New Hampshire Bureau of Turnpikes
Renewal and Replacement Program Assessment

May 16, 2017

Performed by:

HNTB

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May 16 , 2017

John Corcoran
Administrator
New Hampshire Bureau of Turnpikes
36 Hackett Hill Road
Hooksett, NH 03106

Re: 2017 Renewal and Replacement Program Assessment

Dear Mr. Corcoran:

HNTB has completed the review and independent assessment of the Bureau of Turnpikes Renewal and Replacement (R&R) Program. This scope of services included the limited visual assessment of a sampling of the Turnpike facilities, review of the current R&R Program and the development of an independent R&R Program to provide recommendations for future appropriations.

The enclosed report outlines the methodology, assessment results and recommendations for future funding allocations. The approved NHDOT Ten Year Transportation Improvement Plan budgets $69.9 million for Turnpike R&R for FY 2018 to FY 2023 with an average annual expenditure of $11.6 million. HNTB recommends an R&R Program of approximately $81 million dollars for FY 2018 to FY 2023, for an average of $13.5 million annually. This additional funding is deemed necessary to maintain the Bureau's infrastructure in the appropriate condition as to serve the patrons of the Turnpikes, specifically addressing near-term rehabilitation improvements at the I-95 High Level Bridge, Paving, Administration Building Rehabilitation, Bridge Painting, and Toll Plaza Rehabilitation needs.

HNTB's limited visual assessment in 2016 shows that the sampling of Bureau of Turnpikes infrastructure inspected appears generally in "Good" condition. While the Turnpike system was deemed to be in overall "good" condition, some components of the Turnpike system are in need of attention and dedicated funding. There are also turnpike assets that are in good condition and deemed candidates for deferred funding during the peak demand of the I-95 High Level Bridge.

Consideration should be given, and our recommendations reflect the need for, allocation of portions of the overall programmed funding to address the needs of these aging portions of Turnpike facilities as identified during the recent visual inspections. The Executive Summary and subsequent report will expand on these recommendations.

Please do not hesitate to contact us if we can provide any further information.

Best regards,

HNTB Corporation

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EXECUTIVE SUMMARY

The New Hampshire Bureau of Turnpikes (Bureau) currently establishes and executes a program for Renewal and Replacement (R&R) projects as part of the continued maintenance of its infrastructure. This infrastructure includes roadway pavements, bridges, drainage structures, lighting, signage, guardrail and other associated components. Further this infrastructure includes maintenance facilities, toll plazas, rest areas, an administration building, and recreation area (Hilton Park). HNTB was contracted to review the current R&R Program and provide an independent assessment of the R&R needs for the Bureau infrastructure for all assets along the F. E. Everett, Blue Star and Spaulding Turnpikes. Consideration is also included in the report (but not part of the inspection activities) for the R&R associated with the Interstate 95 so-called "High Level" bridge between New Hampshire and Maine.

HNTB performed a visual assessment of a sample of the Bureau's assets in addition to gathering historical and projected R&R data from Bureau staff. The visual assessment was limited to a sampling of each of the aspects of infrastructure noted and was not intended to be a full inspection of all assets. Efforts were made in the planning process to identify representative samples that would demonstrate the range of deterioration of each asset type. Based on the portions observed, the Bureau's infrastructure is generally in good condition. "Good condition" also indicates that the general scope of R&R efforts by the Bureau to date have been sufficient to maintain the facilities observed. Good condition can generally be characterized as a state whereby that component is in appropriate working order to provide the necessary level of service and requires only the anticipated minor maintenance that would be expected in the life cycle. For perspective, components rated one step lower would be classified as "fair" and represent a state where some form of major maintenance is required to prevent the need for rehabilitation involving partial replacement. One step above "good" would be considered new or near new condition, requiring very little or no maintenance given the early stage in the life cycle.

The inspection findings confirmed that prioritization of future funding for R&R projects targeting the most necessary elements will continue to be critical for the future program. **In the near future, the most critical element to be addressed by the Bureau is the I-95 High Level Bridge over the Piscataqua River. The unanticipated magnitude of repairs for the I-95 High Level Bridge nearly exceeds an entire typical Turnpike annual R&R budget based on recent estimates. For this reason, it is necessary for the Bureau to consider major adjustments in the R&R budget program. The Bureau has achieved this by deferring improvements to drainage, guardrail, signing, and other assets, while preserving funding of pavement preservation and striping applications. The I-95 High Level Bridge repair is anticipated to be a three-year construction project with approved funding allocated in FY18 ($1.8M), FY19 ($5.6M) and FY20 ($3.9M). The repair budget recommended by HNTB has been distributed through fiscal years 2018 to 2021. During these years, the New Hampshire Turnpike will need to spend $11.3 million on the I-95 High Level Bridge, potentially with the additional $4 million allocated to unforeseen deck repairs and associated engineering and construction inspection costs not currently included.**

Through visual field inspections and the review of turnpike records, HNTB has examined the facilities of the Turnpike to determine a plan for prioritizing its needs. This process identified Turnpike facilities that require attention due to depleting conditions or facilities that have maintained reasonable conditions for the possibility of deferring funds. For example, pavement resurfacing will continue to be a critical part of the Bureau R&R Program projections in conjunction with projected capital projects related to paving in order to meet the demand of pavement maintenance to maintain level of service. HNTB's visual field inspection found that more than 95 percent of the Spaulding Turnpike pavement was no older than six years old and in good condition. The reason for this widespread "good" condition is an aggressive pavement program by the Turnpike, along with the presence of two large Capital projects - Rochester and Newington - which have replaced large portions of the pavement on the Spaulding Turnpike. Additionally, several smaller scale projects have been completed, increasing the extent of resurfaced facilities (Bow-Concord 13742, Hookset 15803, Merrimack 12105, Manchester Airport Access-Exit 13, F.E. Everett Turnpike). All three Turnpike sections indicated only four miles of roadway considered "fair" as a pavement condition, with the remainder of the roadways rated "good" or better. HNTB recognizes there are roadways that still require maintenance and a pavement budget must be maintained for these areas, but the vast portion of the Turnpike pavement may have its maintenance reduced or preservation treatments used during the fiscal years affected by the I-95 High Level Bridge repair.

HNTB's observations showed a direct correlation between the condition of the bridge decks and the condition of the bridge relative to its age. The deterioration of the bridges was mostly due to leaking bridge joints, corroding girders, bearings, and spalling concrete decks. HNTB recommends the Bureau have an annual bridge budget of $1,500,000 to adequately address bridge maintenance; however, the Bureau has selected specific bridges in their budget. These bridges will replace the recommended $1,500,000 annual expenditure for FY 2021 to FY 2023. The use of Bridge Maintenance forces can also be employed to address some of these needs. **Bridge painting prevents deterioration of a structure by preventing corrosion, which is a long term process. The Bureau of Bridge Design had identified a need for $1,200,000 for I-95 bridge painting; however, with the current funding levels and project commitments, this project was determined to be not feasible. As a result, this project is deferred by the Bureau in their current R&R progam.** The Turnpike Bureau assesses project closeouts, efficiencies and bid results in an effort to identify any potential available funds.

The Bureau has provided an aggressive program for replacement of deteriorated guardrail and use of steel post rail, which has extended the life span of the guardrail, while the remaining wood post guardrail are in satisfactory condition. Guardrail replacement would be a candidate for deferring funds in the fiscal years of 2018 through 2021. HNTB's visual inspection observed that Turnpike signs were in good condition and the reflectivity of the signs were excellent. HNTB believes that Turnpike funds for signs could be deferred for three years, with minor signing needs incorporated into other appropriate projects. Additionally, the Turnpike has identified funding for sign maintenance by the Bureau of Traffic for minor signing needs.

The current R&R Program (FY 2018 through FY 2023) established by the Bureau has an annual anticipated expenditure range from $10.4 to $12 million with an average of approximately $11.1 million and a total cost of approximately $66.2 million. Based on the independent program developed with the factors noted above, the program recommended by HNTB for FY 2018 to FY 2023 would total approximately $81 million, with an average annual expenditure of $13.5 million. The approved 2017 - 2026 Ten Year Transportation Improvement Plan funds have a total budget for the same years of $69.9 million and an average annual expenditure of $11.6 million.

During the fiscal years affected by the I-95 High Level Bridge, the HNTB version of the Turnpike budget is above the Bureau's budget and above the approved funds identified in the 2017-2026 Ten Year Transportation Improvement Plan.

HNTB concludes that the Bureau's current R&R Program funding should be increased for the period from FY 2018 to FY 2023. This is primarily due to the unanticipated increase in funding required for the I-95 High Level Bridge, coupled with the need to reallocate funding to other priorities as well to maintain certain aspects of the infrastructure in a similar manner to previous R&R programs. Prioritization should consider the combined perspective of the most critical components and components with the greatest need. For the lowest condition ratings that are the same across components, prioritization should consider which have the greatest potential to impact levels of service (such as pavement and bridges before rest areas and park and ride lots). As the lowest condition ratings are addressed for the higher priority components, then similarly rated lower priority items should be addressed before moving on to the next higher condition level, if service levels warrant. For example, once pavement or bridge items rated "fair" are programmed under R&R, then "fair" components in other areas should be considered before further R&R expenditure on "good" pavement or bridge assets. Third in the priority would be to address the next level of condition as required until all components are programmed adequately to maintain targeted service levels. In other words, proper prioritization will be key to maintaining the appropriate level of service and "good" condition for the entire Turnpike System and all of its components.

The New Hampshire Turnpike System

The New Hampshire Turnpike System encompasses 88.9 miles across three limited-access highways: Spaulding Turnpike and the Blue Star Turnpike (I-95) along the eastern portion of New Hampshire (the Eastern Turnpike), and the F.E. Everett Turnpike traveling up the middle of the state (Central Turnpike). As shown in Figure 1, the F.E. Everett Turnpike (39.5 miles) extends from the Massachusetts state line in Nashua to Exit 14 in Concord, the 33.2 mile Spaulding Turnpike extends from Portsmouth to Exit 18 in Milton, and the 16.2-mile Blue Star Turnpike extends from the Massachusetts state line in Seabrook to the Maine state line in Portsmouth.

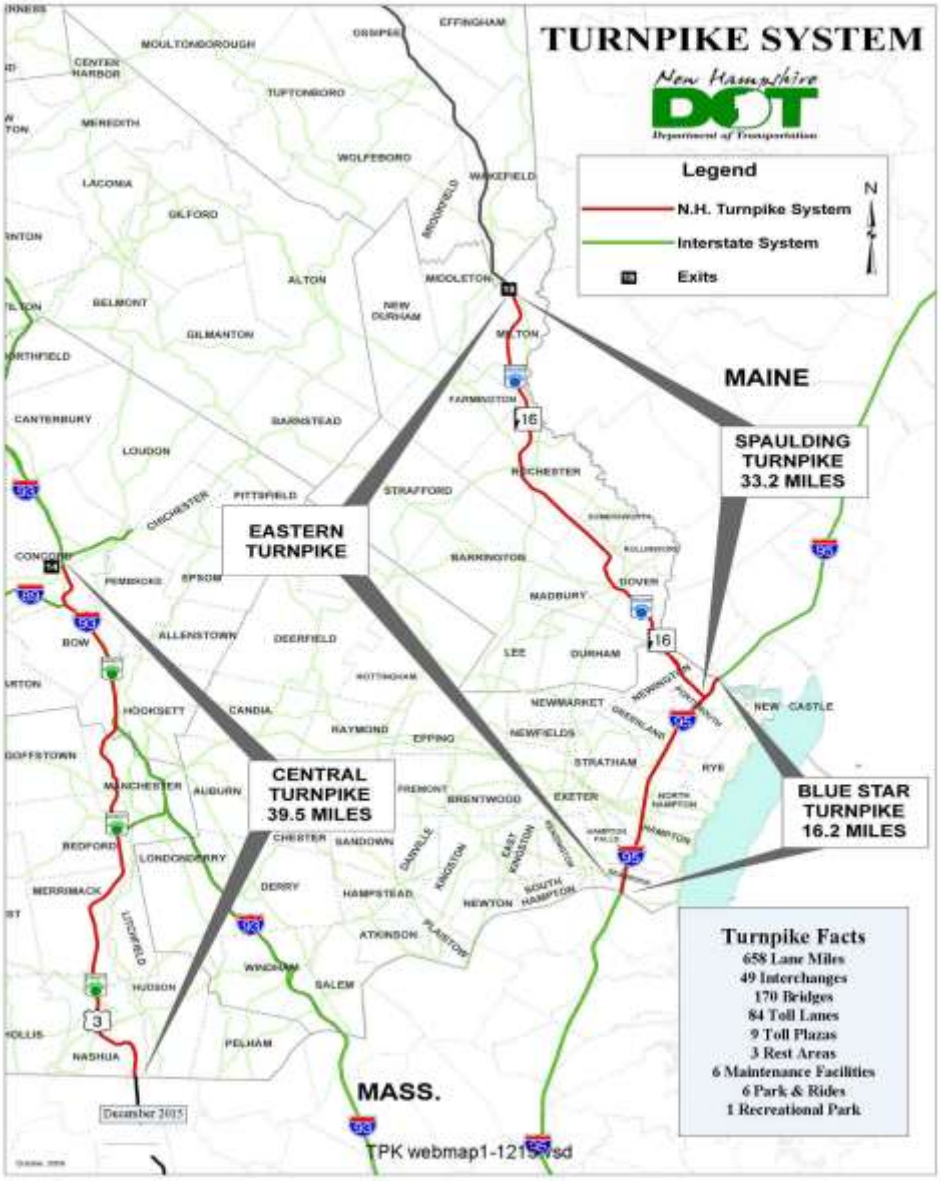
The Turnpike System contains:

- Toll Plazas (9): Bedford, Dover, Rochester, Merrimack (Exits 10 and 11), Hookset (mainline and side), Hampton (mainline and side) - all have attended lanes and dedicated E-ZPass lanes, along with "open road tolling" (ORT) lanes at Hampton and Hooksett Mainline Plaza (Bedford ORT targeted for completion in November 2018);
- Rest Areas/Welcome Centers (3): one in Seabrook NB and two reconstructed, partner-operated facilities in Hooksett NB and SB;
- Maintenance Facilities (6): Nashua, Merrimack, Rochester, Hooksett, Dover (to be replaced with new facility in Newington in 2020), Hampton;
- Park and Ride Facilities (6): Hooksett, Nashua (Exits 7 and 8), Rochester, Dover and Hampton;
- Bridges (170): Spaulding (58 bridges), Blue Star (33 bridges) and F.E. Everett (79 bridges);
- Satellite DMV office/E-ZPass Walk-In Center (Nashua); and
- Administration Building (Hookset).

The Bureau maintains infrastructure assets within the Turnpike system through the efforts of the Bridge Maintenance group and the Building & Grounds Maintenance Mechanics Unit. Responsibilities of the Bridge Maintenance group are critical to the Turnpike system; they include maintaining bridges so that they can be removed from, and remain off of, the “Red List”, which designates bridges that require additional attention due to load restrictions, poor condition or structural deficiencies. The Bridge Maintenance group performs bridge deck replacement and rehabilitation; repairs bridge joints, bridge guardrail, etc. This group also works to address needs at toll plazas, and performs concrete work for treadles, islands, and tunnels. The Bridge Maintenance group also washes each bridge every year. The team is comprised of four Maintenance Mechanics and one Supervisor (currently vacant) who address not just the needs of bridges but also maintain all Turnpike facilities.

The Buildings and Grounds group, consisting of one Maintenance Mechanic Foreman and three Maintenance Mechanics, performs day-to-day maintenance functions, including electrical, HVAC, and plumbing/utility repairs, in all building structures (toll plazas, maintenance facilities, park-and-ride facilities, rest area facilities, administrative office and Division of Motor Vehicles/E-ZPass Walk-In-Center facility).

Figure 1: New Hampshire Turnpike System



Independent R&R Assessment

HNTB Corporation was contracted by the New Hampshire Department of Transportation (NHDOT), Bureau of Turnpikes (Bureau) to perform an independent assessment of the Turnpike System Renewal and Replacement (R&R) Program. In general, the R&R Program is designed to address major, non-routine maintenance projects necessary based on the life cycle requirements of assets to maintain an appropriate level of service and cost effectiveness. In addition to the R&R Program, the Bureau also has a Capital

Program that provides funding for capital projects which typically involve some form of increase to capacity or for significant replacement projects such as bridge replacement projects to address critical red-list bridges. The purpose of the R&R Program is to provide funding for non-Capital Program projects for maintaining the Bureau's turnpike system that are considered too large to be completed as part of regular routine maintenance activities.

The scope of this effort included a review of the current Bureau R&R Program as well as a limited inspection of the New Hampshire Turnpike System in order to produce an updated independent R&R Program recommendation. The inspection included limited field work for undertaking spot checks of a representative sampling of the various Bureau facilities. This assessment was completed in accordance with the April 25, 2016 Scope of Services for HNTB Task Order #1. In addition, the Bureau also included review of available data (but no new inspection) in order to comment on the I-95 High Level Bridge between New Hampshire and Maine.

HNTB met with Bureau officials prior to the field work to collect data, discuss the existing R&R Program and expenditures and review prior visual field inspections. In addition, Bureau officials provided insight into observed facility conditions, ongoing construction and planned projects under both the R&R Program and Capital Improvement Program. A complete list of all information provided by NHDOT and reviewed in support of this effort is provided at the end of this report. HNTB used this information to develop a limited visual inspection plan focused on a representative sampling to independently assess the infrastructure associated with the Central, Blue Star and Spaulding Turnpikes. This inspection of the New Hampshire Turnpike System was completed by HNTB in July and August 2016.

This infrastructure assessment allowed HNTB to gather a sampling of field data to support the review and independent assessment of the R&R Program. HNTB spent approximately one week conducting the roadway and associated facilities inspection and approximately three days visually inspecting bridges. The primary focus of the assessment was to note conditions that should result in repair projects under the R&R Program; however, some features relative to regular maintenance were also noted as these potentially impact the timing for certain R&R projects.

HNTB visually inspected a sampling of the following infrastructure components:

- Bridges;
- Mainline Roadway (includes pavement, pavement markings, signing, slopes, and guardrail);
- Interchanges;
- Culverts (greater than 36" diameter);
- Lighting;
- Toll Plazas (mainline and ramp);
- Maintenance Facilities;
- Rest Areas; and
- Park and Ride Facilities.

Our review of available documents and selected inspection reports provided a reasonable basis for our independent assessment of the Bureau's R&R Program. The Infrastructure Assessment section contains a summary of our approach and findings.

INITIATIVES AND INNOVATIONS

Subsequent to the previous R&R assessment in 2012, the Bureau has implemented a number of new projects that improve and enhance the infrastructure assets on the Turnpike system, including installation of Open Road Tolling and energy-efficient LED lighting in the maintenance, toll plaza and rest area facilities.

E-ZPASS OPEN ROAD TOLLING

The Bureau has installed open road tolling (ORT) lanes at Hooksett and Hampton, and is in the process of designing ORT lane conversion at Bedford Mainline Toll Plaza. Drivers with E-Z Pass transponders can travel through ORT lanes at posted highway speeds without slowing or stopping. This results in improved traffic flow, safety and efficiency while reducing congestion, noise, accidents and vehicle emissions. Additionally, the Bureau is in the process of selecting a consultant for the design of new mainline ORT plazas in Rochester and Dover.

