Spaulding Turnpike Improvements Newington-Dover

NHS-027-1(37), 11238

Table of Contents

Who's Who of Newington-Dover

Mr. Keith Cota, PE
Chief Project Manager
New Hampshire Dept. of Transportation
Phone: (603) 271-1615
Email: KCota@dot.state.nh.us

Mr. John Corcoran, PE
Administrator, Bureau of Turnpikes
New Hampshire Dept. of Transportation
Phone: (603) 485-3806
Email: JCorcoran@dot.state.nh.us

Ms. Nickie Hunter, PE
District Construction Engineer
New Hampshire Dept. of Transportation
Phone: (603) 271-2571
Email: NHunter@dot.state.nh.us

Mr. Marc Laurin
Senior Environmental Manager
New Hampshire Dept. of Transportation
Phone: (603) 271-3226
Email: MLaurin@dot.state.nh.us

Mr. Peter Clary, PE
Consultant Project Manager
Vanasse Hangen Brustlin, Inc.
Phone: (603) 391-3900
Email: PClary@vhb.com

New Hampshire DOT

www.Newington-Dover.com

CONSTRUCTION FORGES ON WITH MORE TO COME

The construction improvements along the Spaulding Turnpike from Exit 1 through Exit 6 have been ongoing since 2010 and dramatic changes are evident in Newington and over Little Bay. The completion of the new Little Bay Bridge (LBB) in 2013 now has traffic on it, and the new full service interchange at Exit 3 is open. These improvements provide increased access and safety to the seacoast region and locally in Newington. The primary safety improvements include the widening of the shoulders along the turnpike and on the Little Bay Bridge with access improvements in providing a secondary access point to and from the Pease International Tradeport via Exit 3. Once the ongoing construction work in Newington is completed this spring construction will shift to Dover. The Dover improvements are scheduled to begin this fall and will continue for several years. In addition, the rehabilitation of the existing Little Bay Bridge will continue into 2017. Once all of the construction is completed, the full impact of the improvements will be seen through increased mobility and safety through the area. The following articles provide specific update on the ongoing and upcoming construction contracts and some interesting aspects of the overall Newington-Dover Project.

CONTRACT M and O UPDATE

Contract M Construction Almost Complete

The construction of the improvements associated with Contract M, which have been ongoing for the past 3 years, are coming to an end. The contractor for the contract, Alvin J. Coleman & Son, Inc. has transformed the landscape in Newington over the last 3 years including the major traffic shift of traffic onto the new Little Bay Bridge that was constructed in Contract L. The traffic shift onto the new Little Bay Bridge provides a less stressful driver experience due to the wider shoulders and allows for the existing Little Bay Bridge to be rehabilitated as part of Contract O. Additional construction milestones for the contract include:

- Prepare Spaulding Turnpike in Newington for future four lanes of traffic in each direction north of Exit 3 (to be completed in Contract Q)
- Closure of Exit 2 – traffic can now access the Spaulding Turnpike and the Exit 2 area via Exit 3
- Completion of improvements at Exit 3 to provide full access to Woodbury Avenue, the Spaulding Turnpike and Arboretum Drive into the Pease Development Authority
- Completion of the permanent improvements for the Exit 4 southbound ramps, the northbound off ramp and a temporary interim northbound on ramp
- Improvements along Woodbury Ave and Arboretum Drive to accommodate projected traffic volumes
- Completion of the wetland mitigation of Railway Brook
- Construction of several wet extended detention ponds to address water quality and peak stormwater flows

Continued on page 2.

CONTRACT M and O UPDATE, Con't

A significant part of Contract M remaining is the wet extended detention pond alongside the Exit 3 Northbound On-Ramp. Completing this pond will allow us to finish all the drainage work that remains on the project, start removing our temporary systems, and then focusing on all the finishing touches that go into a project of this size.

The new 'ponds' you see along the new roadway are what we refer to as BMP (Best Management Practices) ponds. A key part of maintaining a safe roadway is good drainage; and a key part of good, environmentally friendly, drainage is good filtering. Most of the water in the corridor will go through one of these BMP ponds at some point, where the debris, sediments, and pollutants are collected and filtered out. In this way, we can ensure a dry safe roadway, and allow water to exit the area without carrying harmful contamination.

The largest task remaining to be completed however is paving the Wearing Course of pavement on all the new roadway we've installed. Typically on a major roadway there are three courses of pavement: Base, Binder, and Wearing. Most of the contract has only Base and Binder so far, which is perfectly safe to drive on for a short duration. In order to have our roadways last for decades, we'll be applying the Wearning Course project-wide this spring, when conditions are more suitable for installation. All the remaining work for Contract M is scheduled to be completed by May 20, 2016.

Contract O Construction Ongoing

The shift of traffic onto the new Little Bay Bridge has allowed for the existing Little Bay Bridge construction work to commence. The contractor, R.S. Audley, Inc., began construction in the spring of 2015, which has primarily consisted of the following:

- Installing shielding under the old northbound bridge, concrete deck removal, replacement and rehabilitation of both abutments (Dover and Newington ends)
- The existing structural steel was removed on the ends of the bridge to facilitate the rehabilitation of the abutments.
- The bridge seats, where the structural steel girders reside, have been rehabilitated on 5 of the 8 piers.
- Vertical repairs to the face of the existing concrete piers.

A new concrete deck is going to be placed over the 4 easterly existing structural steel girder lines this summer. This deck will serve as a work platform for setting new structural steel (6 girders lines) between the existing bridge and the new Little Bay Bridge constructed in Contract L. The anticipated construction completion date for Contract O is fall 2017. Traffic will not be shifted onto this bridge once it is completed as the roadway approach work within Contract Q needs to be completed prior to this traffic shift. For additional details on Contract O and Contract Q, refer to the Fact Sheets within the newsletter.

