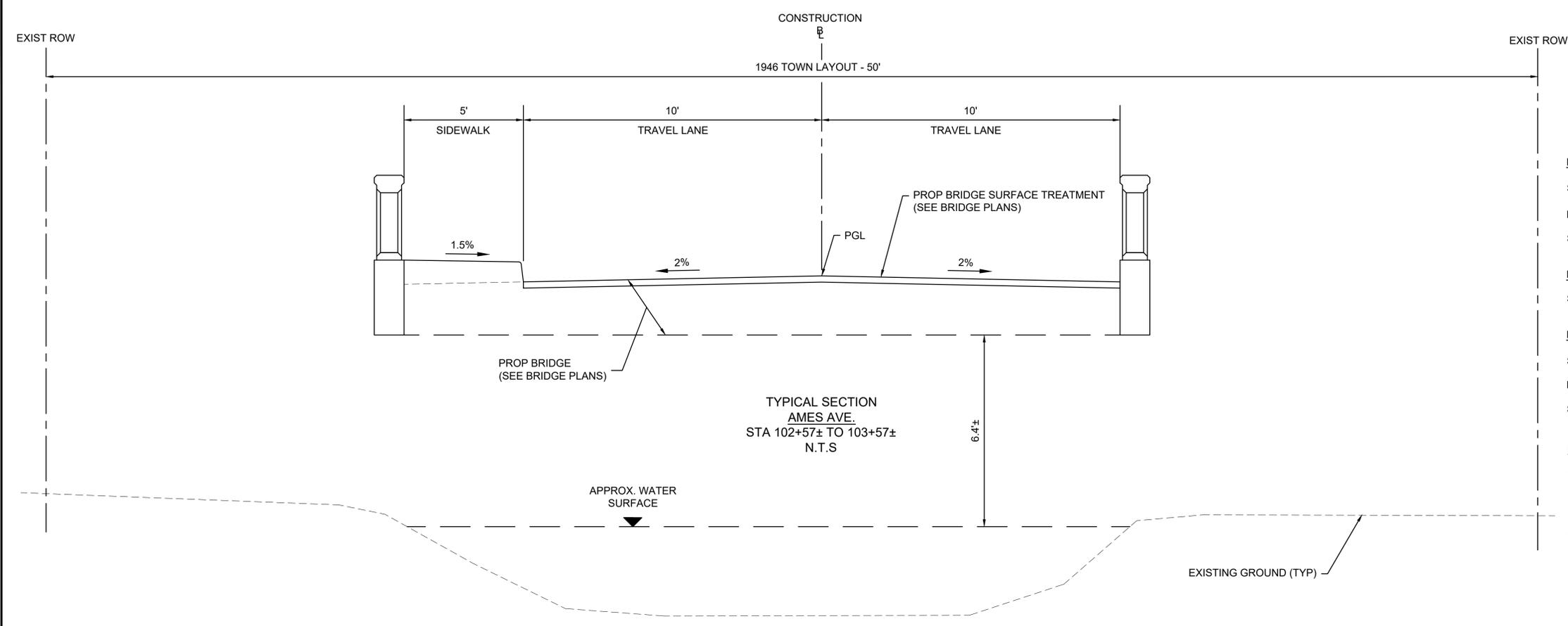
LENGTH OF PROJECT = 550.00 FEET = 0.104 MILES