LED LIGHTING

The Turnpike is undergoing a program of converting conventional high pressure sodium lighting with energy-efficient Light Emitting Diode (LED) lights. The removed lights are used as replacements for outages in isolated and non-public areas. The LED has a higher installation cost, but savings are made up in time with the LED's low operating costs. With federally funded projects the payback period is one (1) year and with 100% highway funded projects the payback period is four (4) years. This cost saving is evident at Toll Plaza and Rest Area facilities where lighting is constant due to 24/7/365 operations.

ASSET MANAGEMENT

Assets managed by the Bureau include guardrail, drainage, buildings, pavement, bridges, and lighting. The Bureau continues to formalize its asset management program, and expects to hire an Asset Manager to support the need upon program approval at the Executive level. The use of Pontis supports the bridge inspection process and assists in making recommendations for a bridge preservation policy, predicts future bridge conditions, and recommends projects to perform on a certain number of bridges to match a user benefit to a specific budget. The Bureau also actively participates in multiple asset management task forces, including the DOT's Asset Management Policy Systems (AMPS) working group, which guides implementation of the Moving Ahead for Progress in the 21st Century Act (MAP-21); the Pavement working group, with a focus on long term pavement resurfacing strategy; and the Statewide Asset Data Exchange System (SADES) cooperative effort with the University of New Hampshire, developing a shared

comprehensive inventory of transportation asset data. The SADES program provides inventories and condition assessments for transportation assets such as guardrail, culverts and drainage. SADES is a collaboration between NHDOT and the Technology Transfer (T2) Center at the University of New Hampshire. Mobile devices are used to collect information which is uploaded into a central geographic information system (ESRI). Previously, the Bureau extracted information from videos provided by the Materials & Research Department to determine guardrail condition. Now the Bureau receives updated guardrail output files each year from the SADES system. The SADES system maintains inventory information such as guardrail height, material type, manufacturer, and installation date, as well as the condition of each section of rail from periodic inspections. Rail sections are identified by town, roadway name, and project number, and can be located within the Bureau's GIS system by a unique code.

PUBLIC-PRIVATE PARTNERSHIPS (P3)

Newly constructed northbound and southbound Welcome Centers were unveiled in Hookset in 2015 through a partnership between the state of New Hampshire and developer/operator Granite State Hospitality, LLC. These new facilities offer extensive services for visiting motorists, and the partnership agreement includes a 35-year ground lease contract which returns a percentage of concession revenue (excluding liquor store sales) to the Turnpike system. This partnership agreement eliminates many of the maintenance and operating expenditures for the Bureau. In FY2008 the Bureau spent $111,000 on the Hooksett Rest Area. None of the concession revenues are returned to the Bureau.

INFRASTRUCTURE ASSESSMENT

BRIDGES

Twenty-three bridges selected from the F. E. Everett, Blue Star and Spaulding Turnpikes were visually inspected as part of this assessment. The primary goal was to perform a limited visual inspection of a portion of the Bureau's bridge infrastructure to confirm and validate the information provided in the inspection reports. This validation process then served as the foundation for independently assessing the R&R program as discussed in the recommendation section of this report. The selection process for these bridges is outlined below.

The Bureau's infrastructure includes 170 bridge assets along the F. E. Everett, Blue Star and Spaulding Turnpikes. The bridge assets are comprised of several different types of structures. Approximately 83% of the bridges are steel stringers with concrete deck resting on concrete substructure, and approximately 10% are single span concrete rigid frame type bridges. The remaining 7% of bridges are concrete T-beam, pre-stressed concrete I-beam or concrete box type structures. These bridges are inspected every two years and detailed inspection reports are prepared by NHDOT. The detailed inspection reports provide overall condition assessments for major bridge components (i.e., deck, superstructure, substructure and culvert) using National Bridge Inventory (NBI) ratings. Additionally, bridge core elements are summarized and broken down into four condition states as defined by the FHWA. This information was used to

organize the Bureau's bridge assets into logical categories in order to identify candidates for the limited visual inspection spot check.

The bridges in the most severe condition are categorized as "Red list" bridges and receive a more aggressive inspection schedule based on condition (every 6 months to 1 year). Red list bridges are prioritized for replacement or significant rehabilitation and represent approximately 4% (6 bridges as of January 9, 2017) of Bureau bridges. At the time of this assessment there were 12 red list bridges but that has decreased due to recent construction. These types of projects are typically beyond the scope of R&R projects and therefore the Bureau has programmed them under the Capital Improvement Program (CIP). R&R level projects typically include deck replacements (re-decking) and/or concrete repair for structural components such as piers and abutments. Because the Bureau has already developed plans for Red List bridges under the CIP, HNTB did not include these bridges in the infrastructure assessment. However, to accurately validate the condition of bridge infrastructure and the inspection process, a baseline needed to be defined. Therefore, one red-list bridge was selected to serve as the baseline for comparison with the better condition bridges. The remaining bridges were considered potential candidates for the R&R Program from FY 2018 to FY 2023 and were the focus of this assessment, with the understood goal of addressing these conditions under the R&R program in order to prevent these bridges from reaching "Red List" status and thus requiring capital replacement.

HNTB's selection process primarily consisted of reviewing existing NHDOT inspection reports and the output from the NHDOT PONTIS Bridge Management System to identify a representative sampling of the Bureau's bridge assets, with consideration to bridges in need of possible R&R level repair or rehabilitation. Review of the 2015 inspection data revealed that there are fifty-four bridges representing 32% of the Bureau's bridges that have an NBI condition rating of 6 (Satisfactory) or less. The 2016 inspection data was not available at the time of this assessment, some of the data noted below may have changed slightly due to new inspection reports. It is noted that NHDOT typically focuses on bridges with NBI of 5 or less, so this approach was a conservative sampling.

Eighteen bridges representing 11% of the Bureau's bridges were programmed into CIP and will receive some rehabilitation work from FY 2015 to FY 2026. Four of those bridges were rehabilitated or replaced in 2015, therefore fourteen bridges are programmed from FY 2016 to FY 2026. Although these bridges were not part of HNTB's assessment, they provide some interesting insight as follows:

- 78% of the eighteen bridges have an NBI Item 58 deck rating of 6 or less.
- 89% of the eighteen bridges have an NBI Item 59 superstructure rating and/or NBI Item 60 substructure rating of 6 or less.
- The bridges in the CIP account for almost all NBI ratings of 5 or less; only three such bridges are not programmed under a current CIP (see list below). All of which are being considered for R&R or maintenance projects.
    - Bow, F.E. Everett Turnpike (FEET) over Dow Road (158/137)
    - Hooksett, I-93 over FEET (067/090)
    - Manchester, FEET over Hackett Hill Road (062/062)

- The majority of these bridges were built in the late 1950's and are the oldest in the Bureau's infrastructure.

The preceding observations show the direct correlation between the condition of bridge deck to the condition of the remaining structure below and generally the condition of the bridge relative to its age. In most cases, leaking bridge joint and deteriorated concrete bridge decks result in deterioration to the portions of the girders, bearings and substructure below the joints and deteriorated concrete decks respectively. Figure 2 shows an example of pier cracking, and Figure 3 displays abutment spalling.

Figure 2: Central Turnpike SB over Hall Street 201/096 – S. Pier Cracking on Cap and Column

Figure 3: Spaulding Turnpike SB over Cocheco River 105/133 – North Abutment Spalling (targeted for R&R program in FY 2021)

As mentioned above, bridges programmed in the CIP were excluded from consideration for the R&R program. The remaining bridges, representing approximately 89% of the Bureau's bridges, were then separated into two categories based on NBI condition ratings provided in the reports for Item 58-Deck, Item 59-Superstructure, and Item 60-Substructure. Category one represents bridges with condition ratings of 7 (Good) or greater; category two consists of bridges with condition ratings of 6 (Satisfactory) or less. NBI ratings of 7 (Good) or greater generally correspond to PONTIS core elements in condition state 1 or 2, and were assumed to not require R&R level work. The bridges visually inspected by HNTB as part of the 2006 and 2012 R&R assessment were purposely excluded from this selection process in order to avoid redundancy. The criteria used to determine the recommended or planned action column was the following:

1. Age: More than 30 years since last rehabilitation.
2. Deck Condition: Deck conditions satisfactory or less.
3. Overall Condition: Multiple condition ratings satisfactory or less.

The bridges that were selected for visual inspection in 2016 ranged from "Excellent" to "Poor" in NBI rating terms, and are listed in Table 1 below.

Table 1 - List of Bridges Visually Inspected

Location	Bridge	Type	Year Built	Condition: Deck, Superstructure, Substructure	Recommended or Planned Action
Bedford	NH 101 WB over FEET 186/131	IB-C	1993	Good, Good, Good	No Action Needed
Bedford	Toll Plaza Access Road over Ramp A 198/086	PIB	2010	Very Good, Satisfactory, Very Good	No Action Needed
Concord	FEET SB over Hall Street 201/096	IB-C	1958	Good, Satisfactory, Poor	Capital Program Project 13742
Concord	FEET SB over B&M RR 203/089	IB-C	1957	Good, Good, Satisfactory	Capital Program Project 13742
Manchester	FEET & I-293 over Granite St. 134/066	IB-C	2007	Very Good, Excellent, Very Good	No Action Needed
Nashua	B & M RR over FEET and ramps 101/129	TPG	1995	Very Good, Satisfactory, Good	No Action Needed
Nashua	Eastbound Connector over D.W. Highway 151/056	IB-C	1993	Very Good, Very Good, Satisfactory	No Action Needed
Hampton	NH 27 Over I-95 113/168	IB-C	1976	Satisfactory, Satisfactory, Good	Evaluate for Rehabilitation
North Hampton	Ramp B-D over I-95 078/070	IB-C	1976	Good, Satisfactory, Good	Evaluate for Rehabilitation (Deck Repairs by Maint. In 2016)
North Hampton	South Rd over I-95 079/079	IB-C	1975	Satisfactory, Satisfactory, Good	Evaluate for Rehabilitation
North Hampton	NH 111 over I-95 081/093	IB-C	1975	Good, Satisfactory, Good	Evaluate for Rehabilitation
North Hampton	NH 151 over I-95 099/144	IB-C	1975	Good, Satisfactory, Good	Evaluate for Rehabilitation
Portsmouth	I-95 NB over B&M RR 105/125	IB-C	1972	Good, Good, Good	No Action Needed
Portsmouth	I-95 over Hodgson Brook 190/118	CB	1956	Culvert Satisfactory	Evaluate for Rehabilitation
Portsmouth	I-95 NB over Sp. Tpk. 197/122	IB-C	1971	Satisfactory, Good, Satisfactory	Evaluate for Rehabilitation
Portsmouth	SB Connector over I-95 NB183/121	IB-C	1972	Good, Good, Satisfactory	No Action Needed
Portsmouth	I-95 NB over Woodbury Avenue 206/121	CRF	1970	Good, Good, Good	No Action Needed
Dover	Sp. Tpk. over long Hill Road 084/165	IB-C	1956	Good, Satisfactory, Good	No Action Needed
Dover	Sp. Tpk. SB over Cocheco River 105/133	IB-C	1957	Satisfactory, Satisfactory, Satisfactory	Planned for Rehabilitation Under R&R in FY 2021

Location	Bridge	Type	Year Built	Condition: Deck, Superstructure, Substructure	Recommended or Planned Action
Dover	Sp. Tpk. SB over NH 108 and RR Spur 132/101	IB-C	1957	Good, Good, Satisfactory	No Action Needed
Milton	Sp. Tpk. over Branch River 098/115	IB-C	1981	Very Good, Good, Good	No Action Needed (Joint Repairs by Maint. In 2016)
Milton	Sp. Tpk. over Teneriffe Road 162/110	IB-C	1980	Satisfactory, Good, Good	Evaluate for Rehabilitation (Bearing Repairs by Maint. In 2016)
Rochester	NH 125 (Ramp D0 over US202 & NH 11 WB (Ramp A) 089/112	IB-C	1966	Satisfactory, Satisfactory, Good	Evaluate for Rehabilitation

HNTB's visual inspection of twenty-three bridges generally agreed with the Bureau's inspection reports, where the conditions observed were (in the opinion of the inspectors) reasonably in line with the NBI ratings. In summary, the following information was determined from the visual inspections:

- The one Red List bridge inspected as a baseline had an NBI substructure rating of 4 and the visual inspection verified that the existing condition warranted that rating.
- Three bridges had NBI deck ratings of 7 or greater, but based on the age of the bridge were expected to be in worse condition. The visual inspections verified that in fact the older decks were holding up well and warranted the ratings the inspection reports showed.
- Seventeen bridges with NBI ratings of 6 were visually inspected by HNTB. The majority of deficiencies observed in the field were leaking joints, deteriorated pavement, isolated concrete spalls, and transverse cracks in the underside of the bridge deck and similarly at the abutments and pier columns. Additionally, the majority of bridge decks exhibited more deterioration on the soffit/overhang of the deck when compared to the interior bays. In some instances, the soffit controlled the deck rating.

The deficiencies as verified during HNTB's visual inspections were utilized to develop R&R recommendations which were then extrapolated to other bridges with assumed similar conditions based on similar NBI ratings and report information. To round out the methodology and assumptions, visual inspection of the bridges that were anticipated to be in better condition (the opposite end of the condition spectrum from the bridges that were inspected) also confirmed that those bridges with NBI ratings of 7 (Good) or greater generally did not require significant or immediate repairs and therefore would generally not be included in a near-term R&R program.

I-95 High Level Bridge

The I-95 High Level Bridge carries Interstate 95 over the Piscataqua River between Portsmouth, New Hampshire and Kittery, Maine. The structure carries six lanes of traffic and consists of a main through-arch span, 19 approach spans in New Hampshire, and 14 approach spans in Maine.

Construction of the bridge was completed in 1973. Since its construction, limited repair and rehabilitation contracts have been issued for the bridge. In 1988, a contract was completed that included repairs to the concrete bridge deck and replacement of the existing bridge pavement and membrane. Painting contracts were issued for the truss span in 1999 and for the New Hampshire approach spans in 2010. In 2009, per legislation, responsibility for the main span and New Hampshire approach spans was transferred from NHDOT to the Bureau of Turnpikes.

HNTB's assessment of funding needs for the I-95 High Level Bridge relative to this report effort was based on a review of the following documents:

- December 2010, Final Report Bi-State Bridge Funding Task Force;
- January 29, 2016, NHDOT Interdepartmental Communication, Turnpike's Replacement and Renewal Program, Annual Report and Status Update
- January 10, 2017, NHDOT Interdepartmental Communication, Turnpike's Replacement and Renewal Program, Annual Report and Status Update;
- January 10, 2017, NHDOT Fiscal Year 2018-2019 State Budget
- October 21, 2014, NHDOT Bridge Inspection Report;
- February 16, 2016, Memorandum, Synopsis of Deck Core Results;
- March 11, 2016, List of Rehabilitation Needs, Portsmouth-Kittery I-95 Piscataqua River Bridges;
- March 21, 2016, Project Development Directors Data Sheet; and
- April 14, 2016, Memorandum, List of Needs Meeting.

The October 2014 inspection report found the bridge to be in generally "satisfactory" condition, indicating that some structural elements are showing signs of minor deterioration. However, similar to the April 2010 inspection findings, the latest inspection report noted isolated areas of more significant deterioration, generally within the concrete soffits along the bridge deck expansion joints where spalling, delamination, efflorescence, and exposed steel reinforcement commonly occur. In these locations, the bridge deck could be characterized as in "fair" to "poor" condition. A "fair" condition indicates that areas of minor losses are present on structural elements, while a "poor" condition indicates that areas of advanced losses and deterioration were found. In April 2010, the inspection report noted that 100% of the bridge deck was a CS1 (*Condition State 1, Good*) per the AASHTO Core Element Condition rating. However, the October 2014 inspection report categorized 100% of both the concrete deck and soffit concrete as a CS2 (*Condition State 2, Fair*), denoting the gradual deterioration of the concrete over the last four years. A 2016 inspection report was not available at the time of this writing. While recent photographs of the deck may not depict a widespread CS2 condition for "100% of the surface area", the

suggestion that the concrete deck is no longer in "Good" condition appears to be a valid statement based on information from the bridge maintenance personnel who periodically must remove delaminated portions of concrete from the underside of the bridge deck.

In light of the 2014 inspection report, the NHDOT and the MaineDOT have undertaken a rehabilitation effort to address the structural deficiencies of the bridge over the next two to four years. Three documents produced between March 11 and April 14, 2016 highlight the collaborative efforts between the two State DOT agencies and their mutual concurrence that improvements to the three-bridge structure are necessary to address the deteriorated structural members and miscellaneous bridge components. Detailed descriptions of the various work required to maintain the structures are best articulated in the March 11, 2016 memo. Table 2 outlines the components slated for rehabilitation.

Table 2: I-95 High Level Bridge - Rehabilitation Needs

Concrete Superstructure			
▪ Compression Joints.	▪ Median Barrier	▪ Girder Haunches	▪ Finger Joints & Troughs
▪ Deck Patching	▪ Deck Overhangs	▪ Drainage Scuppers	▪ Pavement & Membrane
▪ Curbs & Railings			
Concrete Substructure			
▪ Pier Patching	▪ Pier Waterproofing		
Structural Steel Framing			
▪ Catwalk Repairs	▪ Painting	▪ Box Struts	▪ Lightening Hole Screens
▪ Sliding Plates			
Miscellaneous Elements			
▪ Electrical Systems	▪ Bridge Drainage	▪ Utility Brackets	▪ Bearing Inspection

Most of the repair items noted above would have traffic implications given the requirement that three lanes of traffic must be maintained during daylight hours during the summer months. This forces the work to be conducted at night or with narrow work-windows, which will have a cost implication on the overall project. For this reason, the State DOT's have created three levels of alternatives for consideration with incremental levels of funding, as shown in Table 3.

Table 3: I-95 High Level Bridge – Preliminary Rehabilitation Alternatives

Alt. ID	Title	Description	Total Cost[1]	NH Cost[1]
Alt. #1	Minimal Efforts	Replacement and repairs to visual defects and minimal amount of preventive maintenance.	$16,785,000	$8,955,000
Alt. #2	Mid-Level Alt.	Incorporates desired repairs, but omits repairs better suited to separate contracts or maintenance forces.	$20,910,000	$10,965,000
Alt. #3	All Identified Needs	All repairs identified would be addressed.	$21,650,000	$11,270,000

1. *Costs do not include PE, CE, ROW, utility, or other soft project costs. Maine's costs are not shown. Costs are currently in 2016 dollars.*

The State DOT's are contemplating the implementation of Alternative 2 or 3; therefore, the cost associated with Alternative 3 has been carried within this program assessment since the cost differential between the two alternatives is only 3.5%.

The bridge and its approach spans were painted within the last 14 years; therefore, the rehabilitation project does not include any significant efforts to paint the structures, but rather includes some level of paint repairs in isolated areas where paint failure has occurred, primarily below deck beneath the expansion joints and along the catwalk.