Contract M - Southbound Construction at Exit 3

Contract O - Existing Little Bay Bridge over Wentworth Terrace

Contract M - Reconstructed Railway Brook

Contract O - Existing Little Bay Bridge Structural Steel and Utility Pipes

General Sullivan Bridge Advances to Preliminary Design

The last construction contract for the Spaulding Turnpike Improvements project in the Town of Newington and City of Dover is the General Sullivan Bridge, Contract "S". This iconic metal truss has served these communities and other travelers in the region since 1934 when it carried vehicular traffic, and later in the 1980s when it was limited to non-vehicular use after construction of newer steel girder bridges to the east. Currently in the design phase, this project will revitalize this important Little Bay crossing to maintain this critical connection for pedestrians, cyclists, and other recreational users.

The General Sullivan Bridge is considered one of the most significant historic bridges remaining in the State of New Hampshire. Designed in early 1930's, the bridge is an early example that uses continuous span arrangements. This bridge configuration, although more complex to design, afforded a reduction in material weight and an enhancement in aesthetics with incorporation of more slender elements and shallower truss depths. Today, this bridge is not only recognized for its significance in New Hampshire but it is also iconic in the culture and history of bridge design and construction in this country.

The bridge is 1,528 feet long with nine spans supported by concrete piers that are faced with granite. The existing deck is approximately 32 feet wide. The main spans (4 through 6) include a partial thru-truss where portions of the deck are above the truss and portions of the deck go through the truss with lateral bracing overhead. The approach spans include trusses that support the deck from below.

In 2014, the VHB Design Team completed a detailed inspection and structural analysis of the General Sullivan Bridge. Inspectors used ropes and other special equipment to obtain a close-up view and "hands-on" level of observation and assessment of the bridge condition to quantify the repairs and reconstruction required. In addition, under-water inspections and testing of submerged concrete have been performed to provide comprehensive information in the study of this bridge. A follow-up inspection of the truss and decking is scheduled in 2016 to monitor deficiencies and verify observations from the previous inspection.

Based on inspection findings, consultants analyzed the truss and supporting deck for pedestrian use or potential maintenance vehicles. As a result of the structural evaluation, the Department installed fencing along the bridge deck to limit the pathway to middle of the bridge where support members are in better condition.

Preliminary design includes the evaluation of different rehabilitation alternatives that consider and compare historic characteristics, cost, functionality, maintainability, durability, environmental impacts, maintaining pedestrian and vessel passage, and construction duration. Alternatives will also include two different deck widths that are narrower than the existing to reduce cost and loading of the bridge members.

The public will serve an important role in providing valuable input and feedback as a preferred alternative is selected for preliminary plans and eventually for final design and construction. Through public meetings and consultation with resource agencies, the Department and the VHB Design Team will work to seek consensus in developing and delivering the right project for General Sullivan Bridge and the people it serves.

Reduced Width General Sullivan Bridge

Iconic Metal Truss of General Sullivan Bridge

Bridge Inspection Activities at Low Tide

The Newington Construction Project

Contract O Project Fact Sheet

Contract Description:

This contract involves the rehabilitation and widening of the existing Little Bay Bridges that carry the Spaulding Turnpike (NH Route 16) over Little Bay in Newington and Dover. The bridge has an overall length of 1,588 feet with nine spans over Little Bay and Wentworth Terrace. Once this contract is finished and subsequent Contract Q is completed, the rehabilitated bridge will carry four lanes of northbound traffic and the new bridge constructed in Contract L will carry four lanes of southbound traffic. The 11238-O contract includes the following work:

- Repairs to existing piers and application of protective concrete coatings
- Construction of new abutments in Newington and Dover
- Construction of 105 feet of new retaining wall along Wentworth Terrace near the Dover abutment.
- Rehabilitation and retrofits of four steel girders
- Construction of five new steel girders
- Installation of new bridge support shoes at all girders
- Construction of a new concrete deck and asphalt wearing surface
- Construction of new bridge railings and traffic barriers
- Installation of new bridge roadway lighting
- Installation of new navigational lighting and channel clearance signs
- Construction of limited approach roadway and drainage at bridge ends
- Resurfacing 700 feet of Wentworth Terrace under the bridges

Construction Data

Construction Bid Price.....$20,444,479.01

Total Construction Cost (including Engineering).....$23,427,000.00

Contractor: R.S. Audley, Inc., Bow, NH

NHDOT Construction Office: 25 Nimble Hill Road, Newington, NH

Completion Date: September 15, 2017
Final traffic shifts for NB and SB traffic will be completed in Contract Q.

Maintenance of Traffic

Spaulding Turnpike
Existing travel lanes maintained at all times except for limited temporary lane and/or shoulder closures as approved by the Engineer.

Wentworth Terrace
Existing travel lanes maintained at all times except for limited lane closures associated with abutment construction and short-duration (15 minutes) shutdowns when overhead construction or demolition is required.

Marine Traffic
Maintain clear navigational channel in accordance with the US Coast Guard requirements.

Hilton Park

- The boat launch at Hilton Park will remain open during construction
- The sidewalk along Wentworth Terrace that connects Hilton Park beneath the General Sullivan and Little Bay Bridges will remain open except as noted above for Maintenance of Traffic.