DATE	DESCRIPTION	REV #
6/23/20	25% HIGHWAY DESIGN	0

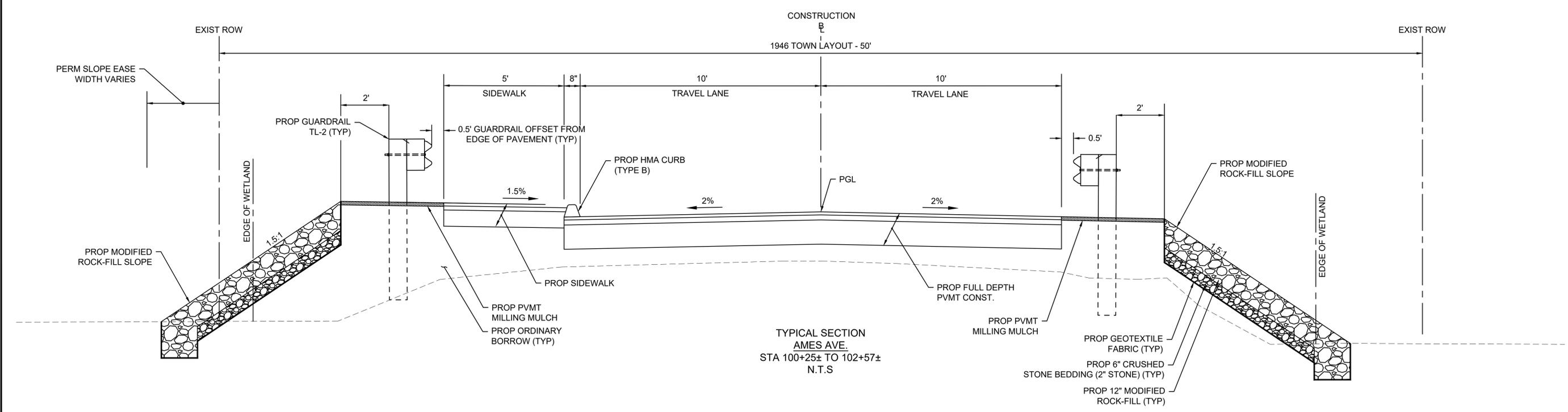


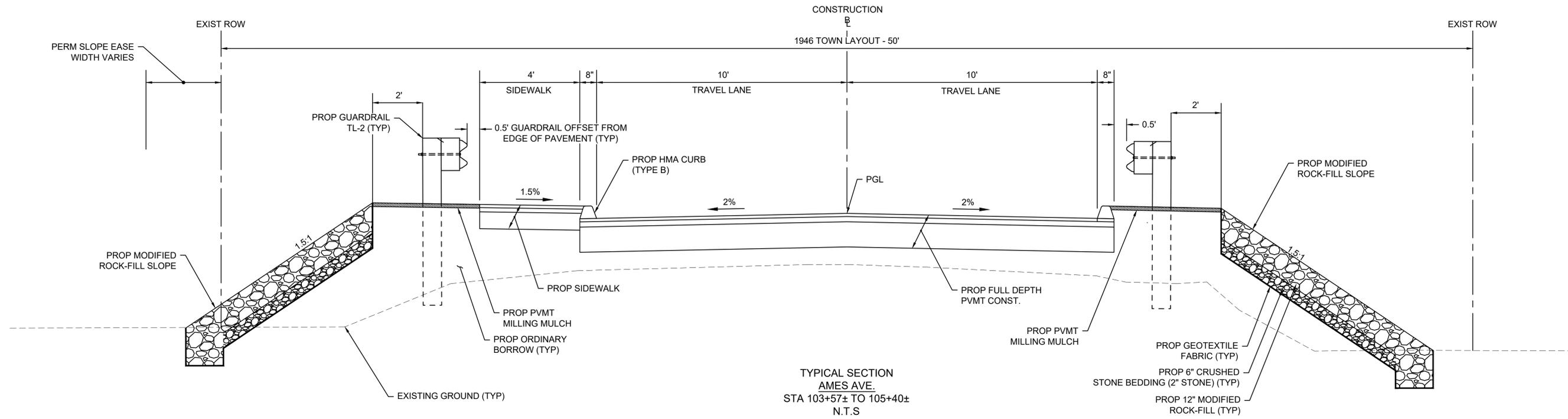
146 Dascomb Road Andover, MA 01810 978-794-1792	311 Main Street 2nd Floor Worcester, MA 01608 508-868-5104	169 Ocean Blvd, Unit 3 PO Box 249 Hampton, NH 03842 603-601-8154
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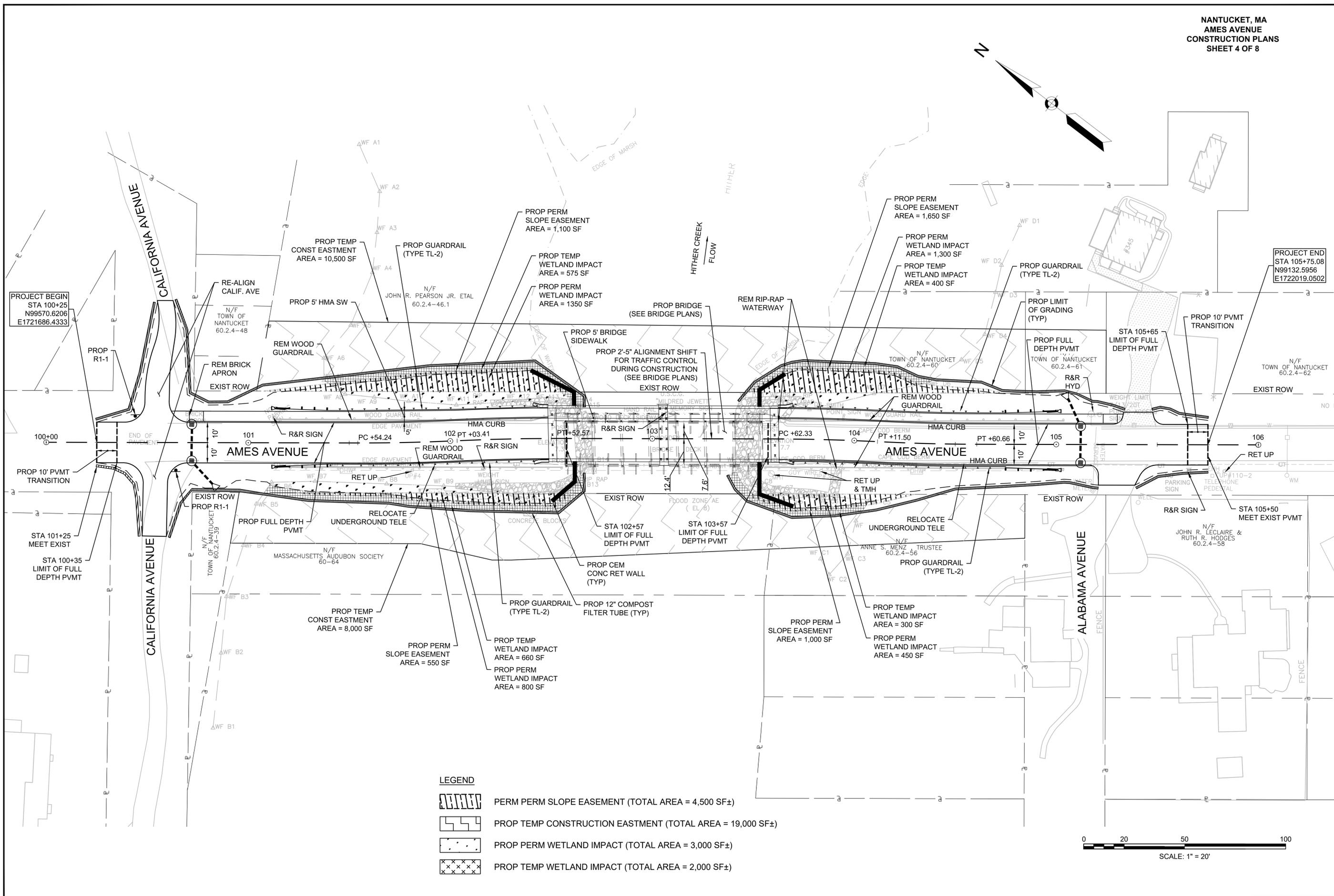
www.TheEngineeringCorp.com