One important factor that could affect the budgetary needs of the bridge is the assumed percentage of deck repairs needed. Currently, the construction cost assumes that 5% of the topside of the bridge deck will require patch repairs (3% above rebar; 2% below rebar), while 1.5% of the underside of the deck will require patch repairs. These assumptions are very general in nature, but appear to be based on the recent results of a deck coring program and Ground Penetrating Radar (GPR) effort completed in January 2016 by the MaineDOT which concluded that the concrete bridge deck was in relatively good condition. The findings indicate that the average concrete strength was 8,218 psi, while 90% of the chloride tests revealed chloride ion levels below the FHWA concentration threshold. The GPR results proved inconclusive as to the condition of the concrete deck. As noted earlier, the 2014 NHDOT bridge inspection report identified the deck to be in satisfactory condition (NBIS rating) with an updated Condition State of CS2 (Fair) for 100% of the deck, which is an element condition downgrade from CS1 in 2010. While it may be reasonable to categorize the bridge deck as in fair to satisfactory condition, there is some doubt whether the percent of deck repairs needed on a 44-year old deck that is showing signs of chloride ion penetration is only 5%. Current feedback from NHDOT's bridge maintenance crews indicates that underdeck delamination and spalling has expanded within the last few years and now requires periodic attention. This observation appears to be congruent with the 2014 inspection findings. Although an accurate estimate of deck deterioration cannot be made based on the limited results from the deck core program or the GPR imaging, the quantity of deck repairs should be increased to 10% of the total area

given the age of the bridge deck and the likelihood that areas currently identified as moderately deteriorated would only exacerbate at an accelerated rate; and therefore, should be addressed at this time.

The construction costs outlined for this project currently do not include professional design engineering or construction engineering/inspection services. Considering that PE and CEI will instill additional costs up to 8% and 10%, respectively, of the construction value, it is likely that additional funding will be required on behalf of the NHDOT and should be programmed accordingly. The cost estimates already include mobilization costs (6%) and contingency (10%). ROW and utility costs are unknown at this time.

According to the Project Development Directors Data Sheet dated March 21, 2016, the advertising date for the project is scheduled for February 6, 2018; however, the anticipated completion date has not yet been determined. For advertising to occur in February 2018, the design would need to be completed in the summer/fall of 2017. Hence, the engineering design work would need to be accounted for in the 2018 fiscal year starting in July and would include approximately 8% of the construction costs. Although the exact duration of the project is not yet determined, the magnitude of this project will likely require a three-year construction timeframe. The construction phase of the project will commence in the spring of 2018 and extend to the fall of 2020.

The NHDOT has indicated that there is an ongoing effort to perform a bridge load rating of the three structures. Results indicate that the main through-truss span maintains sufficient strength to carry typical highway loads; however, the results of the approach spans were not conclusive at this time. The NHDOT is currently working with a subconsultant to complete the load rating of the two approach spans (New Hampshire's 19-span structure and Maine's 14-span structure), to determine the load-carrying capacity of these structures. If strengthening is required, the cost to strengthen the bridge would not be included in this R&R program assessment, but rather would be captured in the capital projects program.

Based on the construction cost estimate completed by MaineDOT and using Alternative 3 as the level of repairs to be completed, the adjusted cost of the construction project is $21.6 million (2016 dollars). Historically, bridge rehabilitation costs for the main span have been split equally between Maine and New Hampshire while the approach spans are fully funded by their respective state agency. Based on this cost distribution New Hampshire's share of the construction costs is approximately $11.3 million. However, this does not include additional deck repairs ($1.6 million) that will be required based on our review of bridge inspection data, as well as associated engineering ($1.1 million) and construction inspection ($1.3 million) costs. Therefore, we believe an additional $4 million will be required. Right-of-Way and utility costs are not included in these numbers as they are unknown at this time. Therefore, we believe that New Hampshire's share of the cost for this project is likely to be approximately $15.3 million.

New Hampshire's share of the annual maintenance cost for the I-95 High Level Bridge prior to the reconstruction of the Sarah Long Bridge had historically been on the order of $100,000 to $150,000. However, maintenance funds have recently been spread thin to address needs at Hampton River, Little Harbor, and six other approach bridges, not to mention the interim needs of the Sarah Long and Memorial

Bridges. Annual maintenance funds for the I-95 High Level bridge have ranged from a low of $30,000 to a high of just $60,000 over the last three years. Therefore, NHDOT should carry $0.2M annually in the upcoming Bridge Maintenance Program commencing in the next fiscal year for annual maintenance needs to compensate for recent shortages and to stabilize the funding allocation. This $0.2M is not directly associated with the Replacement and Renewal Program; however, the value is noted here due to the importance of replenishing and maintaining a reasonable future maintenance fund for the bridge.

From the information available to date, the NHDOT has programmed approximately $11.3 million over the next three fiscal years in accordance with the following breakdown: $1.8 million in FY 2018; $5.6 million in FY 2019; and $3.9 million in FY 2020 (Project No. 16189) to complete the anticipated bridge rehabilitation program according to the Turnpike's "*Replacement and Renewal Program, Annual Report and Status Update*," state budget spreadsheet dated, January 10, 2017. HNTB understands that this project is likely to be constructed over four fiscal years, not three, and therefore recommends the following breakdown: FY18 $2.1 million, FY19 $5.7 million, FY20 $5.7 million, and FY21 $1.8 million. Under this scenario, the I-95 High Level Bridge rehabilitation project will be adequately funded over the next three fiscal years. Additional funding for fiscal years 2021 and 2022 might be required if project complexities and unknowns increase costs; therefore, funding levels beyond 2020 should be revisited once the rehabilitation project is underway and the scope of work is better understood. HNTB understands that the Bureau has requested an additional $4 million for this project, but it has not yet been approved.

OVERHEAD SIGN STRUCTURES

Overhead sign structures are inspected every two years as part of the NHDOT bridge inspection process. Four overhead sign structures were randomly selected from the F. E. Everett, Blue Star and Spaulding Turnpikes and were visually inspected as part of this assessment. The primary goal was to perform a limited visual inspection of the Bureau's overhead sign structure infrastructure to confirm and validate that the structures are being maintained.

The list below shows the overhead sign structures that were included in the visual assessment:

- I-95, NB 14.6, Portsmouth, Sign = 379-0095-0006-N14.4, Type = Monotube
- I-95, Traffic Circle, Portsmouth, Sign = 379-0095-0005-N-28, Type = Overhead Box Truss Twin Upright
- I-95, NB 5.4, Hampton, Sign = 197-0095-0002-N5.4, Type = Overhead Box Truss Twin Upright
- I-95, Side Toll, Hampton, Sign = 197-0095-0002-N-15, Type = Overhead Box Truss Twin Upright

The sign structures inspected were all in good condition and appeared to be maintained adequately.

MAINLINE ROADWAY

The 88.9 centerline mile mainline roadway (or 177.8 miles of NB and SB mainline roadway) was visually inspected while driving at approximately 5 miles per hour in the outside shoulder along the entire mainline

roadway for all three turnpikes. Sections were evaluated in five-mile increments in both the northbound and southbound directions, and significant observations were noted.

The mainline roadway assessment included focus on the following features:

- Pavement condition (overall appearance, cracking, abrasion, potholes);
- Pavement markings (condition);
- Signage (condition);
- Delineators (condition); and
- Guardrail (type, condition, damage).

The visual assessment used the rating system in Table 4 for assessing the condition of the roadway features along the Bureau's Turnpike System.

Table 4: Visual Assessment Rating System

RATING	DESCRIPTION
1	Critical condition – facility is closed and is beyond repair.
2	Critical condition – facility is closed. Study should determine the feasibility for repair.
3	Critical condition – the need for rehabilitation is urgent. Facility should be closed until repair.
4	Poor condition – repair or rehabilitation required immediately.
5	Marginal condition – potential exists for major rehabilitation such as full reconstruction.
6	Generally fair condition – potential exists for minor rehabilitation such as partial reconstruction.
7	Fair condition – potential exists for major maintenance such as wearing surface replacement.
8	Generally good condition – potential exists for minor maintenance such as crack sealing.
9	Good condition – no repairs needed.
10	New condition.
11	Not applicable and/or no repair rating.
12	Under repair by contract.
13	Stagnant water - not inspected.

PAVEMENT CONDITION

Approximately 98 percent of the centerline miles of the pavement surface throughout the turnpike system were in "generally good" to "new" condition, with a rating of 8, 9 or 10 from the scale in Table 4. Select sections were observed that exhibited minor deterioration that will need to be addressed to prevent significant deficiencies. Newer condition pavement areas show only very minor tight cracking, generally

along seam areas which would be expected. A summary of the mainline roadway visual assessment can be found in Appendix A.

Pavement in “generally good condition” (Rated “8”) typically showed some longitudinal cracking in wheel path or along lane lines in addition to typical seam cracks observed in newer pavements. Good condition pavements also generally exhibited regular but not frequent traverse cracking. Rutting depths were not physically measured and the limited visual observations did not reveal areas of significant rutting with the exception of some toll plaza approach pavements. All of these observations are typical of the anticipated deterioration patterns that would be expected as asphalt pavement ages.

Approximately 4 miles of NB and SB mainline turnpike roadway was rated in “fair condition” (Rated “7” from Table 4) and therefore more likely to require resurfacing in 2-4 years, whereas pavements rated 8 or higher would generally be programmed later. Given possible acceleration of deterioration due to site conditions or higher traffic, regular (annual or more frequent) confirmation of pavement states is generally recommended. Pavement conditions can change rapidly so the candidate list is not intended to be an exact program for the near future but a representation of the amount of pavement potentially due for major maintenance. Other considerations include location factors such as lower lying areas near the ocean or significant water bodies (Blue Star Turnpike) that may face more adverse soil conditions. See Appendix A for the full results of all pavement inspection.

Pavements observed in this assessment that appeared to be in fair condition represent only 2 percent of the Turnpike’s roadways. These small portions of roadway, which are likely candidates for resurfacing, generally exhibited extensive longitudinal and transverse cracking that was approaching or had reached a level considered as “map cracking”. Overall cracking was wider on an individual basis than the good condition pavement. These pavement areas also generally exhibited starting, patched or open potholes.

In order to compare the limited inspection data with more comprehensive and quantitative information available from NHDOT, the pavement conditions observed through the visual assessment were also compared to the results of an evaluation of International Roughness Index (IRI) undertaken by the Bureau in 2015. IRI is a measurement of ride quality based on a quantitative measurement of roadway surface conditions using a data collection vehicle that physically measures roadway surface attributes. Based on those measurements, ride quality is determined to be good, fair or poor depending on the numerical value of the rating system (see Table 5). In the 2015 NHDOT assessment, 91% of Turnpike miles fell within the "Good" range, 8% were "Acceptable", and less than 1% were rated "Poor".

Table 5: International Roughness Index (IRI) Ratings

Ride Quality	IRI
Good	<= 95 inches/mile
Fair	<= 170 inches/mile
Poor	> 170 inches/mile

The IRI results from NHDOT and the HNTB visual evaluation assessment were in general agreement. Most areas of pavement that were in visually Good condition (rating of 8, 9 or 10, as shown in Table 4) also had Fair to Good IRI ratings (rating of <=170, as shown in Table 5), except for a few segments of roadway listed in Table 6.

Given the subjectivity and limitations of the visual inspections and the measurement techniques to produce the IRI results, some differences would be expected. In fact, many of the roadway segments listed in Table 6 have already been repaved since the 2015 Road Condition survey was performed, or are scheduled for pavement resurfacing in the current FY17 R&R Program by NHDOT.

Table 6: Pavement Condition - IRI and Visual Assessment Differences

Turnpike	Location	HNTB 2016 Visual Assessment	NHDOT 2015 IRI Rating
Spaulding	MM 2.5 to 5.6 NB	12 (Under Construction)	Fair
	MM 0.1 to 0.5 SB	12 (Under Construction)	Fair
	MM 23 to 33 NB	12 (Under Construction)	Poor to Fair
Blue Star	MM 0 - 0.1 SB	12 (Under Construction)	Poor
	MM 5.6 – 6 NB	8	Fair
	MM 15.9 – 16.1 NB	8	Fair
	MM 15.7 – 15.8 NB	8	Fair
	MM 3.8 – 3.9 NB	12 (Under Construction)	Fair
	MM 0.4 - 0.5 SB	8	Fair
	MM 1.6 - 1.7 SB	8	Fair
	MM 10.2 - 10.4 SB	9	Fair
	MM 10.4 - 10.5 SB	9	Poor
Central Turnpike	MM 0.5 - 0.6 NB	12 (Under Construction)	Fair
	MM 1.7 - 1.8 NB	12 (Under Construction)	Fair
	MM 2.5 - 2.6 NB	12 (Under Construction)	Fair

Turnpike	Location	HNTB 2016 Visual Assessment	NHDOT 2015 IRI Rating
	MM 8.7 - 8.8 NB	8	Fair
	MM 14.57 - 14.67 NB	7	Fair
	MM 17.07 - 17.27 NB	8	Fair
	MM 21.17 - 21.37 NB	12 (Under Construction)	Fair
	MM 22.17 - 22.27 NB	8	Fair
	MM 29.44 - 29.54 NB	8	Fair
	MM 36.44 - 36.54 NB	10	Fair
	MM 36.84 - 37.04 NB	8	Fair
	MM 37.14 - 37.44 NB	9	Fair
	MM 37.64 - 37.74 NB	9	Fair
	MM 1.7 - 1.8 SB	12 (Under Construction)	Fair
	MM 2.0 2.4 SB	12 (Under Construction)	Fair
	MM 9.9 – 10 SB	8	Fair
	MM 17.67- 18.07 SB	9	Fair
	MM 22.17 - 22.27 SB	8	Fair
	MM 23.92 - 24.02	8	Fair
	MM 25.12 - 25.22	8	Fair
	MM 30.62 - 30.72	9	Fair
	MM 37.81 - 37.91	8	Fair
	MM 38.81 - 38.91	8	Fair
	MM 39.21 - 39.31	8	Fair

PAVEMENT MARKINGS

Pavement markings throughout the system were generally visible and in good condition.

The Bureau of Traffic has reduced resources and is not able to complete striping operations for the Turnpike. The Turnpike has contracted with outside vendors to provide their striping operations. The pavement marking contractor provided 2.04 million lineal feet of 6 inch lines at a unit cost of $.09 per lineal foot, while the Bureau of Traffic's cost was $.06 per lineal foot. The FY2017 contract cost the Turnpike $380,000 for pavement striping, and the Turnpike is planning to extend this practice for the following years. HNTB has budgeted $385,000 for FY 2018 and $380,000 for every year until FY 2023.

SIGNING

Night-time visual inspection of signage along the mainline roadway, interchanges and toll plazas was conducted at highway speeds along the Spaulding Turnpike from MM 0.0 to Exit 18 in Milton and along the F.E. Everett Turnpike from the MM 0.0 to Exit 14 to review retro reflectivity. No night time survey of signage was undertaken along the Blue Star Turnpike. Signing throughout the system was generally in good condition with good visibility and reflectivity.

The Turnpike did not perform any signing improvements from FY2008 to FY2012. In FY2012 the Turnpike completed a signing contract for the replacement of signs on the Spaulding Turnpike at Exits 17 & 18 for $301,000. In FY2015 a signing contract was issued for the F.E. Everett, the Spaulding and the Blue Star turnpike for approximately $550,000. In FY2017 a signing contract was issued for Statewide improvements for approximately $590,000.

DELINEATORS

Delineators marking the roadside and guardrail were generally in good condition with the exception of impact damage. Delineators marking drainage and other features, where present, were also generally in good condition. The team did identify some major drainage structures that were unmarked or poorly marked, making identification for inspection or maintenance activities difficult. The Bureau of Turnpikes has begun the implementation of larger delineators (12”X6”) from the traditional size of a 3”X3” delineator to improve visibility and reduce off the road crashes.

INTELLIGENT TRANSPORTATION SYSTEM (ITS)

The Turnpike system features an Advanced Transportation Management System (ATMS) that currently includes variable speed limit signs; twenty-three (23) dynamic message signs (DMS); forty-five (45) closed-circuit cameras; five (5) Motor Vehicle Detection Systems (MVDS); and five (5) Road Weather Information Stations (RWIS), with one each in Newington, Portsmouth, and Seabrook and two in Nashua. This technology is designed to improve incident response, enhance work zone safety, and reduce traffic congestion. The ITS devices are connected via a point-to-point communication system and are controlled remotely by the Traffic Management Center (TMC) in Concord. Bedford Toll Plaza is scheduled for an ORT conversion in the near future, which includes ITS updates. No visual inspection was performed of the ITS components for this report.

GUARDRAIL

Guardrail was evaluated on a limited basis as part of the visual survey. Inspection staff reviewed select sections of damaged guardrail and guardrail within the area of inspected drainage structures. Overall, guardrail was in good condition where observed, including terminal ends, shoulder and median structures. Some guardrail sections were found to have damaged ends, as shown in Figure 4 and Figure 5. Older wood guardrail sections exhibit buildup of debris under the rail, preventing off-road drainage flow. Older

guardrail sections show evidence of reduced height due to paving overlays, debris and plowing operations near the guardrail terminal end sections. Throughout the system, isolated sections of w-beam guardrail and guardrail end treatments were damaged or flattened, probably due to plow impact. Box beam sections have been generally targeted for replacement due to substandard end treatments and difficulty in obtaining replacement parts. Table 7 shows a summary of specific guardrail deficiencies identified during this inspection.

Table 7: Guardrail Deficiencies

	Blue Star		Spaulding		F.E.Everett	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**
Damaged End			5.65, 8.0	5.4	4.2	11.6, 33.2
Damaged Rail	2.1	3.6-4.0 (Construction Zone)	8.4 (@ crossover), 8.6, 12.8			37.7/36.9
Deflected	2.2, 12.2	12.6	6.8, 8.8	6.4, 7.4, 11.9		
Displaced Post				7.5		
End Section Fair (7) Condition	5.3					
End Treatment Marginal (5) Condition					38.3	
Excess Debris	2.7	12.3 (under rail)		11.8 (under rail)		37.8
Flattened Rail			4.9, 6.9, 7.1, 8.9	11.9		7.2, 20.6/4.6, 25.4/9.4, 32.2/31.4, 32.1/31.3, 37.5/36.7
Low End Section		6.8, 7.2, 7.6, 8.1	11.6, 4.9		36.3/35.5 to 37.8/37.0	27.7/11.7/26.9, 23.0/7.0, 26.7/10.7
Median Damage			7.6			
Median Large Deflection 40' down			9.3	9.3		
Median Low End			5.65			
Minor Damage	2.6	12.5				37.6 to 37.7
Missing Offset Blocks						25.1/9.1
Missing Rail	4.1	1.0, 3.0, 10.0, 11.2	8.1			

The Bureau should continue to replace box beams, or at a minimum, replace substandard end treatments as part of the ongoing guardrail replacement program. Outside of future Capital Program limits, HNTB also recommends the continued removal and replacement of decaying wood posts, as well as programming of proactive replacement based on age. HNTB notes that NHDOT has adopted a standard policy of replacement with steel posts going forward, which are anticipated to deliver long term benefits. In the past the Bureau has performed several guardrail replacement projects: FY2008 Hooksett-Bow - $2,530,000, FY2019 Statewide - $590,000, FY2011 Statewide - $1,415,000, FY2015 I-95 - $437,000 and

FY2017 Spaulding Turnpike - $810,000. Box Beam conversions to W or Thrie beams guardrails are usually included in Capital Program Projects.