Environmental

- Permits have been obtained and coordination efforts have occurred with EPA, USACOE, USF&G, USCG, NHDES, NHDHR, NHF&G and local conservation commissions during construction
- The contract has conditions that address Water Quality, Erosion Control, Sediment, Soils and Invasive Species Management

The Newington Construction Project

Contract Q Project Fact Sheet

Contract Description:

This contract involves the widening and reconstruction of the Dover segment of the Spaulding Turnpike (NH Route 16) with minor improvements in Newington. The contract begins approximately 1,000 feet south of the Exit 3 Northbound On Ramp in Newington, and continues 3.2 miles north to approximately 0.5 miles north of the Dover Toll Plaza. The widening in Dover will occur through extensive traffic management on the existing, temporary and proposed northbound (NB) and southbound (SB) lanes. The proposed four lanes in both directions over the Little Bay Bridges (LBB) will be reduced to three lanes at the interchange at Exit 6. The NB and SB lanes will be separated by single slope concrete median barrier. Proposed noise abatement wood sound walls will be provided along the NB and SB lanes beginning north of the LBB and continuing to Route 4 at Exit 6 and beginning again north of Route 4 and continuing approximately 0.5 miles north of the Dover Toll Plaza. The work in Newington involves Spaulding Turnpike improvements to complete the NB lanes and the Exit 4 NB on ramp. The completion of this project will shift traffic into the final proposed configuration, including the opening of the NB LBB being constructed as Contract O. The contract also includes the following work:

- Closure of the Exit 5 ramps and the NB on ramp from the Dover Point Road East neighborhood
- Completion of the Wentworth Terrace roadway improvements with the closure of the Exit 5 ramps
- Construction of a new full access interchange at Exit 6 including the replacement of the Route 4 bridge over the Spaulding Turnpike
- Construction of 5 Best Management Practices stormwater basins for water quality improvements and peak flow mitigation
- Pavement rehabilitation and signal improvements on Woodbury Avenue
- Route 4 roadway reconstruction including a roundabout at the intersection with Boston Harbor Road and Spur Road
- Pavement rehabilitation and sidewalk improvements to Boston Harbor Road and Dover Point Road West
- Spur Road realignment and reconstruction
- Pavement rehabilitation and cul-de-sac construction on Dover Point Road East
- Reconstruction of water and sewer infrastructure
- Landscaping improvements at specific locations within the project limits
- Construction of Intelligent Transportation Systems. including extensive Smart Work Zone devices within, and outside of, the project area to help mitigate construction activity effects to traffic flow

Construction Data

Anticipated Construction Advertising Date.....May, 2016

Anticipated Construction Start Date: .....September, 2016

Anticipated Intermediate Completion Date #1 – Summer 2017

Completion of the WoodburyAvenue roadway and signal improvements Summer 2017

Anticipated Intermediate Completion Date #2 – Fall 2017

Completion of the soundwalls north of the Dover Toll Plaza Fall 2017

Anticipated Construction Completion Date.....Summer 2020

Anticipated Roadway Closures and Openings

Exit 6E NB Off Ramp

This ramp is being closed to allow for the construction of the proposed two lane off ramp. The existing off ramp traffic will be relocated to the Exit 6W ramp which will be widened to a two lane off ramp with a temporary signalized intersection with Route 4 and Dover Point Road East.

Exit 5 Ramps

The Exit 5 ramps are being closed permanently. It is anticipated that the closure will occur in the fall of 2018.

Little Bay Bridge NB

It is anticipated that the rehabilitated bridge will be opened to traffic in the spring of 2019.

Exit 6

It is anticipated that the full service interchange will be opened in the fall of 2018.

Hilton Park

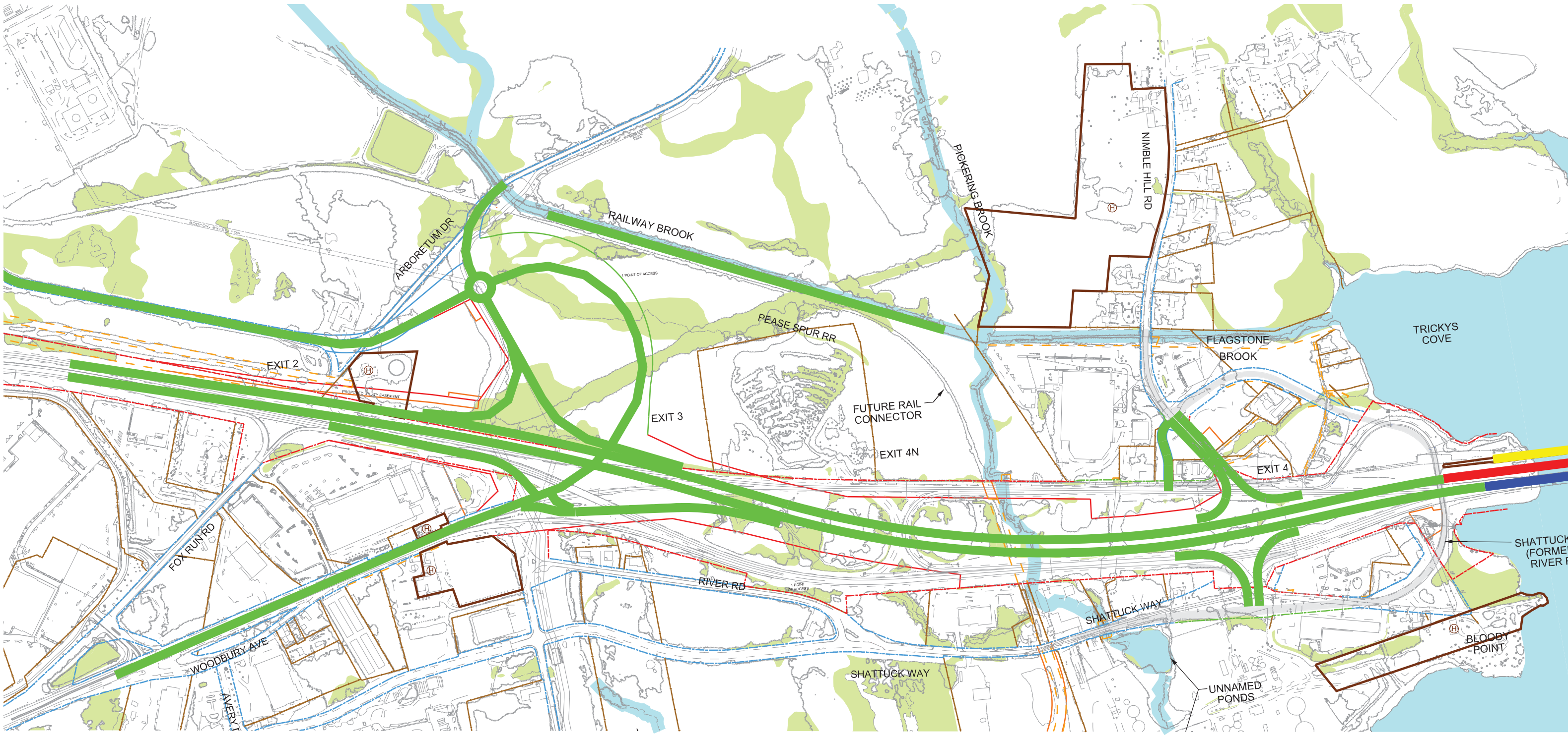
- The boat launch at Hilton Park will remain open during construction