- PAVEMENT NOTES**
- PROPOSED FULL DEPTH PAVEMENT - ROADWAY**
- SURFACE: 1 1/2" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) OVER
- INTERMEDIATE: 2 1/2" SUPERPAVE INTERMEDIATE COURSE - 19.5 (SIC-19.5) OVER
- SUB-BASE: 12" GRAVEL BORROW, TYPE b (COMPACTED)
- PROPOSED FULL DEPTH PAVEMENT - BRIDGE**
- SURFACE: SEE BRIDGE PLANS
- PROPOSED HMA SIDEWALK**
- SURFACE: 1 1/2" SUPERPAVE SURFACE COURSE - 12.5 (SSC-12.5) OVER
- INTERMEDIATE: 2" SUPERPAVE INTERMEDIATE COURSE - 19.5 (SIC-19.5) OVER
- SUB-BASE: 8" GRAVEL BORROW, TYPE b (COMPACTED)
- GENERAL PAVEMENT NOTES:**
1. ASPHALT EMULSION FOR TACK COAT SHALL BE APPLIED BETWEEN ALL ASPHALT SURFACES AND SAWCUT JOINTS BEFORE PAVING. HMA JOINT SEALANT SHALL BE APPLIED TO ALL COLD JOINTS (LONGITUDINAL AND TRANSVERSE) BEFORE PAVING SURFACE COURSE.
 2. ALL GRAVEL BORROW MEETING SPECIFICATION SHALL BE RETAINED IN PLACE, COMPACTED, AND LEVELED AS REQUIRED.
 3. * GEOTEXTILE FABRIC FOR STABILIZATION SHALL BE PLACED ON 2:1 SLOPES







PROJECT BEGIN
STA 100+25
N99570.6206
E1721686.4333

PROJECT END
STA 105+75.08
N99132.5956
E1722019.0502

LEGEND

	PROP PERM SLOPE EASEMENT (TOTAL AREA = 4,500 SF±)
	PROP TEMP CONSTRUCTION EASTMENT (TOTAL AREA = 19,000 SF±)
	PROP PERM WETLAND IMPACT (TOTAL AREA = 3,000 SF±)
	PROP TEMP WETLAND IMPACT (TOTAL AREA = 2,000 SF±)