Figure 4: Spaulding Turnpike – Post Sheared

Figure 5: Central Turnpike – Trailing End Damaged

INTERCHANGES

Two out of 18 interchanges were evaluated, at Exits 9 and 17 on the Spaulding Turnpike. Based on discussions with Bureau staff, the roadway inspection team selected the interchanges that would best provide typical conditions or conditions likely to require repair in the near future. The same components that were visually inspected on the mainline roadway were visually inspected at the selected

interchanges. As a matter of practice, the Bureau of Turnpike resurfaces one to two interchanges as part of Central and Eastern projects respectively.

The pavement observed on interchanges was generally good, and Exit 17 on the Spaulding Turnpike had just been resurfaced. Slopes, drainage, signage, guardrail, and light poles were all generally in good condition.

CULVERTS

Culvert were selected for assessment based on a random sampling of culverts over 36" in diameter from a drainage inventory list provided by the Bureau. HNTB staff visually inspected 34 culverts, including nine on the Blue Star Turnpike, nine on the Spaulding Turnpike and 16 on the F.E. Everett Turnpike (a detailed Culvert Summary is presented in Appendix B). HNTB field inspector's assessment is based on a modified FWHA culvert criteria that does not include any interior inspection of the culverts. The culvert inspection is limited to the roadway surface above the culvert, the surrounding slopes, the headwall/wingwalls, the head and tail water conditions. Interior inspections are limited to a general visual alignment assessment from each end of the culvert in an effort to find any shadowing or silhouetting that would suggest joint failures.

Overall, culverts were in sound condition with a majority of pipes on the Blue Star and F.E. Everett Turnpikes made of reinforced concrete with stone and mortar headwalls and wingwalls. Of the eight pipe crossings inspected on the Spaulding Turnpike, one was a concrete-lined asphalt coated corrugated metal pipe, one was a plastic-lined pipe, another was a PVC pipe, and the remaining five pipe crossings were made of reinforced concrete. Pipes with little or low flow conditions were observed to be in generally good condition with little or no silt deposits or settling observed within the pipe structures. Several culverts on the Blue Star Turnpike could not be fully evaluated due to high water conditions. Many areas were unapproachable due to poison ivy or generally high, thick vegetation growth. Inlet and outlet areas were generally clear and water flow was positive along the Spaulding and F. E. Everett Turnpikes.

The culverts that are over 36" in diameter are in good condition, and the Bureau has done well in maintaining them through previous projects. The Bureau performed drainage repair along the Central Turnpike in FY 2015. The Bureau intends to repair additional drainage on the turnpike system in FY 2022, and the future focus will be on culverts that are less than 36".

Figure 6: Spaulding Turnpike – Twin Pipes

In most cases, slopes around pipe ends were stable and well vegetated. Delineator posts used for identifying locations of drainage structures were missing or poorly marked in several locations.

SLOPE CONDITIONS

Slopes along roadways that were visually inspected were observed to be generally in good condition. Note that the slope review was limited to windshield survey and sampling.

LIGHTING

A night-time visual survey of lighting was conducted at highway speeds to confirm lighting outages along the mainline and at interchanges and toll plazas along the Spaulding Turnpike from MM 0.0 to Exit 18 in Milton, and along the F. E. Everett Turnpike from the MM 0.0 to Exit 15. No night-time survey of lighting was undertaken along the Blue Star Turnpike. Daylight assessment of the mainline roadway included sample evaluation of the general condition of light poles for leaning, rusting or other indications of rehabilitation need. Field inspection did not reveal any conditions that would warrant immediate attention to the repair of light poles.

Light poles were in good condition based on visual observation of selected locations. The night survey revealed varying levels of service among lighting facilities. On the F. E. Everett Turnpike, most interchanges had at least one light out and certain interchanges had full outages. Like the F. E. Everett Turnpike, the Spaulding Turnpike had numerous interchanges with only a few lights out. Multiple high mast lighting, particularly in the Spaulding Turnpike area, had either full or partial outages. Toll plaza approaches and departures and rest areas also had few isolated outages associated with light fixtures that were not working. Regarding lighting outages, the Turnpike completes a “Lights Out” assessment monthly

and reports them to the respective utility owner for repair. Note that repair of lights is not a Turnpike responsibility but is done by the utility companies; per agreement the Turnpike cannot repair lights.

The Bureau turns off certain types of lighting at specific locations as part of an energy conservation program. The Turnpike is performing an ongoing assessment of lighting to identify appropriate locations for removal consistent with policy. The goal is to reduce energy use and costs, while not compromising safety. This effort requires coordination with Design Services, Utility Section and utility firms. Now that a tariff rate agreement for LED lighting has been developed, Capital and R&R projects will include the replacement of high mast lighting with more energy efficient LED lighting. HNTB recommends that the Bureau address lighting outage either through the ongoing capital projects, "Lights Out" program or through NHDOT statewide maintenance.

TOLL PLAZAS

One mainline toll plaza and four ramp toll plazas out of five mainline and four ramp plazas on the turnpike system were inspected as a part of this assessment. Bureau officials provided input for identifying which plazas would be selected for inspection to gather the general condition of revenue collection facilities, including consideration for new, renovated or expanded plazas (such as Hampton, Rochester and Dover). Inspection staff walked the plaza area, interior and exterior of the administration building, and tunnels. The field inspection of toll collection equipment or toll plaza signage was not included. The field inspection did not include treadles, coin collection machines, sensors, generators, heating or cooling systems. Approach signage beyond the ramp toll plazas were not inspected. Informal interviews were conducted with plaza supervisors and toll attendants to assist in the identification of plaza deficiencies. Table 8 identifies which plazas were inspected.

Table 8: Toll Plazas Inspected

Location	Toll Plaza
Blue Star Turnpike	Hampton Mainline Plaza, Hampton Ramp Plaza
F. E. Everett Turnpike	Hooksett Ramp Plaza, Exit 10 Ramp Plaza, Exit 11 Ramp Plaza

The Hampton toll plaza was provided with some renovations during the ORT conversion. The tunnel continues to experience water and salt infiltration through the tunnel ceiling, as shown in Figure 7. This has caused an unsafe condition for personnel and equipment with the interaction of water and the electrical panels within the tunnel. This condition has been temporarily mitigated by covering the electric panels with plastic bags. Ongoing efforts are being performed by the Bureau's Maintenance mechanics and vendors to address leakage and some of the work can be found under contracts 16100 and 15803.

The canopy showed paint peeling to a level in which corrosion of its members has started. Toll collection areas showed evidence of wear or deterioration mainly in the lane pavements and structural concrete

over tunnels as typical for these types of facilities. Plaza approaches showed typical signs of rutting and cracking with localized spalling at the interface of the approach and lane pavements. Lane pavements varied from minor cracking to heavy cracking with spalling and potholes (see Figure 8). The interior of the plaza administration building was in good condition with sufficient space for operations.

At the Hampton mainline plaza, tunnel leakage and salt penetration was observed at most of the pipe joints and at the duct openings for the toll booths. Most of the calcium hydroxide deposits have been removed but the cracks in the tunnel ceiling need to be addressed.

Figure 7: Hampton Mainline Toll – Tunnel Ceiling Leak

Figure 8: Hampton Mainline Toll – Cracked Lane with Differential Settlement

The Hampton Ramp Plazas are in generally poor condition. The area showing the greatest deterioration is the toll collection area, where there is major spalling, exposed reinforcing steel and delamination on the bumpers. The approach pavement is in poor condition on both sides.

The Hooksett Ramp Plaza administration building was observed to be in generally good condition. The transformer base cabinet is rusted through, and the pavement around the basins are in a deteriorated condition.

The Hooksett Ramp Plaza tunnel is in fair condition, with spalling, concrete delamination, ceiling leaks, and deterioration around the door frames.

The Ramp Plazas at Exit 10 in Merrimack were in generally fair to poor conditions. In the toll collection area, the bumpers have minor spalling, and the canopy needs paint. The lanes are spalled on patches with exposed reinforcement (see Figure 9). The tunnel has rusting at the expansion joint and minor shrinkage cracking. There is minor leaking at the booth opening. In the Ramp Plaza administration building, the interior walls exhibit minor cracking in the break room.

The Northbound Ramp Plaza at Exit 11 in Merrimack is in generally fair to poor condition. In the toll collection area, the bumpers have some spalls with exposed rebar (see Figure 10), the sidewalks are spalled, and the canopy needs paint. In the Ramp Plaza administration building, the interior walls have minor dings.

The Southbound Ramp Plaza at Exit 11 is in generally good condition. The coin lane is in fair condition, and the bumpers have heavy spalling with exposed reinforcement. This plaza slab was repaired in 2015 by Bridge Maintenance, however more repairs are needed to the plaza as a whole. This toll plaza should be targeted as an early FY 2022 repair. Traffic congestion is another issue during peak periods and should be addressed if possible under a Capital Program project.

Figure 9: Exit 10 NB Merrimack Side Toll - Spalling

Figure 10: Exit 11 NB Merrimack Side Toll – Spalling with Exposed Rebar

MAINTENANCE FACILITIES

Three of the six maintenance facilities on the turnpike system were visually inspected as a part of this assessment: the Hampton maintenance facility on the Blue Star Turnpike, and the Nashua and Hooksett maintenance facilities on the F. E. Everett Turnpike. Bureau officials provided input for identifying which maintenance facilities might be selected for inspection based on maintenance facilities that will remain on the system after pending projects have been completed. The Rochester maintenance facility on the Spaulding Turnpike is brand new, and the Dover maintenance facility was not included as a candidate for inspection because the Bureau's future Capital Program will provide funding to replace this older maintenance facility with new facilities in the town of Newington by the fall of 2020.

The inspection team walked the maintenance area sites with the foreman and viewed the exterior and interior of maintenance garages, other maintenance facility structures and the general layout of each facility. Table 9 provides a list of structures at each of the maintenance facilities.

Table 9: Inspected Maintenance Facility Structures

Structure	Hampton	Nashua	Hooksett
Main Garage Facility includes administrative offices	15 bays (7 Drive Thru, 2 bay Deep, 1 Single bay) Garage: 12,740 SF Mezzanine: 2,140 SF 1975	N/A	5 bays (4 Side Single-Stall and 1 End Single-Stall)
Salt Storage Building	Approx. – 8,300 SF Approx. 6,000 ton capacity 2002	N/A	N/A

Structure	Hampton	Nashua	Hooksett
Cold Storage Building	1 building Approx. 5,500 SF 1955	N/A	N/A
Salt Spreader Storage Facility	5 bay Approx. 2,000 SF 2010	N/A	8 bay Approx. 275 SF 2012
Fuel Pump Island	Pump island with new canopy (owned by Fuel Distribution Bureau)	N/A	Pump island (owned by Fuel Distribution Bureau)
Safety Training Facility	1 – Older 10x60 foot mobile home used as safety training facility.	N/A	N/A
Brine Building	New 2 bay facility for preparing and loading brine. Approx. 2,400 SF 2010	N/A	N/A

HAMPTON MAINTENANCE FACILITY

The Hampton facility was in generally good to very good condition. Site and access road pavements are in generally good condition. The main building was in very good condition; both the interior and exterior appeared to have been recently renovated. The wood exterior of the salt storage building should be treated to extend the life and minimize deterioration of the structure. An older cold storage building had some exterior siding damage and some of the wood joists inside the building appear to have some deflection. A new salt spreader storage facility should have the column bases grouted to prevent water/corrosion damage.

NASHUA MAINTENANCE FACILITY

The Nashua facility is in generally good condition, as are the site and access road pavements. The main building interior and exterior are also in generally good condition, with only slight cracks in the flooring, some deterioration at the base of bays, and minor soffit damage (see Figure 11).

The spreader rack, salt storage, Hillside 8-bay and 6-door storage building are all in generally good condition. The 4-door storage building shows signs of board rot on the exterior door.

A new metal roof is being installed to replace the existing shingle roof installed in 1999 under this R&R program. The Nashua DMV/E-ZPass WIC facility is also getting a roof replacement. The existing shingle roof installed in 1999 is proposed to be replaced with a metal roof.

Figure 11: Nashua Maintenance Facility – Minor Soffit Damage

HOOKSETT MAINTENANCE FACILITY

The Hookset facility is in generally good condition. The site pavement is in generally good condition but has some cracking and delamination, and the access road has some transverse cracks. The main garage is in generally good condition but there is minor cracking in the interior floors, the exterior door frame is cracking and has minor deterioration and rust at the base, and the exterior walls require caulking in spot locations. The 9-bay lean-to roof requires repair as a header beam post connector has failed (see Figure 12). The 5-bay storage building exterior door and walls are in fair condition, and the drainage is flowing against the building. The 7-bay exterior walls exhibit minor siding rot at the base and the end panels need to be secured; the exterior door is in fair condition. The exterior of the 40’ x 80’ storage building and 2-bay garage with lean-to were in generally good to very good condition. The 2-bay garage with lean-to, the 7-bay, and the 40’ x 80’ storage building were locked, and therefore their interiors were not inspected.

Figure 12: Hooksett Maintenance Facility – Nine Bay Lean-To – Failed Connection

REST AREAS

One rest area facility, the Seabrook rest area on the Blue Star Turnpike, was reviewed as a part of this assessment. A visual inspection was conducted of the site and facility conditions, including pavement, drainage, slopes, fencing and landscaping. Facilities including buildings were evaluated for significant deterioration or need. Staff walked through all buildings and sites to observe general conditions.

The rest area site was in generally fair condition. Striping for the vehicle and truck parking areas was barely visible at time of inspection, but was striped subsequent to our inspection. The visitor's center rear granite stairs had excessive gaps between the granite blocks and a loose handrail. There were numerous areas of poor grass growth; however, the inspection took place during a severe drought. Many trees required trimming or arborist care; most picnic tables had substantial deterioration; and numerous trash containers were damaged or missing. The truck parking area had severe map cracking in the pavement, and barriers appear to be blocking a converted overflow gravel parking area that was in poor condition. The perimeter fence was damaged from reported snow plowing activities. The ramps to and from the rest area were in fair condition with areas of map cracking and substantial patching. All of the pavement surfaces are to be rehabilitated in 2017 under an R&R contract.

The building exteriors were in good condition. The vending machine building is in generally good condition except for the door threshold which was to be ground down level by a later contract (40268). The telephone building was in fair condition; four telephone units are in place, but all others have been removed, and walls were unfinished due to that removal. The maintenance shed and trash area fencing were in fair to good condition. The main building exterior is in generally good condition. The interior of the main building is in very good condition.

The Bureau has an ongoing relationship with the Department of Resources and Economic Development (DRED) to coordinate maintenance operations at the Seabrook rest area. NHDOT and DRED performed an audit of rest areas/welcome information centers in 2015. The audit reviewed existing facility operations and maintenance practices and incorporated results of condition assessments, driver surveys, focus groups, and traffic, parking, and visitor data. The audit results for the Seabrook Rest Area stated that while the building was in excellent physical condition and the parking lot pavement was in fair condition, there were some Americans with Disabilities Act (ADA) compliance deficiencies that needed to be addressed. The audit report made short-term maintenance and repair recommendations including rectify ADA compliance items and provide new sidewalks, as well as long-term recommendations such as expanding the truck parking lot to increase capacity.

The Bureau recently completed a project in July 2016 which included HVAC updates, air conditioning installation, vendor building improvements, siding repairs, and painting. The site was updated to accommodate DOT inspection operations in the spring of 2016.

The condition of the parking lot is poor. The Bureau is planning to repave the parking lot next year, and the Highway Design group will evaluate modification of the tractor-trailer parking area with a goal of increasing the overall number of parking spots.

ADA projects are underway to address ADA compliance, including installation of automatic doors, new sidewalks and restriping of parking lots to add handicap spaces. HNTB recommends that in future, beyond FY 2023, the Bureau should additional funding to address ADA elements.

PARK AND RIDE FACILITIES

One park and ride facility, the Timber Swamp Road park and ride lot on the Blue Star Turnpike, was visually inspected as a part of this assessment and found to be in generally good condition. The pavement, markings, signage, and general site conditions were noted to be in generally good to fair condition. Pavement markings in the handicap area were starting to deteriorate. It is our understanding that the Turnpike restriped the parking lot late in the summer of 2016. Signage and drainage appeared adequate. This is a small lot with an estimated 105 spaces. There are a total of seven (7) Park and Ride facilities including Hampton's Timber Swamp Road, Nashua Exit 6 (built 2001) with 137 spaces, Nashua Exit 7 (built 1997) with 48 spaces, Nashua Exit 8 (built 1998) with 350 spaces, Hooksett Exit 11 (built 1995) with 56 spaces, Dover Exit 9 (built 2009) with 415 spaces and Rochester Exit 13 (built 2014) with 201 spaces. All of these Park and Ride facilities were striped in 2016, with the exception of the Dover site, where only half were striped due to active parking spaces.

BUREAU ADMINISTRATION BUILDING

As noted in the 2012 R&R report, the Bureau administration building, located near the Hooksett Toll Plaza, was in poor condition with many elements showing rot and decay, including exterior siding, casement windows, roof, stairs, carpeting, HVAC system, plumbing, and drainage. The water service to the building

was not safe for human consumption. The Bureau has spent $1300 per year for quarterly testing, which showed arsenic 3 and arsenic 5 in the water, and an additional $12,000 was spent on a treatment system that cannot be used due to the dissolution of the vendor. Only one tap in the building provides potable water.

A 2016 audit by the NHDOT Office of Federal Compliance (OFC) identified a number of ADA compliance issues in the Administration Building. The Bureau has initiated a two-phase approach to address ADA compliance issues such as parking, stairs, doors and elevators to align with the OFC ADA Transition Plan. The Bureau will repair deficiencies with its own forces where appropriate, and will repair others under the R&R program.

The facility was in need of extensive repair and replacement, and the Bureau subsequently received approval to completely reconstruct the facility, retaining as much of the existing facility as feasible. The need remains for reconstruction to address the items previously identified, including issues that affect employee health and safety. The Bureau and BPW have worked collaboratively to schedule this project under the Renewal and Replacement program for FY 2018.

AUDIT OF RENEWAL AND REPLACEMENT PROGRAM

The assessment of the Bureau's current R&R Program was conducted in conjunction with the development of an independent program for renewal and replacement. Data was collected through Bureau records of previous R&R expenditures since 2010 and documentation on the currently programmed amounts through FY 2021. The historic information serves as a record of the work conducted that played a role in the conditions observed during the assessment by HNTB. For example, the Bureau has historically targeted a 10-year cycle for pavement resurfacing and this compared with the assessment results provides the point of comparison with the historical program. Based on the condition assessment and comparison to the historic program, an independent program could be developed and subsequently compared to the current Bureau-programmed R&R activities through FY 2021. This process serves as both the independent development of an R&R Program for the Bureau and the audit of the Bureau's current program for R&R projects.

PREVIOUS AND PROJECTED BUREAU OF TURNPIKES R&R PROGRAM

The Bureau has developed and executed the R&R Program with the primary focus on pavement resurfacing, bridge repair, and guardrail replacement. These are the heart of the roadway system and represent generally 80-90 percent of the annual expenditure; this expenditure profile is typical of similar facilities. Other roadside components typically included in the R&R Program were signage, slopes, drainage and lighting, which receive about 5-10 percent of the allotments, with the remaining amounts serving support facilities such as maintenance, rest areas, and revenue collection facilities (toll plazas). The more extensive infrastructure such as roadway resurfacing and bridge repair requires continuous annual programming to keep up with the life cycle of these structures. Figure 13, Figure 14, Table 11 and

Table 12 summarize the Bureau's historical and projected R&R Program by the categories discussed in the assessment.