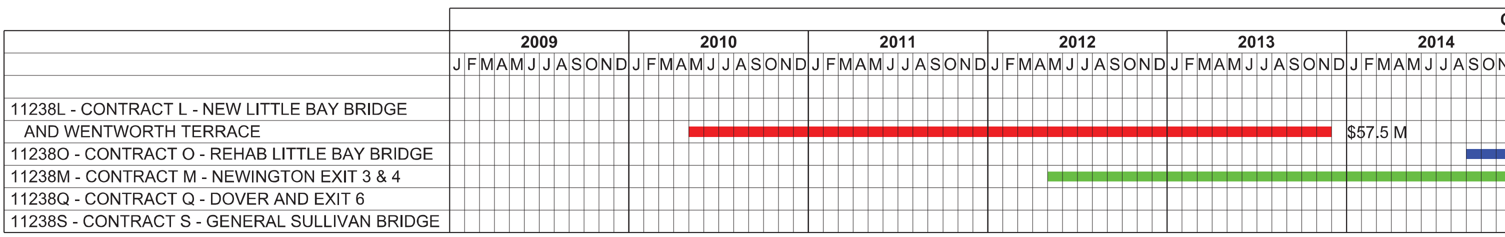
Geotechnical

- Settlement periods up to 90 days are required to provide necessary time to consolidate the existing marine clay deposits

Environmental

- Permits have been obtained and coordination efforts have occurred with EPA, USACOE, USF&G, USCG, NHDES, NHDHR, NHF&G and local conservation commissions during construction
- The contract has conditions that address Water Quality, Erosion Control, Sediment, Soils and Invasive Species Management





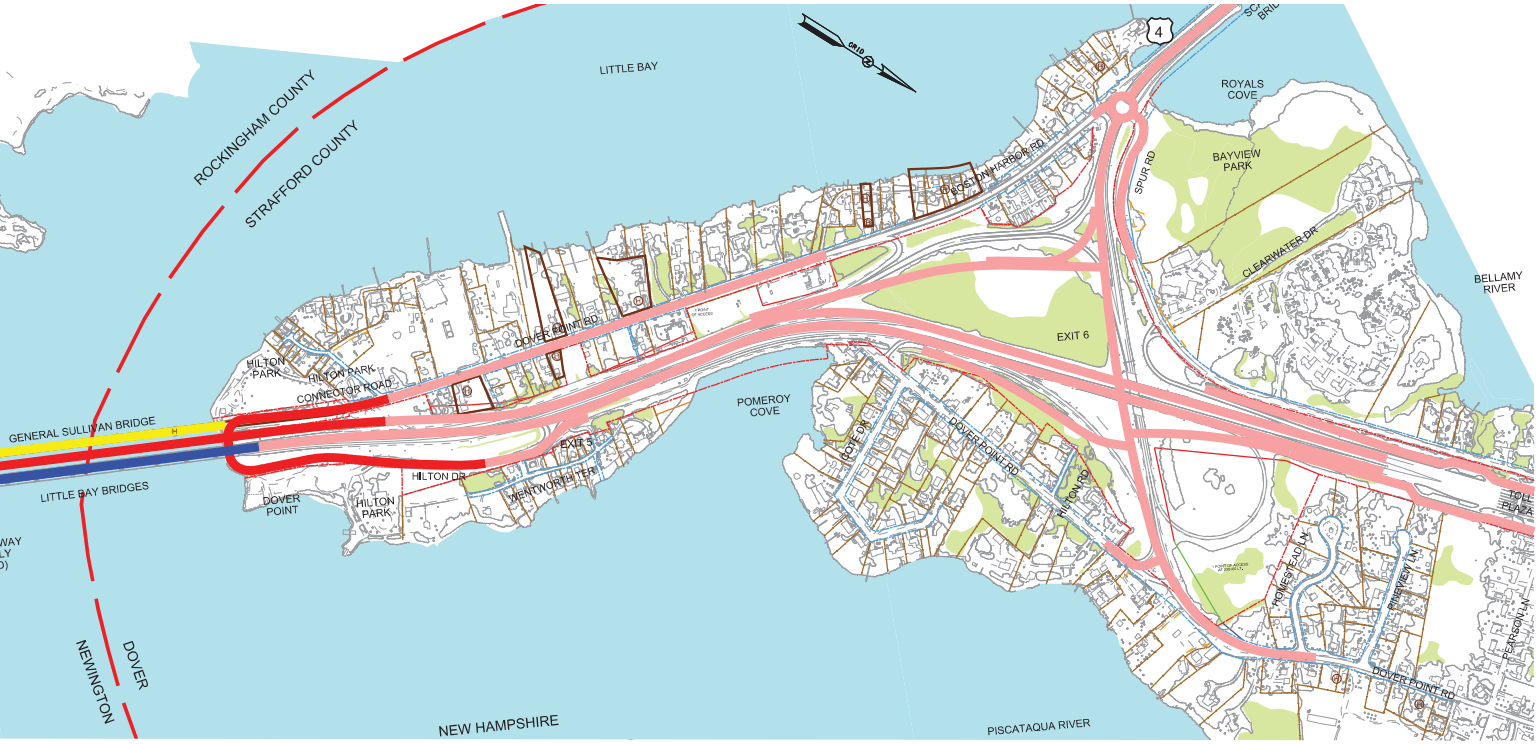
NOTE: CONSTRUCTION SCHEDULE INCLUDES ADVERTISING, BID PERIOD, AND CONSTRUCTION DURATION
COSTS ARE DEPICTED IN 2015 DOLLARS.

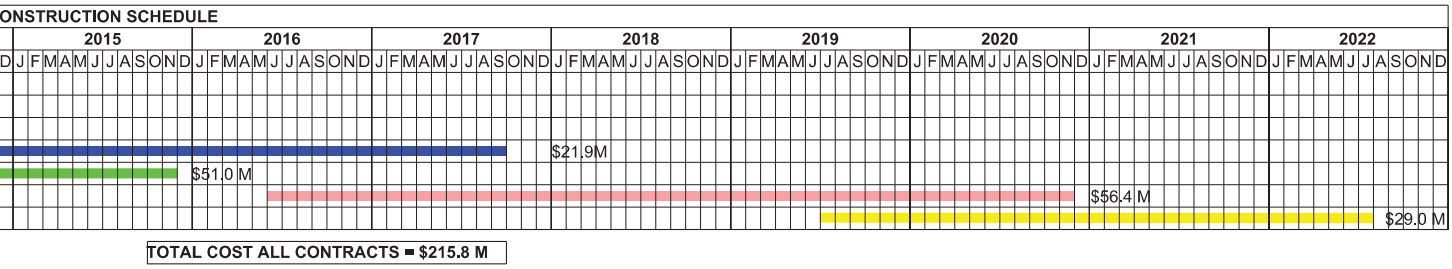
CONSTRUCTION CONTRACT BREAKOUT

The Department and the VHB Design Team have worked collaboratively to identify the construction contract breakout plan that allows for the efficient progression of construction. This $270M project has significant utility and geotechnical challenges that required extensive coordination to identify the critical path for construction sequencing and scheduling. The relocation of several critical gas pipes in Newington and Dover requires unique construction methods to maintain service and minimize down time in switching over to the new pipes. The geotechnical challenges in Dover were unique and required a special test embankment and settlement program so that the engineers could determine the extent of the settlement that could be expected over time. This information was utilized in developing a cost effective solution considering the overall construction schedule and maintaining the existing the existing drainage, water, and sewer facilities that cross the Spaulding turnpike in several locations. The initial schedule for the construction contract breakout plan has been modified based on the information as it became available. The construction costs for each project have also been modified based on actual construction costs and updated construction cost estimates based on the latest information.

CONTRACT L

This Contract's major element was the construction of the proposed Little Bay Bridge (LBB), which is located between the existing LBB and the General Sullivan Bridge (GSB). Wentworth Terrace was constructed and opened to two-way traffic from the west side of the Spaulding Turnpike beneath the LBB and tied into the existing roadway prior to the exit 5 ramps, which remain open today. The pedestrian & bicycle bridge structure was constructed to provide access to the GSB from Hilton Park. This required modifications to the GSB Dover abutment. The proposed SB barrel of the Spaulding Turnpike was constructed from just north of the Shattuck Way bridge to the LBB in Newington. The proposed SB barrel of the Spaulding Turnpike was constructed from the LBB in Dover approximately 800 feet north stopping just short of the existing Spaulding Turnpike. This contract was completed in the fall of 2013 with the shift of SB and NB traffic onto this new bridge in 2015.





CONTRACT M

Contract M constructs the entire Exit 3 interchange, discontinues Exit 2, constructs the Spaulding Turnpike from the southerly limit of work to the Exit 4 area and completes the Exit 4 SB ramps and the NB off ramp to their final condition. The Exit 4 NB on ramp requires an interim match to the proposed SB barrel of the Spaulding Turnpike while the existing LBB is being rehabilitated. The interim roadway connection of the proposed Spaulding Turnpike in Dover to the existing Spaulding Turnpike occurs in this contract along with the reconstruction of the Exit 5 ramps. These connections provide for the SB and NB barrels to be shifted onto the proposed LBB that was constructed in Contract L.

CONTRACT O

This Contract rehabilitates the existing LBB while the traffic is shifted on the proposed SB LBB constructed in Contract M. Minor roadway approach work along the Spaulding Turnpike is also included within this contract. At the completion of this contract, the contractor for Contract Q will be responsible for shifting traffic back onto the rehabilitated bridge.

CONTRACT Q

Contract Q completes the majority of the Spaulding Turnpike improvements in Dover, discontinues Exit 5, completes Exit 6, constructs the soundwalls north of Exit 6 and completes the Exit 4 area for the NB barrel in Newington. Contract Q shifts the NB traffic into its final condition onto the rehabilitated LBB and opens the SB barrel over the LBB.

CONTRACT S

Contract S rehabilitates the General Sullivan Bridge for pedestrian and recreational users. The rehabilitation of this bridge requires that it be closed to allow for construction to be completed in a cost efficient manner. The Department is considering on providing a shuttle service for pedestrians and bicyclists to get across Little Bay. The details of the shuttle service such as pick-up and drop-off locations, time of service, etc. are to be determined during the final design and public involvement process.

The Dover Test Embankment

The Dover Test Embankment (See article on page 3 of the February 2013 newsletter - Geological History and Affects on the Project.) provided a unique opportunity to assess the engineering properties of glacial marine (soft clay) soils on New Hampshire's seacoast, and it resulted in important design changes to the Spaulding Turnpike widening project in Dover. In the three years since the embankment's construction, the NHDOT with assistance from UNH research staff and students have performed a comprehensive amount of field and laboratory testing to gain a more complete understanding of the thick clay deposit found in the Dover area. Clay is one of several soils deposits at the site, but the most problematic soil deposit in terms of constructing the expanded highway, ranging up to 74 feet in thickness and having a consistency of "flowing pudding".