Figure 13: FY 2013 to 2017 Past and Current Bureau R&R Programs

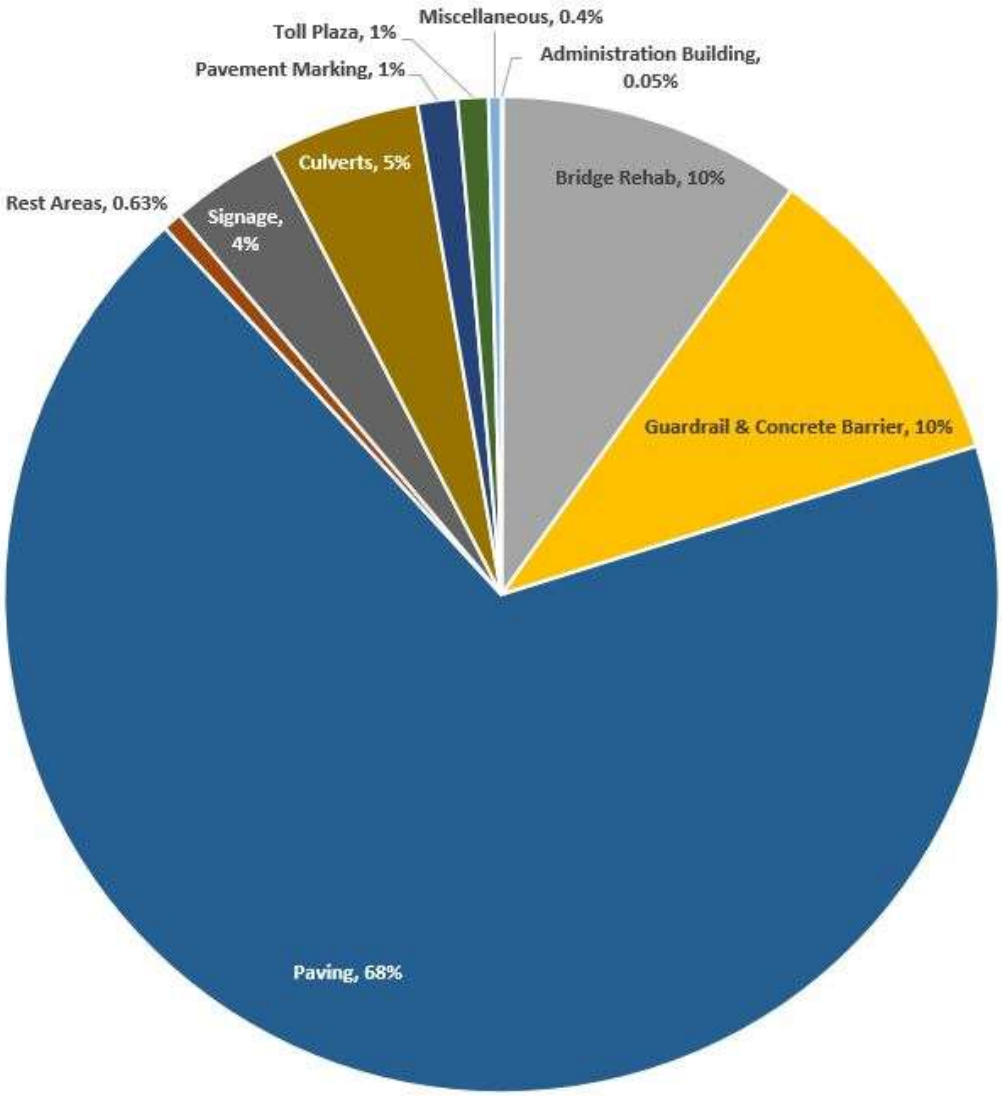


Figure 14: FY 2018 to FY 2023 Currently Projected Bureau R&R Programs

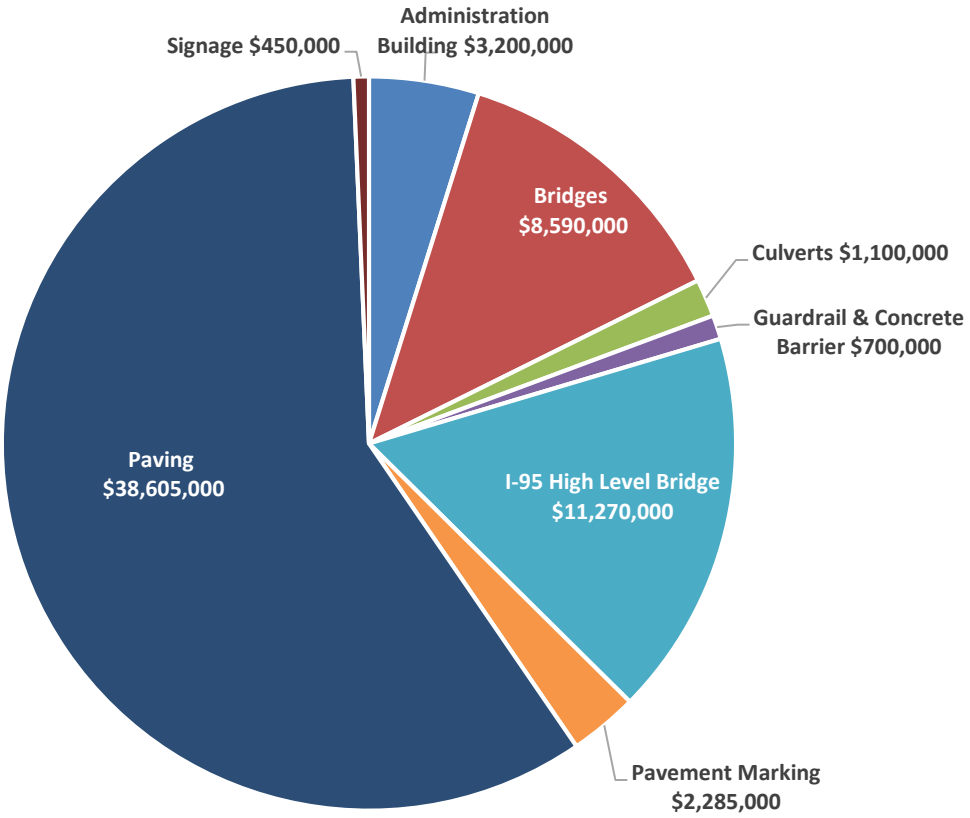


Table 10: Approved Funding Levels for Bureau of Turnpikes R&R per NHDOT Ten Year Plan 2017-2026 (Millions)

FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26
$12.8	$14.3	$10.4	$10.6	$10.8	$11.0	$11.3	$11.5	$11.7

Table 11: Bureau of Turnpikes R&R Programs FY 2013 to FY 2017

Project Type	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Totals	R&R
Administration Building				$25,000		$25,000	0.05%
Bridge Painting						$0	0.00%
Bridge Rehab	$2,383,262	$1,596,688		$611,065		$4,591,015	9.85%
Guardrail & Concrete Barrier	$1,625,116	$871,504	$1,035,665	$490,155	$767,765	$4,790,205	10.28%
Lighting						$0	0.00%
Maintenance Areas						$0	0.00%
Paving	$5,940,658	$6,217,956	$6,223,043	$6,710,247	$6,596,491	$31,688,395	67.99%
Rest Areas				$294,917		$294,917	0.63%
Signage			$553,190	$529,985	$588,470	$1,671,645	3.59%
Culverts		$522,216	$510,750		$1,251,729	$2,284,695	4.90%
Pavement Marking			$287,029	$315,320		$602,349	1.29%
Toll Plaza	$455,349			$9,307		$464,656	1.00%
Miscellaneous	$169,073	$23,821	$1,790			$194,684	0.42%
Total	$10,573,458	$9,232,185	$8,611,467	$8,985,996	$9,204,455	$46,607,561	100%

Table 12: Current Bureau of Turnpikes Projected R&R Programs for FY 2018 to FY 2023

Project Type	Projected (Currently Projected Bureau R&R Programs)							
	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Totals	% of R&R **
Administration Building ****	$2,400,000	$800,000					$3,200,000	4.83%
Bridge Painting							$0	0.00%
Bridge Rehab				$3,360,000		$1,790,000	$5,150,000	7.78%
Guardrail & Concrete Barrier						$700,000	$700,000	1.06%
Lighting							$0	0.00%
Maintenance Areas							$0	0.00%
Paving	**$6,525,000**	$5,120,000	$6,150,000	$6,860,000	$6,970,000	$6,980,000	$38,605,000	58.32%
Rest Areas							$0	0.00%
Signage						$450,000	$450,000	0.68%
Culverts					$400,000	$700,000	$1,100,000	1.66%
Pavement Marking	**$385,000**	$380,000	$380,000	$380,000	$380,000	$380,000	$2,285,000	3.45%
Toll Plaza							$0	0.00%
North Hampton Bridge Deck					$3,050,000		$3,050,000	4.61%
Manchester-Auburn Bridge	**$390,000**						$390,000	0.59%
I-95 High Level Bridge***	$1,800,000	$5,600,000	$3,870,000				$11,270,000	17.20%
Grand Total	$11,500,000	$11,900,000	$10,400,000	$10,600,000	$10,800,000	$11,000,000	$66,200,000*	100%

* Grand totals for those years show approved 2017 - 2026 Ten Year Transportation Improvement Plan (TYP) budgeted amounts.
** Percentages are calculated against the total R&R program for FY 2018 – FY 2021 only.
*** NHDOT portion only, MaineDOT portion not included.
**** Does not include PE, which was provided in FY17

Actual bid prices shown in bold

INDUSTRY COMPARISON

In order to provide perspective relative to the Bureau R&R program within the context of other toll roads, a comparison with information that was readily available for other agencies is presented in Table 13. This information must also take into consideration a number of factors that influence these numbers, and therefore should only be considered as a range of possible measurements rather than exact comparisons. These factors include:

- A range of interpretations concerning which expenditures should qualify as R&R versus capital projects or routine maintenance exists within the industry. Therefore, readily available information varies in the scope of what is included, and can introduce wide variations.
- R&R costs can vary by climate or region. For example, climates with more frequent freezing and thawing and wider use of salt for snow and ice control tend to have more frequent and extensive R&R programs in order to keep up with more rapid deterioration.
- The age of a facility and previous maintenance practices impact the levels of R&R required.
- R&R expenditures tend to be non-uniform, with "spikes" in program costs depending on where the facility is in the overall component life cycle. Thus, a single year is only a snapshot and may be higher or lower than average.
- The R&R required can vary based on the quantity and size of infrastructure within the total system miles. For example, a facility with a higher percentage of bridges per mile would be expected to have a higher cost of R&R per mile, if bridges in that region typically require more R&R over an extended period than pavement.

Table 13: Industry Data for R&R Program Comparison

	New Hampshire Turnpikes	Maine Turnpike	New Jersey Turnpike	North Texas Tollway	Miami Dade Expressway	New York State Thruway
2016 Gross Revenue	$132,700,000	$128,196,957	$1,106,268,000	$608,400,000	$182,824,000	$691,700,000
Lane miles	658	550	2,450	950	222	2,818
2016 R&R Program	$8,930,389	$26,000,000	$45,185,100	22,572,948	$6,843,000	$25,960,562
R&R as % Gross Revenue	6.7%	20.3%	4.1%	3.7%	3.7%	3.8%
R&R per lane mile	$13,572	$47,272	$18,443	$23,761	$30,824	$9,212

Based on the table and the limitations noted, the Bureau falls within the industry ranges with regards to R&R expenditures. Please note that the Maine Turnpike Authority (MTA) R&R program values are higher than other agencies identified. The MTA R&R program includes projects that are considered capital-type projects by other agencies, such as bridge reconstruction and toll system replacement.

HNTB RECOMMENDATIONS

In general, the scope of the R&R Program has been sufficient to maintain the Bureau's facilities and infrastructure in good working order.

For the purposes of accounting for price increases in the future, the recommendations include an estimated annual inflation of three percent based on published construction cost data.

PAVEMENT RESURFACING

The current goal of resurfacing the Bureau's mainline and ramps every ten years (but ultimately based on conditions) has maintained the roadway pavement in a good condition with visuals indicting 2% "fair", 43% "generally good", 33% "good" and 22% "new". The 10-year Turnpike resurfacing program for mainline roadway and ramp resurfacing and the frequency of interchange and toll plaza resurfacing is appropriate based on the observations of the inspection team.

The current amount of pavement showing the greatest distress (worse condition) and thus likely requiring the earliest resurfacing attention is estimated at approximately 3.1 lane miles for the entire Turnpike system. On average over the last four (4) years, the Bureau has executed resurfacing (R&R) contracts on approximately 48 lane miles per year. The Bureau has also executed capital improvement projects, some of which have also addressed areas of existing pavement. 100% of the Spaulding Turnpike has pavement and the pavement is no older than six years.

The quality of lane miles noted in the visual inspection as "fair" condition and requiring near term resurfacing appears to be minimized to an exceptionally small portion of the turnpike. A "fair" condition rating for pavement represents less than 2% of the entire turnpike. The combined due diligence of the pavement program and the coexistence of large capital program projects have improved the pavement quality beyond expectation. In the short term during the High Level Bridge construction, pavement preservation efforts should be minimized due to budget constraints.

Per recent bid prices, the Bureau will pave approximately 48 lane miles in FY 2018 at an approximate cost of $6,525,000. Based on the Turnpike's goal of paving 10% per year of the Turnpike system which is not otherwise handled by the capital program, a cost was estimated to maintain such a program based on recent historical prices for NHDOT paving projects. HNTB used the average unit costs for asphalt paving in the last two (2) years to develop a cost per lane mile of $145,800 starting in FY 2019. During the last four (4) years the price per lane mile per project was very erratic and hot bituminous pavement prices increasing and decreasing during these years. The cost per lane mile for FY 2019 was adjusted with an annual 3% inflation cost to FY 2023. Factoring in the recent capital program of approximately 55 lane miles per year, the total for resurfacing as part of the R&R program at 10% per year would be about 60 lane miles per year

(658 lane-miles total minus 55 lane miles of capital program impacts equals 603 lane miles). During the years (FY2018 - FY2020) in which the Turnpike will incur the majority of the I-95 High Level bridge costs, we believe an annual 30 percent reduction in pavement resurfacing could temporarily take place during these years. This is based on the high quality of the current Turnpike roadways. Using the estimated lane mile amount, the estimated cost to pave 41 lane miles (60 lane miles – 30 %) would be about $6 million in 2019 dollars. 41 lane miles for FY2019 is only a 12% difference from the average lane miles the Turnpike has paved annually in the last four years (48 lane miles). This lane mile cost was then used with the Turnpike Bureau's programmed paving budgets to provide an estimated lane-miles that the Turnpike Bureau could pave each year. Please see Table 14 below.

Beyond FY2020 and the effects of the I-95 High Level Bridge costs, the Turnpike could begin to return to the annual 10% of the pavement resurfacing or 60 lane miles per year as shown in Table 14 below.

Table 14: Bureau of Turnpikes Forecasted Paving Costs

FISCAL YEAR	PAVING COSTS	LANE MILES	COST PER LANE MILE
2018	$6,525,000	48	$135,938
2019	$6,000,000	41	$145,800
2020	$6,200,000	41	$150,200
2021	$7,700,000	50	$154,800
2022	$8,800,000	55	$159,400
2023	$9,900,000	60	$164,200

Based on the assumptions regarding capital projects that address R&R needs outside the R&R program, the current Bureau pavement projections for R&R appear to be adequate to maintain the quality of turnpike roadway surfaces

Other considerations were made when evaluating the appropriateness of the 10-year resurfacing program. Currently NHDOT uses crack sealing for non-Bureau of Turnpike facilities to slow overall deterioration by prohibiting water or vegetation intrusion into established cracks. Without crack sealing, the cracks have a greater propensity to widen through freeze thaw action, and further water intrusion can deteriorate substructure elements, leading to potholing or other significant failure modes. Since crack sealing would typically occur five or more years into the pavement cycle, the economic benefit during a 10-year cycle can be impractical if operational restrictions and traffic control requirements are significant. Crack sealing can require significant traffic control and worker exposure to traffic. Bureau facilities have traffic volumes that are generally prohibitive for daytime operations, requiring night work considerations that increase costs and traffic control requirements. Because of these limitations, the Bureau has selected to not utilize crack sealing.

In an effort to maximize R&R expenditures, the Bureau has used the option for the pavement resurfacing program (in addition to the standard overlay) that involves an inlay process that mills and replaces the pavement in the travel lanes while not replacing the pavement surface along the shoulders rather than the previous full width overlay process in some cases. In these inlay areas, the Bureau may want to consider a crack sealing program for sealing cracks in the older shoulder pavements to remain. This will help to reduce water infiltration into the granular subbase and extend the life of the shoulder pavements. The crack sealing operation could be done in conjunction with the travel lane repaving operation within the work zone to minimize additional traffic control requirements.

Park and ride lots, maintenance lots and rest areas should continue to be part of the paving program and resurfaced as needed. In FY 2018 the Turnpike will repave three park and rides: Seabrook, Nashua Exit 7 and Nashua Exit 8.

GUARDRAIL

In addition to pavement, another important roadway feature in the R&R Program is guardrail. The Bureau has included appropriations for guardrail and signage projects in the current R&R Program.

HNTB recommends that prioritization of guardrail replacement should be for guardrail sections that are in the greatest need of replacement - sections of wood post guardrail and wood post guardrail end treatments in which the wood posts are reaching their 15-20 year service life (as typically experienced by other agencies).

For the level of this assessment, the budgeted amounts appear to be sufficient so long as the program focuses on the prioritization of areas in greatest need. All new w-beam and thrie beam guard rail installations by NHDOT were noted as using steel post with composite offset blocks in place of wood posts with wood offset blocks. This continued approach to phasing out the use of wood posts will increase the life cycle of guardrail installations.

The guardrail observed to be possibly lower than the required height of 27 5/8” (due to plowing operations and pavement overlays) may be a consideration for replacement due to safety concerns and non-conformance. As the need to replace substandard barrier due to non-compliance with height requirements is realized, it can be addressed under the Capital program project.

At localized areas where barrier has deteriorated, the replacement has been addressed on R&R paving contracts. Under the resurfacing contracts, concrete barrier is receiving a water repellant (silane siloxane) treatment application to preserve the asset. Nine (9) miles of barrier will be treated this summer of 2017.

Wood guardrail is in good condition, and the Bureau is in the process of replacing wood rail with steel. Based on the current good condition of guardrail, and in order to accommodate other priorities such as the I-95 High Level Bridge rehabilitation, HNTB recommends that guardrail replacement be deferred until FY 2022 for $750,000 and FY 2023 for $700,000 through the end of this R&R schedule.

SIGNAGE

Relative to signage (including signage structures), the Bureau has appropriated an amount for replacement of signage throughout the system. The $590,000 of appropriations in FY 2017 should be sufficient in addition to the capital improvement programs replacing signage in full roadway reconstruction areas. Our visual inspection indicated that the Turnpike signage is in very good condition. Sign reflectivity for providing nighttime visibility deteriorates over time usually in a 7 to 10-year period. Hence, we agree with the Bureau deferring signage expenditures until FY 2023 For $450,000 would be reasonable. This deferment would be during the period of major cost effects of the I-95 High Level Bridge.