As described in the February 2013 newsletter, soft clay soil will settle and take an inordinate amount of time (years) doing so when something new is built over the deposit. The net result is vertical settlement at the ground surface. For example, when the 12 foot high Dover Test Embankment was in place for only 4 months, ground settlement was measured at 9.5 inches. The most recent measurement in January 2016 showed that total ground settlement has reached 19 inches at the same location. Settlement under the 18 foot high section (Segment #4 of the Test Embankment), which was newly constructed at the time of the February 2013 newsletter, has exceeded 25 inches to date.

If not managed properly in the project's design, slowly occurring ground surface settlement could cause construction scheduling delays and significant long term maintenance problems for the new roadway. The primary engineering tool in addressing this problem is through the installation of closely spaced prefabricated vertical drains (PV-Drains). In addition, the project plans have been modified in important ways to better handle the expected and unavoidable ground settlement.

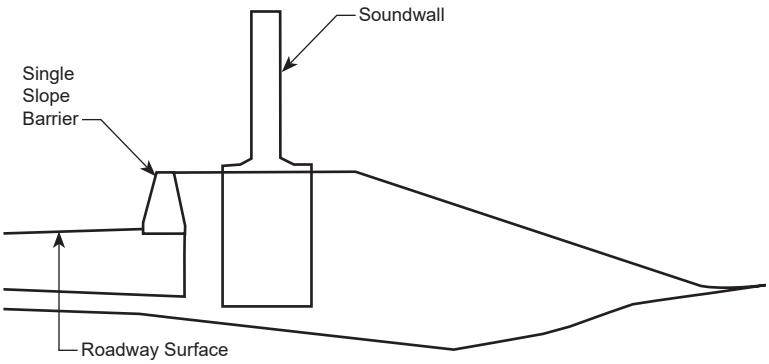


Figure 1: Initial Single Slope Concrete Barrier Concept

Roadway

One early design concept affected by the long-term ground settlement issue was the concrete traffic barriers on the outside edges of the highway. The concrete barriers would have had earth fill behind them with a sound barrier wall built on the fill in many locations (**see Figure 1**).

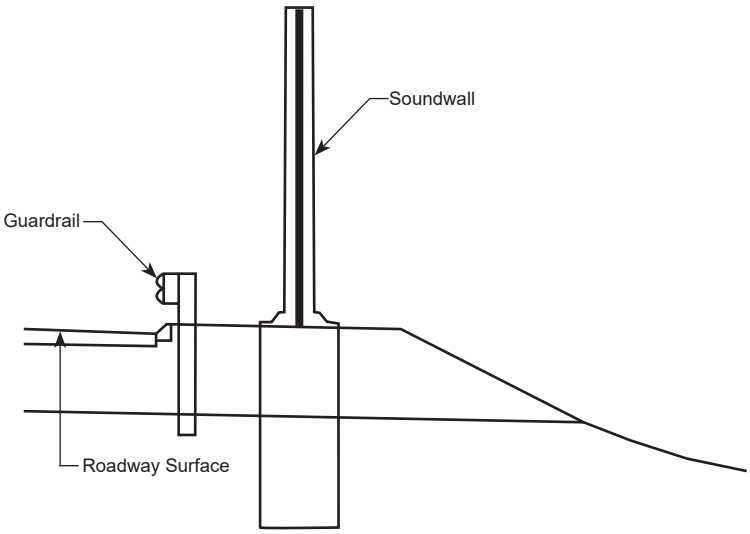


Figure 2: Revised with Beam Guardrail

This configuration would have resulted in the construction of higher roadway embankments. After considering the long-term settlement issue at the site, the NHDOT design team worked with the VHB design team to modify this configuration to reduce embankment heights significantly. The design was changed to beam guardrail in front of the sound barrier wall, dropping embankment heights about 3 feet (**see Figure 2**).

Bridge

The US Route 4 Bridge over the Spaulding Turnpike will be replaced by a new, wider bridge. To address ground settlement at the site, NHDOT geotechnical engineers proposed the use of a ground treatment called high modulus columns for the abutments on either side of the Turnpike. High modulus columns are constructed by advancing a specialized drill head into the ground, then injecting pressurized cement grout through it into the ground surrounding the drilled hole (**see Figure 3**). The installation of a regular pattern of high modulus columns provides a way to transfer large bridge loads through weak soils (in this case, the glacial marine deposit) to a deeper, competent bearing layer. The central bridge pier, located between the Turnpike's northbound and southbound roadways, will have a conventional steel pile foundation. Fortunately, there are no settlement issues at the pier location because there are no new embankments being constructed at that location.

Retaining Walls

There are a number of earth retaining wall structures proposed at different points along the project. The long-term ground settlement issue resulted in many changes to the retaining wall designs, including the complete elimination of two walls. The reduced embankment heights resulting from the change of single slope barrier to beam guardrail mentioned above made these two walls unnecessary. A combination of mechanically stabilized earth (MSE) and gravity walls will be used on this project. Selection of the wall type is dependent on wall height and subsurface conditions.

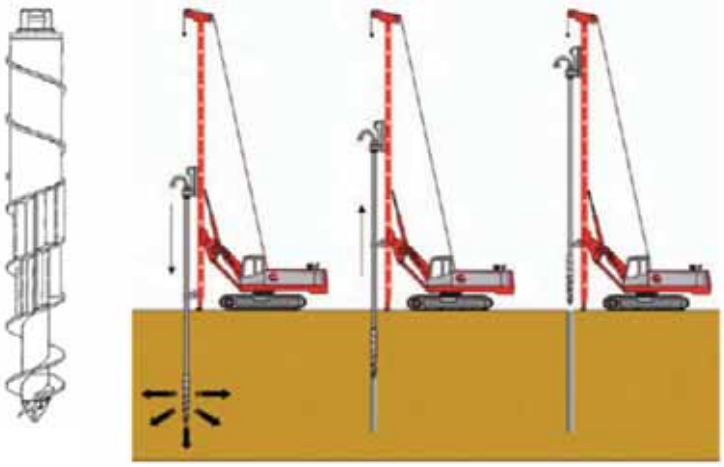


Figure 3: High Modulus Column Construction Sequence

An MSE wall consists of segmented concrete facing panels connected to metal strips buried in the earth fill behind the facing panels. An MSE wall can settle and flex without adversely affecting its performance or service life. An MSE wall system was used for the abutment construction of the Woodbury Avenue Bridge over the Turnpike on the Newington side of the project, and similar MSE walls will be used for the US Route 4 Bridge abutments. The 10 foot height of the wall adjacent to the Division of Motor Vehicles (DMV) raised concerns about excessive long term settlement. To mitigate this potential problem, an MSE wall with lightweight aggregate backfill, which weighs less than half of conventional backfill, will be used to reduce ground pressure at the base of the wall (**see Figure 4**).

Utilities

Buried utility lines including water, sewer, gas and storm drains are another aspect of the project that required much discussion between the NHDOT and VHB design teams. Ground settlement is expected to affect both new and existing utilities in the ground, because it results in damaging stresses on utility lines, possibly causing them to fail prematurely or break catastrophically. For example, discussions about the ground settlement issue between NHDOT, VHB and the utility company, Unitil, prompted them to relocate their gas line from its current location in Dover to outside the planned construction limits. With a new utility installation, there are several options available to engineers when contending with a ground settlement problem. One option is to delay utility installation until after ground settlement has occurred, or has been mitigated. Another approach is to place the utility in an oversized steel pipe sleeve before the ground has settled, with the idea being only the sleeve experiences the settlement leaving the utility line intact. With an existing utility, there are fewer options and replacement is often the only viable one. In these cases, it is not uncommon for a temporary utility service to be set up until the permanent replacement can be installed, once the ground settlement is not a concern. A combination of the above approaches will be used on the project.

Conclusion

The ground settlement information gathered at the Dover Test Embankment has benefited the Newington-Dover project in several ways. One immediate benefit is that the ground settlement at the future Exit 6 On-Ramp, 19 inches so far underneath the 12 foot high embankment, will have already been achieved. Construction scheduling and phasing of the project has been adjusted to account for the ground settlement treatment in other areas of the project. Finally, the design of the project itself has evolved to deal with the ground settlement as it became better understood by the design teams. In a greater scope, engineering properties learned about the soft clay at the Dover Test Embankment can be applied to future NHDOT projects.

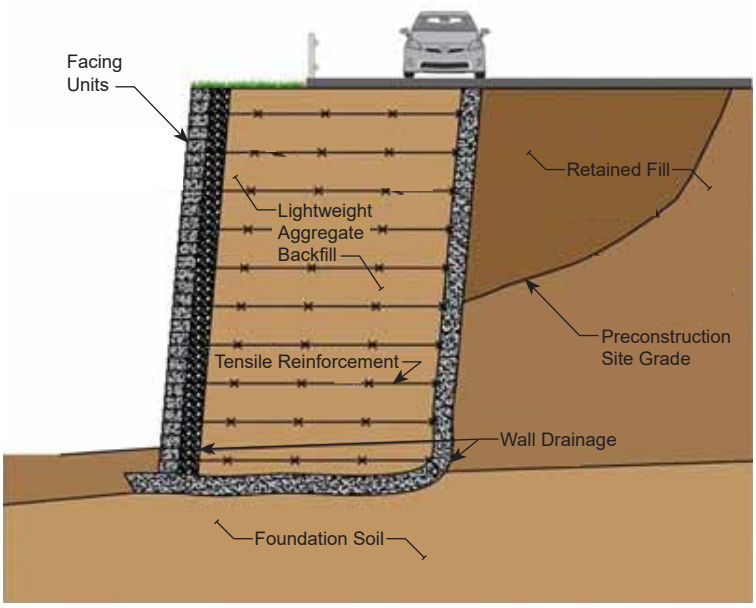


Figure 4: Mechnically Stabilized Earth Wall

What Makes a Work Zone Smarter?

What makes a work zone smarter? In a word, technology. By employing state-of-the-art technology, a typical freeway construction work zone can be improved. When you combine highway sensors with computers and a communication system, you get what we call a Smart Work Zone (SWZ) system. The application of a SWZ system, when properly implemented can:

- Provide real-time information to motorists to reduce their frustrations
- Alert emergency personnel to an incident so that it can be more quickly cleared off the highway
- Encourage drivers to take an alternate route when congestion increases
- Make work zones safer for both workers and motorists

Smart work zones are typically deployed for a particular construction project or for a series of projects in the same area, like the Spaulding Turnpike in Newington and Dover or I-93 from Salem to Manchester. The typical components of a SWZ system include highway sensors, changeable message boards, closed circuit television (CCTV) cameras and speed limit trailers. Often, these devices are mounted on portable trailers so they can be moved around the highway to where they are needed most, and then removed from the highway when the project is done. Sometimes these devices are so beneficial to the operations and maintenance of the highway that they are installed for use during construction and remain permanently to support traffic monitoring after construction is complete.

Portable Changeable Message Sign (PCMS) in a construction work zone

Portable CCTV Camera in a SWZ System

The brains of a SWZ system are the computers that control the flow of information. The highway sensors continuously measure the traffic flow and vehicle speeds along the roadway and send this information to the central computer. The central computer monitors the incoming information for patterns or unusual activity. When the sensors see normal highway conditions, the computer can translate that information to an estimated travel time through the work zone. This information is then posted to the changeable message boards so motorists driving through know what to expect ahead. The central computer is also monitoring for unusual activity such as a sudden reduction in speed that might indicate an incident on the highway. This is where the CCTV cameras come in. Once the computer system identifies an unusual highway activity, an operator at the central control system can view a CCTV camera to find the source of the activity, whether it is normal congestion or an accident. In the event of an incident that will impact traffic, the operator can change the travel time message to something more appropriate for the drivers, such as a suggestion for an alternate route or direction to the motorist:

ACCIDENT	USE
AHEAD	RIGHT
LEFT LANE	SHOULDER

If the computer is the SWZ system's brain, communications is the system's nerve center. A SWZ system relies on a high speed, high capacity communication system to pass real-time information between the highway equipment and the central computer. The SWZ is truly a system, with all components working together to provide reliable responses to real-time traffic operations.