The Bureau currently has an inventory of all signing maintained by designated staff at NHDOT. Complete replacement of entire sections of roadway signing have recently been replaced on the Spaulding Turnpike, while other locations are being monitored and programmed as needed.

INTELLIGENT TRANSPORTATION SYSTEM

The Bureau has installed dynamic message signs, closed-circuit television (CCTV) systems, portable variable message signs and variable speed limit signs which are primarily along the Spaulding Turnpike and I-95 in the past six years. Components for dynamic message signs, motor vehicle count readers, and CCTV cameras will require component replacement under the R&R Program. A ten-year cycle is not uncommon for these types of assets from the standpoint of computer components. HNTB recommends that some level of funding be included in the projected R&R Programs for replacing and updating the computer components of the signs at their estimated end of life.

BRIDGES

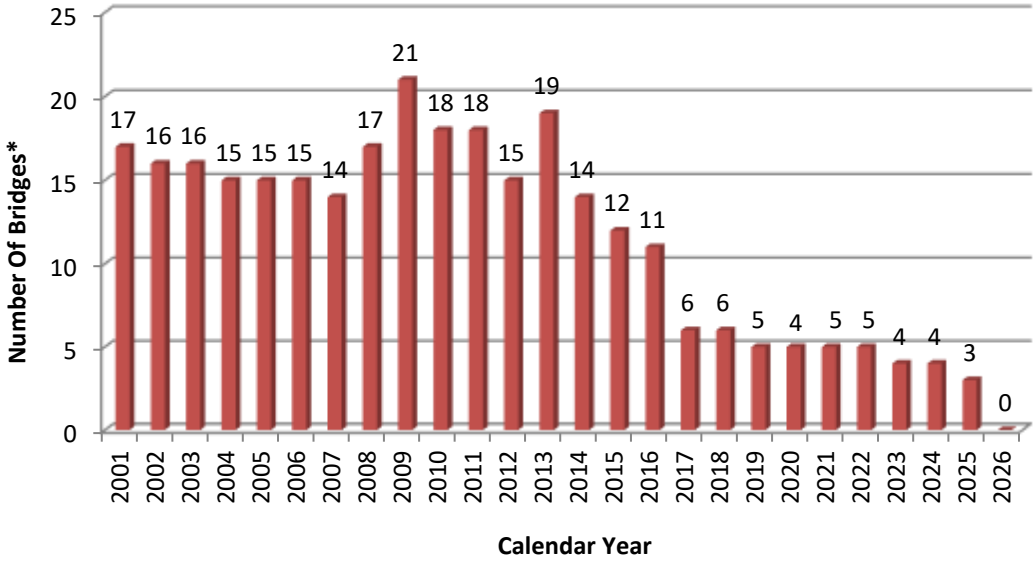
HNTB developed an independent R&R Program based on the general scope of work that the Bureau uses for bridge R&R projects. In most cases, the Bureau has included the most severe structures (“Red List” bridges) in the Capital Improvement Program. Projects that are typically targeted in the R&R Program include less deteriorated structures that have been assessed through visual inspections or extrapolated assumptions; re-decking or concrete repairs also generally qualify a bridge for rehabilitation.

For the purpose of this assessment, three funding sources or operational approaches were assumed to be available for maintaining bridge infrastructure:

1. Capital Improvement Program (CIP)
2. Renewal and Replacement (R&R)
3. Bridge Maintenance Operations

These funding sources mainly focus on bridges with moderate to severe deficiencies (i.e., NBI ratings of 6 or less). HNTB developed a list of Bureau bridges that fell under this umbrella (54 bridges); refer to the table in Appendix C. The 54 bridges listed include fourteen CIP bridges , six Red List bridges, and 12 Near Red List bridges. All current Red List bridges will be replaced/rehabilitated by FY 2026 in the current CIP schedule; refer to Figure 15. These bridges are already funded and therefore have been excluded from R&R level repairs. Bridge Maintenance Operations has completed work as straight forward as joint repairs to more extensive deck replacements. Bridge Maintenance Operations also completes preservation efforts such as bridge washing every year.

Figure 15: Turnpike Red List Bridges



*** Consistent with project funding and schedules in draft TYP 2017-2026**

Bureau of Bridge Maintenance Operations staff currently have a program that includes several bridges with the intent of proactively addressing bridge deficiencies before they become severe. These bridges were noted as having relatively minor deficiencies, that once addressed by

maintenance, would not be candidates for the R&R program. Additional bridges were noted as candidates for future maintenance activities as shown in the table in Appendix C.

After removing the Capital Improvement Program bridges and the Maintenance Operations bridges, twelve bridges remain and have been classified as R&R candidates based on condition ratings and inspection notes. One of the twelve bridges is the I-95 High Level bridge over the Piscataqua River and is discussed in further detail later on in this report; R&R funding is separate for this bridge. Table 15 provides a list of the bridges and work scope identified as the result of HNTB's assessment.

Table 15: List of Bridges and Potential Proposed Work Scope

Location	Bridge	Recommended Action	Current Turnpike Strategy
Bow	FEET over Robinson Road 168/120	Concrete Repairs	Bridge Maintenance Repair or R&R
Bow	FEET over Dow Road 158/137	Concrete Repairs	Bridge Maintenance Repair or R&R
Dover	Sp. Tpk. SB over Cocheco River 105/133	Concrete Repairs with need for Bearing and Girder Painting	R&R Program for FY 2021
Dover	Sp. Tpk. NB over Cocheco River 106/133	Concrete and Joint Repairs with need for Bearing and Girder Painting	R&R Program for FY 2021
Hampton	NH 27 over I-95 113/168	Concrete and Wearing Surface Repairs	Bridge Maintenance Repair
Hooksett	Pine Street over I-93 069/162	Concrete and Bearing Repairs	Bridge Maintenance Repair or R&R
Manchester	FEET over Hackett Hill Road 062/062	Concrete Repairs	Bridge Maintenance Repair or R&R
North Hampton	South Rd over I-95 079/079	Concrete Repairs with need for Bearing and Girder Painting	Bridge Maintenance Repair or R&R Painting under Statewide Bridge Painting project in R&R Program is dependent upon available funding
Hampton	I-95 over Access Road 115/157	Concrete Repairs	R&R FY Unknown Due to Funding Limitations
Portsmouth	I-95 NB over Sp. Tpk. 197/122	Concrete and Joint Repairs	Bridge Maintenance Repair or R&R
Portsmouth	I-95 over Maplewood Avenue 222/121	Concrete Repairs	Bridge Maintenance Repair or R&R

Location	Bridge	Recommended Action	Current Turnpike Strategy
Portsmouth	I-95 over Piscataqua River Rd, BMRR 258/128	*refer to "I-95 High Level Bridge" section of this report*	*N/A*

Once the bridge R&R candidates were defined, a conceptual estimate was developed based on the anticipated scope of work for each bridge with historical bid prices. The majority of bridges listed above require concrete repair work with a few joint replacement locations and some steel painting. The repair estimate ranged from $300,000 for some of the smaller bridges to $1,300,000 for some of the larger bridges. More significant repair or rehabilitation scopes would require closer to $2,000,000 per project. These price points compare well to the last ten years of R&R bridge projects. In light of this information, an annual expenditure of up to $1,500,000 annually would be recommended, to match past years' funding level and to maintain the current condition of the Bureau's bridge infrastructure. However, given that recommendation it is understood that several projects have already been selected for the upcoming R&R budget. The current list of bridge projects selected by the Bureau are FY 2018 Manchester-Auburn bridge ($390,000), FY 2021 Cocheco bridge ($3,360,000), FY 2022 N. Hampton Bridge deck ($3,050,000) and FY 2023 Bridge Preservation ($1,790,000) locations to be determined. Those projects will replace the recommended $1,500,000 annual expenditure for FY 2018 to FY 2023. The $1,500,000 annual expenditure does not include bridge painting.

Given that there are twelve bridge R&R candidates, the condition of the bridges permits a certain amount of flexibility in programming and regular monitoring will generally be necessary to prioritize the bridge projects. With the priority of bridges being driven by condition the current practice of one bridge repair per year would adequately address the Bureau's needs. Depending on the scope of work, two or three smaller projects could be funded in one year. This approach would leave approximately two to four bridges from the recommended list untouched at FY 2023.

In addition to the preceding bridge R&R candidate recommendations, the current Bureau R&R Program includes bridge painting. For the purpose of this assessment and to maintain consistency for comparison, bridge painting remains in the recommended R&R Program but HNTB's assessment was limited to the twenty-three bridges that were inspected. Nineteen of the bridges inspected by HNTB were steel girder bridges, nine of which were painted and ten of which were weathering steel. Based on visual inspections, five of the nine painted bridges warrant repainting in the near future. Expanding that trend to the entire bridge inventory shows that there are 143 steel girder bridges, 57 of which are painted and 86 of which are weathering steel. Given condition and age, 20 of the 57 painted bridges could require repainting. This approximation lines up well with the Bureau's recent painting assessment where 23 painted steel bridges were flagged for painting. Some of the issues are related to girder end painting and can be handled with a maintenance project. Assuming maintenance takes care of half of the bridges that leaves ten painted steel girder bridges that require repainting in the near future. By addressing one or two

bridges per year the current infrastructure condition would be sustained. HNTB recommends an annual expenditure of $500,000 beginning in FY 2022 after the completion of the I-95 High Level Bridge Project. Also, HNTB recommends including $1,200,000 in FY 2019 for I-95 bridge painting.

Ongoing maintenance activities by the Bureau of Turnpikes and the Bureau of Bridge Maintenance staff relative to bridge bearings and joint maintenance should continue. Additionally, regular pavement crack sealing, concrete substructure sealing, monitoring of joint conditions, bridge rails and safety fences, as well as approach guardrail maintenance are recommended. These proactive activities will have the potential to delay costlier repairs in the future.

I-95 HIGH LEVEL BRIDGE

HNTB recommends allocating $15.3 million in the FY 2018 thru FY 2023 R&R program for the I-95 High Level Bridge. This is approximately $4 million higher than the base cost for the I-95 High Level Bridge rehab project which is listed with a construction cost of $11.3 million in Table 16. The additional costs are associated with engineering, construction inspection, project complexities, maintenance of traffic limitations, and additional deck repairs anticipated to be required that are not currently included in the rehab budget. Right-of-way and utility costs are also not included herein, as they are not known at this time, which could also increase the cost of the project. Also excluded from this R&R program is any annual maintenance activities. Construction of the bridge rehabilitation project is anticipated to occur over a three-year period spread over four fiscal year cycles. Based on the most recent available information, a construction start year for the rehabilitation project of 2018 is reasonable. Furthermore, we recommend that the $15.3 million for the construction component of the rehabilitation project be split evenly by a linear weighted percentage by month over the anticipated construction period. Table 16 summarizes the program costs by year; and therefore, outlines the recommended program funding.

Table 16: I-95 High Level Bridge – Summary of Program Costs by Year

	FY 2018 7/1/17 to 6/30/18	**FY 2019** 7/1/18 To 6/30/19	**FY 2020** 7/1/19 To 6/30/20	**FY 2021** 7/1/20 To 6/30/21	***Totals***
Rehab Project (Construction)	$0.9M	$4.4M	$4.4M	$1.6M	***$11.3M***
Rehab Project (Added Deck Repairs)		$0.8M	$0.8M		***$1.6M***
Rehab Project (PE Only @ 8%)	$1.1M				***$1.1M***
Rehab Project (CEI Only @ 10%)	$0.1M	$0.5M	$0.5M	$0.2M	***$1.3M***
TOTAL	**$2.1M**	**$5.7M**	**$5.7M**	**$1.8M**	***$15.3M***

CULVERTS

Based on our inspection of culvert structures, only minor expenditures are anticipated and may be handled outside of the R&R Program. For FY 2017 the Central Turnpike will have slip-lining and outlet/inlet repairs at several locations. Additionally, the Turnpike Bureau has initiated an Asset Management effort which will allow for improved reporting and prioritization of the drainage assets, further enhancing the Bureau's ability to assess its needs for this asset. The Bureau has previously completed an assessment of culverts 36" and larger via a study for the Bureau, which identified culverts needing repair that resulted in two R&R Program projects.

The only anticipated future expenditures related to drainage structures are maintenance activities, including slope repairs, general masonry repair and vegetation and debris removal around the culvert inlets and outlets and stream channels of the larger drainage structures (drainage structures that are 36” in diameter and larger, and drainage structures comprised of multiple pipe crossings). These efforts could be considered on the R&R level if the needs were combined into larger contracted efforts, but given the capabilities of the Bureau’s maintenance forces, these efforts as standalone projects could likely be most effectively handled by internal maintenance crews. In addition to these efforts, continued monitoring of conditions following major storm events is recommended. Significant storm events or unchecked deterioration over time can lead to significant failures that are most cost effectively identified and addressed early.

This report recognizes that the Bureau has proactively begun addressing these maintenance issues. The current R&R Program provides drainage maintenance funding in FY 2022 for $400,000 and FY 2023 for $700,000. This funding level appears adequate for addressing drainage structure deficiencies noted in the visual inspections.

LIGHTING

Relative to lighting on the mainline and at interchanges, R&R appropriations have not been programmed nor are they anticipated based on this assessment. Under Capital Programs high mast light poles with conventional luminaires are being converted to low pole LED luminaires. Conversion to LED is approved now that an LED tariff rate has been established. LED conversion projects are not in the current program, but are anticipated in the future.

The Bureau performs a monthly "Lights Out" assessment; these results are reported to the utility owner. By agreement, the utility owner is responsible for repair to ensure continuous operation. Under R&R projects, lighting is also evaluated to determine whether lighting can be replaced consistent with DOT policy.

All existing lighting fixtures appear to be in good condition with the exception of nonfunctioning luminaires. HNTB recommends that nonfunctioning luminaires be proactively replaced as part of a maintenance activity on an as-needed basis and not undertaken as a yearly R&R Program item.

In the expanded R&R Program with increased budgets there is an LED lighting conversion project for $300,000 but is not currently listed in any budget.

REST AREAS

The Bureau has no R&R expenditures identified in future programs for addressing deterioration at the any of the rest area facilities. The site at the Seabrook Rest Area facility has recently had extensive renovations to the building exterior, walkways, HVAC, and ADA compliance needs. Paving and restriping of the parking lot at the Seabrook facility is planned under the Seabrook-Hampton 40770 resurfacing project in 2017. The Hooksett facilities are being maintained by others.

HNTB recommends that some level of funding beyond FY 2023 should be included in future R&R Programs for addressing any identified needs for rest area facilities providing Turnpike patrons with public facilities. At a minimum, any potential safety issues should be identified and repaired.

TOLL PLAZAS

The Bureau does have appropriations planned for renovation to the ramp toll plazas at Exits 10 and 11 on the F.E. Everett Turnpike in FY 2019. However, this is dependent upon legislation supporting an increase in funding for a R&R Program for Toll Plazas.

Regarding approach pavements, the frequency of resurfacing toll plaza asphalt approach areas within the resurfacing program appears adequate and appropriate. The condition of lane and tunnel concrete at older facilities warrant additional attention through both the continued regular Bridge Maintenance Group efforts and the R&R Program. As noted in the assessment summary, several locations exhibited significant deterioration of concrete lane pavement and cracking over tunnel roofs that will likely require attention sooner if not part of capital replacement. While these deteriorations do not present an immediate need to repair, the deterioration has resulted in leakage inside the tunnels and salt attack on the concrete and metal surfaces resulting in spalling or rusting. Addressing these conditions on a regular cycle could reduce the rate of deterioration and the potential for structural weakening or failure. At a maintenance level, cracks that have not fully penetrated slabs could be routed and filled or isolated spalling could be cleared to sound concrete for repair. In cases where lanes have reached significant levels of concrete deterioration that have penetrated into the tunnel and deteriorated a significant portion of the lane area, specific R&R contracts may be required.

To address the lane and structural concrete over the tunnels and with consideration to the applicability of the capital program, HNTB recommends the Bureau continue a regular program of concrete lane and tunnel repair under the R&R Program (similar to what was conducted at Hampton) and similar to the repair cycle for roadway resurfacing. The exact scope of the rehabilitation would be dependent on detailed assessments of the concrete condition at each plaza and the design of the concrete in the lanes by plaza, but for the purposes of this analysis,

the assumption was that for each of the lanes to be rehabilitated, some partial and full depth concrete repair would be required. Partial rehabilitation would involve the removal of all deteriorated concrete to sound concrete and the repair of the section with the appropriate joints and bonding. This could be typical of areas outside of the tunnel footprint that have localized partial depth deterioration. Full depth repair would involve the complete removal of the entire structural concrete section. Such work would be expected in areas of complete crack penetration and significant concrete deterioration. Assuming 25 percent of a lane in the cycle requiring partial depth repair and full depth repair over the tunnel section, this would roughly equate to about $75,000 of repair cost per lane with the assumptions made. HNTB recommends adding $1,050,000 to the R&R Program over the currently programmed amounts in FY 2019 for approximately 14 lanes.

The Hampton and Hooksett mainline toll plaza were recently rehabilitated, including the incorporation of Open Road Tolling. Currently funded capital program projects include upgrading mainline toll plazas at Rochester and Dover along the Spaulding Turnpike, and F. E. Everett Turnpike's Bedford plaza. Based on these assumptions this would leave Merrimack's Exit 10 & 11 Toll Plazas that are not programmed into a capital program, an ORT conversion or a demolition in the foreseeable future. This would leave a total of 14 lanes (at Exit 10 a total of 8 lanes, four in each direction, and at Exit 11 a total of 6 lanes, three in each direction) that would need rehabilitation. As stated, about 14 lanes could be rehabilitated in four years.

It should be noted that the recommended amount of lane and tunnel repair does not include work to maintain booth seals to concrete islands, island concrete repair or bumper maintenance. While the general condition of these components was fair, general maintenance (caulking, concrete sealing, and minor spall repair) should be continued to maintain an adequate condition. These costs have not been included. Additionally, the program to rehabilitate concrete lanes and tunnel features results in a repaired not replaced structure. While the life expectancy can be significantly extended, the resulting appearance of the lane and tunnel surfaces would not hold the same visual aesthetics of a new plaza facility.

BUREAU ADMINISTRATION BUILDING

The current administration building, which serves as the headquarters for the Bureau of Turnpikes in Hooksett, has been recognized by the Bureau as a structure that has reached the end of its design life and will require serious consideration for significant renovation or replacement based on the cost effectiveness of potential solutions. The visual assessment confirmed the deficiencies from a facilities condition standpoint. Facility conditions include leakage in the roof and window areas due to rot and corrosion, flooding of basement offices during significant rain events due to drainage deficiencies, spalling concrete stairs, lack of potable water, an inefficient HVAC system and corroded plumbing that could result in emergency repairs and/or causing the facility to be inhabitable without warning.

Assessment of the Administration Building and identification of potential solutions have been ongoing since 2007 with several iterations of reports, conceptual drawings/plans, and general efforts. Replacement or rehabilitation costs will continue to rise while the building further deteriorates as this topic is further delayed.

A renovated Turnpike Administration Building is identified in the Turnpike budget in FY 2018 for $3,600,000. Approval was granted in February 2017 for a new facility (not to exceed 11,400 SF) to progress to the final design stage. It is anticipated that final design shall be finished by August 2017, with construction expected to be complete by March 2019.

MAINTENANCE AREAS

HNTB inspected three maintenance facilities; Nashua, Hooksett and Hampton. The Maintenance buildings, both inside and out, as well as the pavement and the grounds rated very high in the field inspection. Since our last inspection in 2011 there have not been many rehabilitation projects programmed for maintenance areas, but the facilities remain in good condition. The Bureau has scheduled a project for Spring 2017 for roofing at the Nashua Maintenance facility and for other minor needs at the Nashua WIC/DMV.

HNTB recommends ongoing routine maintenance considerations at the maintenance facilities to include the preservation of wood structures, including sealing of salt storage structures, cold storage and miscellaneous hanger racks and some roof replacements to reduce the potential for premature deterioration that might accelerate the need for costlier R&R expenditures. At this time these components did not exhibit need for inclusion in the R&R Program, but preventative maintenance through repair of isolated deteriorated siding, windows, and staining of wood could extend the life of these structures.

CONTINGENCY PLANNING

Outside the known scope of R&R appropriations, the Bureau has recognized and experienced the need for funding in emergency conditions. For example, unanticipated storm events that result in significant slope failures requiring immediate repair. The majority of these costs are likely to be covered by deferral from the R&R Program. Historically, the Bureau has utilized R&R funding previously allocated to lower priority projects such as bridge painting to address certain types of emergency repairs. Additionally, as part of policy, R&R funds that are not expended during a fiscal year are reserved for future contingency as needed. Given the history of adequate funding and amount of the reserve, such practice appears to be appropriate for contingency purposes. HNTB recommends that in future when funding allows, the Bureau should consider creating a contingency fund to address emergency situations. Historically, the Bureau has needed to address bridge rehabilitation projects in order to prevent near-red-list bridges from reaching the Red List. HNTB recommends that funding be considered in future R&R budget allocations to address this anticipated need.

INSPECTIONS

The status of facility and infrastructure conditions is constantly evolving based on environmental and construction factors. While certain aspects require more frequent assessment than others, all infrastructure elements require regular assessments to maintain an updated and accurate projection of costs and needs for maintenance, R&R and Capital Improvement Program consideration.

The Bureau currently has internally-provided assessments for most projections and in certain circumstances has involved outside independent consultants to carry out specific assessments. Infrastructure such as roadway, guardrail, toll plazas, major drainage structures and bridges are both the majority of R&R expenditures and the most critical components of the overall system, and therefore should be considered for regular formal evaluation.

Items which are less critical and have slower potential deterioration such as lighting, signage, maintenance facilities, Park and Ride, and rest area facilities, could be evaluated on a lesser, rolling cycle. Items subject to significant deterioration under the less frequent cycles could be moved to the annual assessment for monitoring until addressed.

In addition to the existing bridge inspection and roadway pavement audits, the introduction of a robust guardrail inspection process (which is complete and in-place), and drainage inspection process (which is under development), serve the R&R program well and provide current ongoing asset conditions.

The regular programming and documentation of assessments would not only provide the appropriate level of monitoring based on the critical nature or deterioration potential of the component, but it could also serve as formal documentation and assist in regular justification of budget expenditures. While a regular expenditure for inspection activities is not included, it is recommended that the Bureau consider an evaluation of the current assessment process based on internal and external needs and requirements.

SUMMARY

As discussed, the infrastructure associated with the Bureau is generally in good condition and the overall scope of work relative to R&R projects has generally been sufficient in the past. The New Hampshire DOT Bureau of Construction indicates that trend lines reveal the fuel and liquid asphalt prices are going down, roadway excavation, rebar, crushed material, structural concrete and hot mix are going up in price and structural steel is maintaining a level price. Inflation factors of 3% annually have been applied to future appropriations. The mainline pavement has less than 4 miles of a "fair" rated condition and toll plaza areas require some rehabilitation. Because of these factors, there could be a slightly reduced effort in paving during the fiscal years of 2018 through 2020 while the Turnpike incurs the majority of the anticipated $15.3 million costs of the I-95 High Level Bridge. The higher unit costs of pavement are making it difficult to maintain an annual schedule paving 10% of the turnpike's lane miles while balancing the needs of the remaining facilities.

HNTB's report in 2011 stated that the Administration Building was "fair to marginal condition" and although some mitigation was attempted since the last report the facility has been down rated to "poor". A warning was given that corroded plumbing combined with contaminated water could leave the facility inhabitable if there is a case of flooding.

The current Bureau R&R Program (FY 2018 through FY 2023) has a cost range from $10.4 to $11.9 million with an average annual expenditure of approximately $11.1 million and a total cost of approximately $66.2 million. Based on the independent program developed with the factors noted above included, the HNTB recommended program from FY 2018 to FY 2023 would total approximately $81 million, with an average annual expenditure of $13.5 million. The approved 2017 - 2026 Ten Year Transportation Improvement Plan funds have a total budget for the same years of $69.9 million and an average annual expenditure of $11.6 million.

Figure 16, Figure 17 and Table 17 summarize the entirety of the R&R Program recommendations.

We conclude that the Bureau's current R&R program funding should be increased to the totals shown for the period from FY 2018 to FY 2023.

Figure 16: Current and Recommended R&R Program Amounts from 2018 to 2023

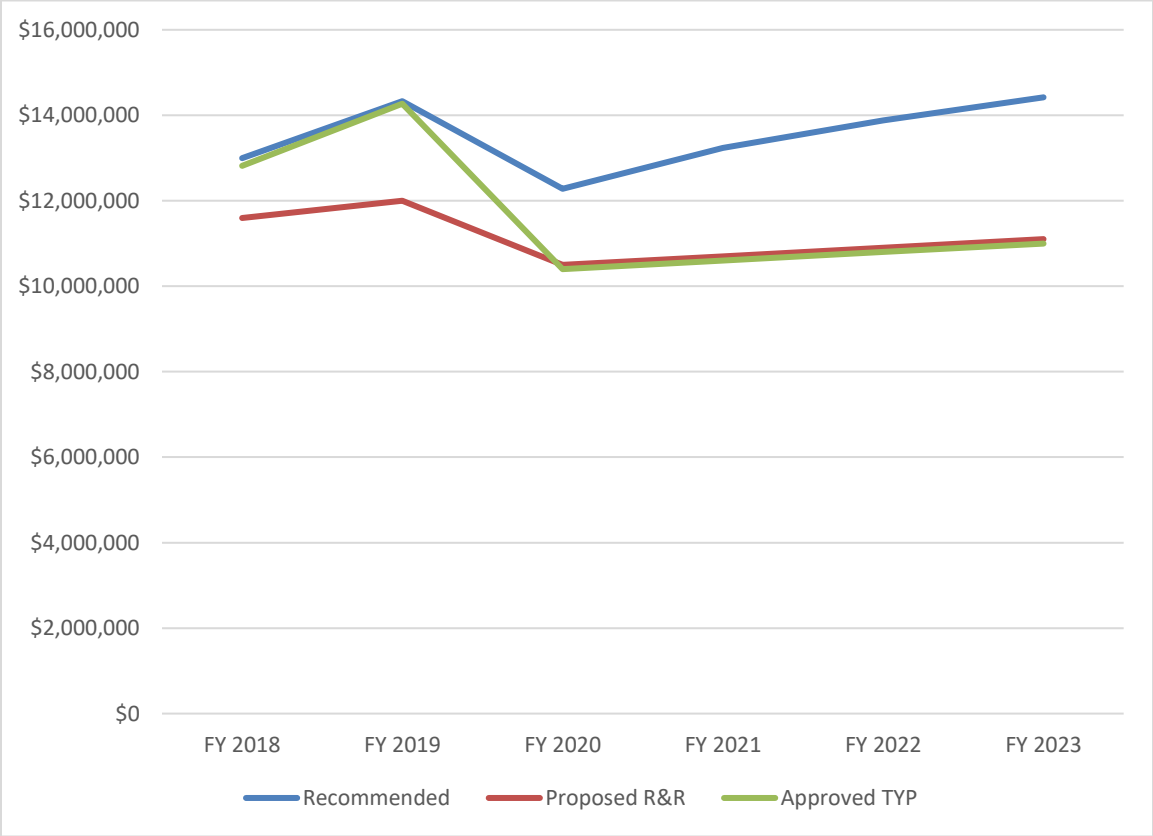


Figure 17: Recommended R&R Program Amounts from FY 2018 to FY 2023

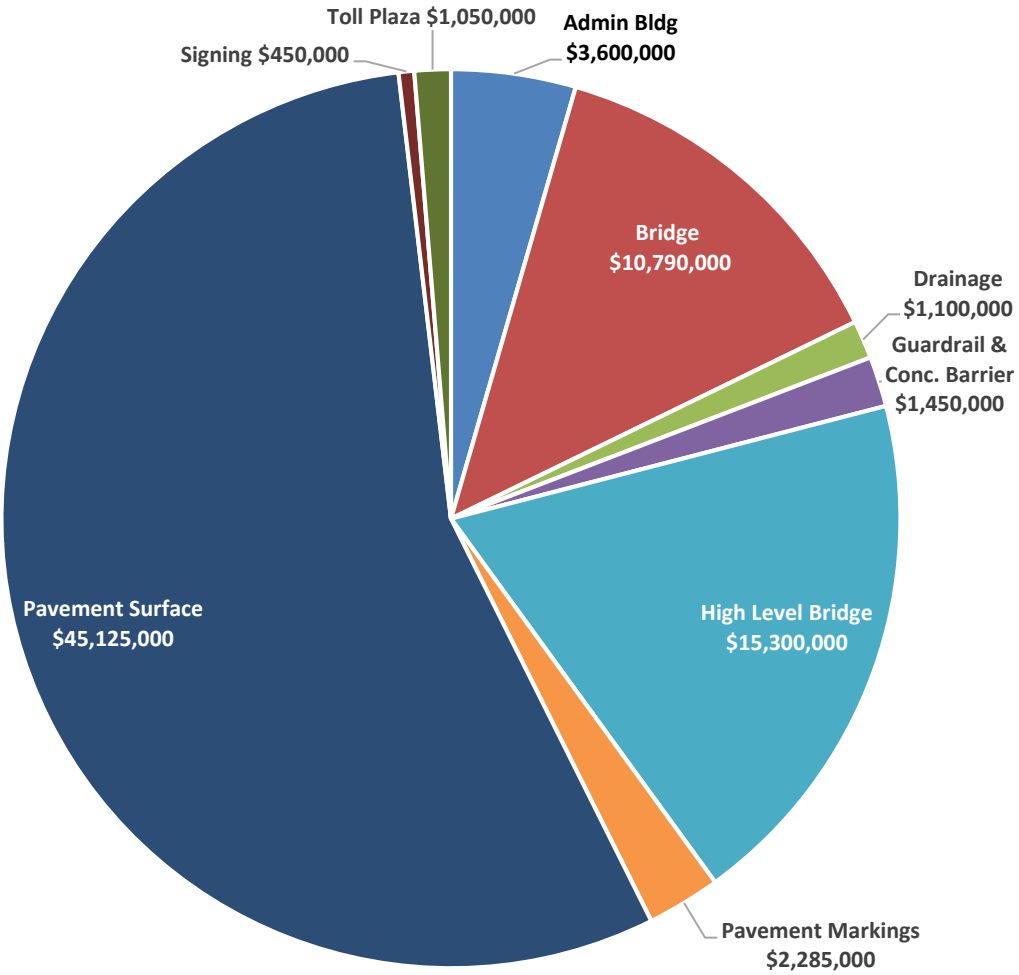


Table 17: Recommended FY 2018 to FY 2023 R&R Program Amounts with Comparison to Current Program Amounts

Project Type	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Totals
Admin Building	$3,600,000						$3,600,000
Bridge Preservation						$1,790,000	$1,790,000
Cocheco Bridge Rehabilitation				$3,360,000			$3,360,000
North Hampton Bridge Deck					$3,050,000		$3,050,000
Manchester-Auburn Bridge	$390,000						$390,000
Bridge Painting I-95		$1,200,000					$1,200,000
General Bridge Painting					$500,000	$500,000	$1,000,000
Drainage					$400,000	$700,000	$1,100,000
Guardrail & Conc. Barrier					$750,000	$700,000	$1,450,000
I-95 High Level Bridge	$900,000	$4,400,000	$4,400,000	$1,600,000			$11,300,000
I-95 High Level Bridge Ancillary Items	$1,200,000	$1,300,000	$1,300,000	$200,000			$4,000,000
Lighting							$0
Park & Ride							$0
Pavement Markings	$385,000	$380,000	$380,000	$380,000	$380,000	$380,000	$2,285,000
Pavement Surface	$6,525,000	$6,000,000	$6,200,000	$7,700,000	$8,800,000	$9,900,000	$45,125,000
Rest Area							$0
Signing						$450,000	$450,000
Toll Plaza		$1,050,000					$1,050,000
PROPOSED TOTAL	**$13,000,000**	**$14,330,000**	**$12,280,000**	**$13,240,000**	**$13,880,000**	**$14,420,000**	**$81,150,000**
APPROVED BUDGET *	$12,820,000	$14,270,000	$10,400,000	$10,600,000	$10,800,000	$11,000,000	$69,890,000
Delta: Approved - Proposed	-$180,000	-$60,000	-$1,880,000	-$2,640,000	-$3,080,000	-$3,420,000	-$11,260,000

* Approved Budget reflects the Governor's Recommended Budget for FY 2018/FY 2019 biennium. Future fiscal years, FY 2020 to FY 2023, reflect the Approved Ten Year Plan for 2017-2026.

REFERENCES

The following documents were provided by NHDOT Bureau of Turnpikes staff via electronic copy in support of the project:

Name	Description	Electronic Filename
Turnpikes R&R Report	2016 report documenting the historic and currently projected Bureau R&R program from 2016-2019; includes Red List Bridges, Near Red List Bridges, guardrail historical cost per foot, and general locations of pavement resurfacing by fiscal year. FY16 projects and expenditures	Turnpike Renewal and Replacement Report 2016.pdf R&R Status Report-Final 2015.pdf R&R Status Report-Final 2014.pdf R&R Status Report-Final 2013.pdf R&R Program Monthly Reconciliation 0616.pdf R&R Expenditure Breakdown.xls Proposed RR 07-26-16.xlsx R&R 04-05-16.xlsx R&R 03-02-16.xlsx Rehabed Bridges Per Fiscal Year Cost.xlsx
Turnpike System Priority Capital Program	Approved 2017 – 2016 Ten Year Transportation Improvement Plan	NHDOT-Approved-TYP-06262016.pdf
Various drainage inspection reports and culverts lists	Central Turnpike inspections	Central Culvert Inspections Shed 815.pdf Central Culvert Inspections Shed 820.pdf Central Culvert Inspections Shed 825.pdf Stantec Full Central Drainage List.xlsx
Guardrail information	Location and condition of guardrail	SADES GR.xlsx Soundwall.xls
Pavement condition data Total Lane Miles, Historical Resurfacing Costs	NHDOT quantitative pavement condition measurements of International Roughness Index (IRI) for Bureau pavements 2009-2015. Turnpike Pavement Lane Miles, Turnpike Resurfacing Cost Summary 1989-2017, including total cost and cost/lane mile.	Turnpike_Condition_Graphs_2009-2015_20160204.xlsx TPKresurfacinglanemile1.xls

Name	**Description**	**Electronic Filename**
Bridge Inventory	List of bridges with overall conditions; Red List bridges and Near Red List bridges updated June 2016; bridge repair schedule dated April 2016.	Turnpikes Bridges 06-13-16 (Updated).xlsx Turnpikes Bridges 02-11-16.xlsx Tpk Red list and Near Red list 061816.pdf Bridge Maintenance Repair List 061816.pdf
Bureau bridge inspection reports	2014-2016 NHDOT bridge inspection reports for Bureau bridges	Inspection Reports (All 170 Bridges).pdf Inspection Reports (Element Level).pdf Inspection Reports (Condition Data).pdf
I-95 High Level Bridge In-Depth Inspection and Condition Report	Inspection report dated July 2014 for Piscataqua River Bridge	Inspections 7-21-2014.pdf
I-95 High Level Bridge R&R needs and funding	December 2010, Final Report Bi-State Bridge Funding Task Force; January 29, 2016, NHDOT Interdepartmental Communication, Turnpike's Replacement and Renewal Program, Annual Report and Status Update; October 21, 2014, NHDOT Bridge Inspection Report; February 16, 2016, Memorandum, Synopsis of Deck Core Results; March 11, 2016, List of Rehabilitation Needs, Portsmouth-Kittery I-95 Piscataqua River Bridges; March 21, 2016, Project Development Directors Data Sheet; and April 14, 2016, Memorandum, List of Needs Meeting.	Piscataqua River Bridge - WIN 19270 - List of Needs.pdf List of Needs Meeting Minutes 4.5.16.docx Project Info Sheet 030816.doc Alternative Cost Matricies.xlsx 16189 Funding.xlsx
NHDOT 2016 Bridge Priority List	2016 Bridge Maintenance Repair Schedule NHDOT State-Owned Red List Bridges	Bridge Maintenance Repair List 061816.pdf 2016-03-31_nhdot_state_red_list
Overhead Sign Bridges	OH Sign Inventory Inventory of Eastern Turnpike Overhead Sign Bridges	Statewide OH Sign Structure List.xls OHSS_14_1110 I-95 Structures.pdf
ITS	ITS Devices on Turnpikes	ITS-TurnpikeDevices_2016-08-03.pdf

Name	**Description**	**Electronic Filename**
Buildings & Grounds (Maintenance, Toll, Service Area, Park-and-Ride, and Rest Area Facilities)	Memo from Buildings & Grounds engineer detailing current needs and recent history of rehabilitation (in lieu of detailed inspection reports) Approval memo regarding Administration Building New Hampshire Rest Areas & Welcome Info Centers Study Recommendations	Hooksett Admin Buildings System Wide 123015.docx Park and Ride Inspection Report.xls Seabrook Welcome Center ADA review.docx Seabrook Rest Area ADA Report revised.pdf Tpk Admin Building Approval Memo 021717.pdf WIC Study Results.pdf Seabrook Rest Area ADA Report.pdf

Appendix A

VISUAL

PAVEMENT

ASSESSMENT

RATINGS

PAVEMENT ASSESSMENT - JULY 2016

SECTIONS RATED NEW (10) OR CURRENTLY **UNDER CONSTRUCTION (UC)** ARE DESIGNATED WITH GREEN	**10**
SECTIONS RATED IN GOOD (9) CONDITION ARE DESIGNATED WITH GRAY	**9**
SECTIONS RATED IN GENERALLY GOOD (8) CONDITION ARE DESIGNATED WITH BLUE	**8**
SECTIONS ENTIRELY RATED FAIR CONDITION (7) IS DESIGNATED WITH ORANGE	**7**

MILE MARKER	BLUE STAR		SPAULDING		CENTRAL	
	NB	SB	NB	SB	NB	SB
0.0	8	8	9	9	10	10
0.1	8	8	9	9	10	10
0.2	8	8	9	9	10	10
0.3	8	8	9	9	10	10
0.4	8	8	9	9	10	10
0.5	8	8	9	9	10	10
0.6	8	8	9	9	10	10
0.7	8	8	9	9	10	10
0.8	8	8	9	9	10	10
0.9	8	8	9	9	10	10
1.0	8	8	9	9	10	10
1.1	8	8	9	9	10	10
1.2	8	8	9	9	10	10
1.3	8	8	9	9	10	10
1.4	8	8	9	9	10	10
1.5	8	8	9	9	10	10
1.6	8	8	9	9	10	10
1.7	8	8	9	9	10	10
1.8	8	8	9	10	10	10
1.9	8	8	10	10	10	10
2.0	8	8	10	10	10	10
2.1	8	8	10	10	10	10
2.2	8	8	10	10	10	10
2.3	8	8	10	10	10	10
2.4	8	8	10	10	10	10
2.5	8	8	10	10	10	10
2.6	8	8	10	10	10	10
2.7	8	8	10	10	10	10
2.8	8	8	10	10	10	10
2.9	8	8	10	10	10	10
3.0	8	8	10	10	10	10
3.1	8	8	10	10	10	10
3.2	8	8	10	10	10	10

MILE MARKER	BLUE STAR		SPAULDING		CENTRAL	
	NB	SB	NB	SB	NB	SB
3.3	8	8	10	10	10	10
3.4	UC	8	10	10	10	10
3.5	UC	8	10	10	10	10
3.6	UC	8	10	10	10	10
3.7	UC	8	10	10	10	10
3.8	UC	8	10	10	10	10
3.9	UC	8	10	10	10	10
4.0	UC	8	10	10	10	10
4.1	UC	8	10	10	10	9
4.2	8	8	10	10	10	9
4.3	8	8	10	10	10	9
4.4	8	7 [1]	10	8	10	9
4.5	8	7 [1]	8	8	10	9
4.6	8	7 [1]	8	8	10	9
4.7	8	7 [1]	8	8	10	9
4.8	8	7 [1]	8	8	10	9
4.9	8	7 [1]	8	8	10	9
5.0	8	7 [1]	8	8	10	9
5.1	8	7 [1]	8	8	9	9
5.2	8	8	8	8	9	9
5.3	8	8	8	8	9	9
5.4	8	9	8	8	9	9
5.5	8	9	8	8	9	9
5.6	8	8	8	8	9	9
5.7	8	8	8	8	9	9
5.8	8	8	8	8	9	9
5.9	8	8	8	8	9	9
6.0	8	8	8	8	9	9
6.1	8	8	8	8	9	9
6.2	8	8	8	8	9	9
6.3	8	8	8	8	9	9
6.4	8	8	8	8	9	9
6.5	8	8	8	8	9	9
6.6	8	8	8	8	9	9
6.7	8	8	8	8	9	9
6.8	9	8	8	8	9	9
6.9	9	8	8	8	9	9
7.0	9	8	8	8	9	9
7.1	9	8	8	8	9	9

[1] To be paved in FY 2019.