In cases where congestion is expected due to the nature of the highway work, such as at lane closures, the SWZ system can be automated to provide specific information when traffic congestion reaches predetermined thresholds. For example, when the traffic sensors find that vehicle speeds have reduced from 55 mph to 45 mph, the central computer can post preprogrammed messages to the changeable message boards on the approaches to the work zone, and within the work zone, to let drivers know that the travel time through the work zone is longer than normal. This type of automated response can provide value to the motorist by providing real-time information about the expected delay through the work zone. Drivers are given information exactly where they need it, when they need it, to make decisions that are in their own best interest. These automated SWZ systems are relatively inexpensive to set up because they use devices on portable trailers, with solar power systems, cellular or radio communications, and computer algorithms that have been tested and proven in hundreds of work zones throughout the country.

When highway travel is predictable, it is also safer, both for the motorists and the construction workers. One of the biggest causes of construction zone crashes is unpredictable behavior. When drivers encounter unexpected brake lights in front of them on a highway, the natural reaction is to slow down quickly to assess the situation. All it takes is for one inattentive driver to be just a second too slow to react to have a rear-end crash in the work zone. Incidents in the work zone lead to more congestion, which can lead to secondary crashes. Providing quick responses to clear the initial incidents and preventing the crashes in the first place is a way that SWZ systems have improved the work zone environment in many states, including New Hampshire.

Portable Traffic Sensor along the Spaulding Turnpike

Construction workers are also safer when highway traffic behaves in a predictable manner. When drivers are caught by surprise through unexpected behaviors by the vehicles in front of them, some drivers will swerve to avoid the rear-end crash, only to enter the construction zone and injure construction workers just doing their jobs. The goal of the SWZ system is to provide better information to drivers and to make travel through the construction zone predictable. For these reasons, SWZ systems have proven their value to highway agencies like the New Hampshire Department of Transportation over and over again.

In addition to the information available to drivers on the highway, SWZ systems in New Hampshire also have a tool for predicting travel behaviors even before they leave home or the office. The New Hampshire Department of Transportation (NHDOT) has set up a series of project specific websites on the Transportation Management Center (TMC) homepage (www.nhtmc.com) that allows drivers to gather information before they get into their vehicles. On the home screen, there is a link to SWZ systems in New Hampshire construction projects, including the Spaulding Turnpike construction. Click the map icon located on the Spaulding Turnpike to see the current estimate speeds through the construction zones, and even read any messages posted to the changeable message boards. Additionally, be watching over the next year as NHDOT expands the SWZ system to include sections of US Route 4 approaching the Spaulding Turnpike.

For more information about SWZ systems in New Hampshire, feel free to contact the TMC at the Contact Us button on the homepage, or call the TMC, staffed 24/7, at 603-271-6862.

NHDOT Traffic Control Center

Frequently Asked Questions

Q. **Property Acquisition – When during the project development process can I expect to have the Bureau of Right-of-Way contact me for the impacts to my property?**

A. The property acquisitions for the entire project are essentially complete. The Department generally acquires properties prior to advertising the project for construction. With Contract Q scheduled for advertising in May 2016, these property negotiations have occurred and the final Right-of-Way certificate is pending. The remaining contract, Contract S – General Sullivan Bridge Rehabilitation, does not require any property acquisition.

Q. **Funding – Is the funding in place for construction of the remaining construction contracts?**

A. The current draft Ten Year Plan (2017 – 2026) includes construction funding for Contract Q – Dover and Exit 6 and Contract S – General Sullivan Bridge Rehabilitation. The review and anticipated approval of the Ten Year Plan through the legislative process is expected this spring.

Q. **Traffic Operations – When can we expect Exit 5 to be closed permanently and when will Exit 6 be opened with full access to and from the Spaulding Turnpike?**

A. The anticipated construction sequencing in Contract Q is for Exit 5 to be closed and for Exit 6 to be fully operational in the fall of 2018. However, the construction contractor has the ability to propose different construction sequencing to the Department and, if accepted by the Department, these dates could be modified.

Q. **Traffic Operations – When will traffic be shifted to the NB Little Bay Bridge?**

A. Construction completion for this bridge is anticipated to be done in September 2017. However, the construction sequencing for Contract Q does not allow for this traffic shift until the spring of 2019 where the Exit 4 NB on ramp will be placed on the bridge first. The northbound traffic will be shifted onto the bridge in the fall of 2019.

Q. **Soundwalls – When will the soundwalls be constructed in Dover?**

A. The soundwalls north of the Dover Toll Plaza will be constructed early in the schedule and are anticipated to be finished by fall of 2017. The remaining soundwalls will be constructed concurrently with the of the adjacent roadway construction to account for the geotechnical settlement conditions and construction access.

Q. **Traffic Operations – With construction in Newington ending and beginning later this year in Dover, are there other traffic management measures that are being proposed to assist in traffic control during construction?**

A. Yes. The Department has included additional real time traffic management equipment along the US Route 4 corridor within the Smart Work Zone package for Contract Q. You will see additional message boards and real time information starting near the Lee roundabout. This information will provide alternate routes and associated travel time.

Q. **What is the status of the General Sullivan Bridge Rehabilitation contract?**

A. Following additional inspections that were completed in 2016, more evaluation on the existing condition of the bridge are anticipated. In the coming year, rehabilitation alternatives will be developed for review with the stakeholders.