MILE MARKER	BLUE STAR		SPAULDING		CENTRAL	
	NB	SB	NB	SB	NB	SB
7.2	9	9	8	8	8	9
7.3	9	9	8	8	8	9
7.4	9	9	8	8	8	9
7.5	9	9	8	8	8	9
7.6	9	9	8	8	8	9
7.7	9	9	8	8	8	8
7.8	9	9	8	8	8	8
7.9	9	9	8	8	8	8
8.0	9	9	8	8	8	8
8.1	9	9	8	8	8	8
8.2	9	9	8	8	8	8
8.3	9	9	8	8	8	8
8.4	9	9	8	8	8	8
8.5	9	9	8	8	8	8
8.6	9	9	8	8	8	8
8.7	9	9	8	8	8	8
8.8	9	9	8	8	8	8
8.9	9	9	8	8	8	8
9.0	9	9	8	8	8	8
9.1	9	9	8	8	8	8
9.2	9	9	8	8	8	8
9.3	9	9	8	8	8	8
9.4	9	9	8	8	8	8
9.5	9	9	8	8	8	8
9.6	9	9	8	8	8	8
9.7	9	9	8	8	8	8
9.8	9	9	8	8	8	8
9.9	9	9	8	8	8	8
10.0	9	9	8	8	8	8
10.1	9	9	8	8	8	8
10.2	9	9	8	8	8	8
10.3	9	9	8	8	8	8
10.4	9	9	8	8	8	8
10.5	9	9	8	8	8	8
10.6	9	9	8	8	8	8
10.7	9	9	8	8	8	8
10.8	9	9	8	8	8	8
10.9	9	9	8	8	8	8
11.0	9	9	8	8	8	8
11.1	9	9	8	8	8	8
11.2	9	9	8	8	8	8
11.3	9	9	8	8	8	8
11.4	9	9	8	8	8	8
11.5	9	9	8	8	8	8
11.6	8	9	8	8	8	8

MILE MARKER	BLUE STAR		SPAULDING		CENTRAL	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**
11.7	8	9	8	8	8	8
11.8	8	9	8	8	8	8
11.9	8	9	8	8	8	8
12.0	8	9	8	8	8	8
12.1	8	9	8	8	8	9
12.2	8	8	8	8	8	9
12.3	7 [2]	8	8	8	8	9
12.4	7 [2]	8	8	8	8	9
12.5	8	8	8	8	8	9
12.6	8	8	8	8	8	9
12.7	8	8	8	8	8	9
12.8	8	8	8	8	8	9
12.9	8	8	8	8	8	8
13.0	8	8	9	9	7 [3]	8
13.1	8	8	9	9	7 [3]	8
13.2	8	8	9	9	7 [3]	8
13.3	8	8	9	9	7 [3]	8
13.4	8	8	9	9	7 [3]	8
13.5	8	8	9	9	7 [3]	8
13.6	8	8	9	9	7 [3]	8
13.7	8	8	9	9	7 [3]	8
13.8	8	8	9	9	7 [3]	8
13.9	8	8	9	9	7 [3]	8
14.0	8	8	9	9	7 [3]	8
14.1	8	8	9	9	7 [3]	8
14.2	8	8	9	9	7 [3]	8
14.3	8	8	9	9	7 [3]	8
14.4	8	8	9	9	7 [3]	8
14.5	8	8	9	9	7 [3]	8
14.6	8	8	9	9	7 [3]	8
14.7	8	8	9	9	7 [3]	8
14.8	8	8	9	9	7 [3]	8
14.9	8	8	9	9	7 [3]	8
15.0	8	8	9	9	7 [3]	8
15.1	8	8	9	9	7 [3]	8
15.2	8	8	9	9	7 [3]	8
15.3	8	8	9	9	7 [3]	8
15.4	8	8	9	9	8	8
15.5	8	8	9	9	8	8
15.6	8	8	9	9	8	8

[2] Asphalt patching for pavement joint and potholes.

[3] To be paved in FY 2018.

MILE MARKER	BLUE STAR NB	BLUE STAR SB	SPAULDING NB	SPAULDING SB	CENTRAL NB	CENTRAL SB	
15.7			9	9	8	8	
15.8			9	9	8	8	
15.9			9	9	8	8	
16.0			9	9	8	8	
16.1	Blue Star ends at		9	9	8	8	
16.2	MM 16.2± on the		9	9	8	8	
16.3	Piscataqua River		9	9	8	8	
16.4	Bridge.		9	9	8	8	
16.5	Bridge abutment is at		9	9	8	8	
16.6	MM 15.7±.		9	9	8	8	
16.7			9	9	8	8	
16.8			9	9	8	8	
16.9			9	9	8	8	
17.0			9	9	8	8	
17.1			9	9	8	8	
17.2			9	9	9	8	
17.3			9	9	9	8	
17.4			9	9	8	8	
17.5			9	9	8	8	
17.6			9	9	8	9	
17.7			9	9	8	9	
17.8			9	9	8	9	
17.9			9	9	8	9	
18.0			9	9	8	9	
18.1			9	9	8	9	
18.2			9	9	8	9	
18.3			9	9	8	9	
18.4			9	9	8	9	
18.5			9	9	8	9	
18.6			9	9	8	9	
18.7			9	9	8	9	
18.8			9	9	8	9	
18.9			9	9	8	9	
19.0			9	9	8	9	
19.1			9	9	9	8	
19.2			9	9	9	8	
19.3			9	9	9	9	
19.4			9	9	9	9	
19.5			9	9	9	9	I-293
19.6			9	9	9	9	MM
19.7			9	9	9	9	on F.E.
19.8			9	9	9	9	Everett
19.9			9	9	9	9	Turnpike
20.0			9	9	9	8	4.0

MILE MARKER	BLUE STAR NB	BLUE STAR SB	SPAULDING NB	SPAULDING SB	CENTRAL NB	CENTRAL SB	
20.1			9	9	9	8	4.1
20.2			9	9	9	8	4.2
20.3			9	9	9	8	4.3
20.4			9	9	9	8	4.4
20.5			9	9	9	8	4.5
20.6			9	9	9	8	4.6
20.7			9	9	9	8	4.7
20.8			9	9	UC	UC	4.8
20.9			9	9	UC	UC	4.9
21.0			9	9	UC	UC	5.0
21.1			9	9	UC	UC	5.1
21.2			9	9	UC	UC	5.2
21.3			9	9	UC	UC	5.3
21.4			9	9	UC	UC	5.4
21.5			9	9	UC	UC	5.5
21.6			9	9	UC	UC	5.6
21.7			9	9	UC	UC	5.7
21.8			9	9	8	8	5.8
21.9			9	9	8	8	5.9
22.0			9	9	8	8	6.0
22.1			9	9	8	8	6.1
22.2			9	9	8	8	6.2
22.3			9	9	8	8	6.3
22.4			9	9	8	8	6.4
22.5			9	9	8	8	6.5
22.6			9	9	8	8	6.6
22.7			9	9	8	8	6.7
22.8			9	9	8	8	6.8
22.9			9	9	8	8	6.9
23.0			10	10	8	8	7.0
23.1			10	10	8	8	7.1
23.2			10	10	8	8	7.2
23.3			10	10	8	8	7.3
23.4			10	10	8	8	7.4
23.5			10	10	8	8	7.5
23.6			10	10	8	8	7.6
23.7			10	10	8	8	7.7
23.8			10	10	8	8	7.8
23.9			10	10	8	8	7.9
24.0			10	10	8	8	8.0
24.1			10	10	8	8	8.1
24.2			10	10	8	8	8.2
24.3			10	10	8	8	8.3
24.4			10	10	8	8	8.4
24.5			10	10	8	8	8.5

MILE MARKER	BLUE STAR NB	BLUE STAR SB	SPAULDING NB	SPAULDING SB	CENTRAL NB	CENTRAL SB		
24.6			10	10	8	8	8.6	
24.7			10	10	8	8	8.7	
24.8			10	10	8	8	8.8	
24.9			10	10	8	8	8.9	
25.0			10	10	8	8	9.0	
25.1			10	10	8	8	9.1	
25.2			10	10	8	8	9.2	
25.3			10	10	8	8	9.3	
25.4			10	10	8	8	9.4	
25.5			10	10	8	8	9.5	
25.6			10	10	8	8	9.6	
25.7			10	10	8	8	9.7	
25.8			10	10	8	8	9.8	
25.9			10	10	8	8	9.9	
26.0			10	10	8	8	10.0	
26.1			10	10	8	8	10.1	
26.2			10	10	8	8	10.2	
26.3			10	10	8	8	10.3	
26.4			10	10	8	8	10.4	
26.5			10	10	8	8	10.5	
26.6			10	10	8	8	10.6	
26.7			10	10	8	8	10.7	
26.8			10	10	8	8	10.8	
26.9			10	10	8	8	10.9	
27.0			10	10	8	8	11.0	
27.1			10	10	8	8	11.1	
27.2			10	10	8	8	11.2	
27.3			10	10	8	8	11.3	
27.4			10	10	9	8	11.4	I-93
27.5			10	10	9	8	11.5	MM
27.6			10	10	9	8	11.6	on
			10	10	9	8		F. E.
27.7							11.7	Everett
27.8			10	10	9	8	11.8	Turnpike
27.9			10	10	9	8	11.9	27.0
28.0			10	10	9	9		27.1
28.1			10	10	9	9		27.2
28.2			10	10	9	9		27.3
28.3			10	10	9	9		27.4
28.4			10	10	9	9		27.5
28.5			10	10	9	9		27.6
28.6			10	10	9	9		27.7
28.7			10	10	9	9		27.8
28.8			10	10	9	9		27.9
28.9			10	10	9	9		28.0

MILE MARKER	BLUE STAR		SPAULDING		CENTRAL		
	NB	SB	NB	SB	NB	SB	
29.0			10	10	8	9	28.1
29.1			10	10	8	9	28.2
29.2			10	10	8	9	28.3
29.3			10	10	8	9	28.4
29.4			10	10	8	9	28.5
29.5			10	10	8	9	28.6
29.6			10	10	8	9	28.7
29.7			10	10	8	9	28.8
29.8			10	10	8	9	28.9
29.9			10	10	8	9	29.0
30.0			10	10	8	9	29.1
30.1			10	10	8	9	29.2
30.2			10	10	8	9	29.3
30.3			10	10	8	9	29.4
30.4			10	10	8	9	29.5
30.5			10	10	8	9	29.6
30.6			10	10	8	9	29.7
30.7			10	10	8	9	29.8
30.8			10	10	8	9	29.9
30.9			10	10	8	9	30.0
31.0			10	10	8	9	30.1
31.1			10	10	8	9	30.2
31.2			10	10	8	9	30.3
31.3			10	10	8	9	30.4
31.4			10	10	8	9	30.5
31.5			10	10	8	9	30.6
31.6			10	10	8	9	30.7
31.7			10	10	8	9	30.8
31.8			10	10	8	9	30.9
31.9			10	10	8	9	31.0
32.0			10	10	8	9	31.1
32.1			10	10	8	9	31.2
32.2			10	10	8	9	31.3
32.3			10	10	8	9	31.4
32.4			10	10	8	9	31.5
32.5			10	10	8	9	31.6
32.6			10	10	8	9	31.7
32.7			10	10	8	9	31.8
32.8			10	10	8	9	31.9
32.9			10	10	8	9	32.0
33.0			10	10	8	9	32.1
33.1			10	10	8	9	32.2
33.2					8	9	32.3
33.3					8	9	32.4

MILE MARKER	BLUE STAR NB	BLUE STAR SB	SPAULDING NB	SPAULDING SB	CENTRAL NB	CENTRAL SB	
33.4					9	9	32.5
33.5					9	9	32.6
33.6					9	9	32.7
33.7					9	9	32.8
33.8					9	9	32.9
33.9					9	9	33.0
34.0					8	9	33.1
34.1					8	9	33.2
34.2					8	9	33.3
34.3					8	9	33.4
34.4					8	9	33.5
34.5					8	9	33.6
34.6					8	9	33.7
34.7					8	9	33.8
34.8					8	9	33.9
34.9					9	9	34.0
35.0					9	9	34.1
35.1					9	9	34.2
35.2					9	9	34.3
35.3					9	9	34.4
35.4					9	9	34.5
35.5					9	9	34.6
35.6					9	9	34.7
35.7					9	9	34.8
35.8					10	9	34.9
35.9					10	9	35.0
36.0					10	9	35.1
36.1					10	9	35.2
36.2					10	9	35.3
36.3					9	9	35.4
36.4					9	9	35.5
36.5					9	9	35.6
36.6					9	9	35.7
36.7					9	9	35.8
36.8					9	10	35.9
36.9					9	10	36.0
37.0					9	10	36.1
37.1					9	10	36.2
37.2					9	10	36.3
37.3					9	10	36.4
37.4					9	10	36.5
37.5					9	10	36.6
37.6					9	10	36.7
37.7					9	8	36.8

MILE MARKER	BLUE STAR NB	BLUE STAR SB	SPAULDING NB	SPAULDING SB	CENTRAL NB	CENTRAL SB	
37.8					9	8	36.9
37.9					9	8	37.0
38.0					9	8	37.1
38.1					9	8	37.2
38.2					9	8	37.3
38.3					9	8	37.4
38.4					9	8	37.5
38.5					9	8	37.6
38.6					9	8	37.7
38.7					8	8	37.8
38.8					8	8	37.9
38.9					8	8	38.0
39.0					8	8	38.1
39.1					8	10	38.2
39.2					8	10	38.3
39.3					8	10	38.4
39.4					8	10	38.5
39.5					8	10	38.6
					8	10	38.7
					8	10	38.8
					8	8	38.9
					8	8	39.0
					8	8	39.1

	Total Miles of Each Pavement Category By Turnpike System							
	Blue Star		Spaulding		Central		Total	
Pavement Rating Category	NB & SB Miles	% of Each Rating	NB & SB Miles	% of Each Rating	NB & SB Miles	% of Each Rating	NB & SB Miles	% of Each Rating
7	1.0	3%	0.0	0%	2.9	4%	3.9	2%
8	19.3	62%	17.0	25%	39.5	49%	75.8	43%
9	10.2	33%	23.7	36%	25.5	32%	59.4	33%
10	0.8	2%	25.5	39%	12.1	15%	38.4	22%
Totals	**31.4**	**100%**	**66.2**	**100%**	**80.0**	**100%**	**177.6**	**100%**

Appendix B

CULVERT SUMMARY

(DRAINAGE STRUCTURE

VISUAL INSPECTIONS)

DRAINAGE STRUCTURES 2016 SUMMARY OF VISUAL INSPECTIONS

Turnpike System

Culvert Ratings

	Date	Mile Marker	Type	Number of Pipes	Size	Head wall	Wing wall	End Section	Slope	Barrel	Barrel Joints	Ditches	Comments
Spaulding	7/20/16	0.4 NB	RCP	1	36”	9	9	No Access	No Access	No Access	No Access	9	Southbound culvert not found.
	7/20/16	7.1 NB	Plastic Lined	1	36”	9	9	9	9	9	9	9	Barrel has slight sag.
	7/20/16	7.1 SB	RCP Plastic Lined	1	36”	9	9	9	9	9	9	9	
9	7/20/16	7.2 NB	PVC	2	72”	9	N/A	9	9	9	9	9	North culvert has 16” SS pipe.
	7/20/16	7.2 SB	PVC	2	72”	9	N/A	9	9	9	9	9	
	7/20/16	14.6 NB	RCP	2	72”	9	9	9	9	9	9	9	See Figure 6.
	7/20/16	14.6 SB	RCP	2	72”	9	9	9	9	9	9	8	
	7/20/16	19.1 NB	RCP	1	48”	9	9	9	9	9	9	9	40 feet north of speed limit. Headwall has metal inlet. Manhole located southbound.
	7/20/16	23 NB	RCP	2	60”	9	9	9		No Access	No Access	7	Ditches have six inches of silt.
	7/20/16	22.98 SB	RCP	2	60”	9	9	9	9	No Access	No Access	7	Screened opening. Ditches have silt.

	Date	Mile Marker	Type	Number of Pipes	Size	Head wall	Wing wall	End Section	Slope	Barrel	Barrel Joints	Ditches	Comments
	7/20/16	25.42 NB	Concrete-lined CMP	1	84”	8	N/A	9	9	9	9	9	
	7/20/16	25.42 SB	CCMP	1	84”	8	N/A	9	9	9	9	9	
	7/20/16	25.44 NB	RCP	1	36”	9	9	8	9	No Access	No Access	9	Skewed crossing at wingwall.
	7/20/16	25.45 SB	RCP	1	36”	9	9	9	9	9	Not visible	9	
Everett	7/26/16	.1 NB	RCP	1	36”	9	9	9	9	9	8	9	First barrel joint is separated.
	7/26/16	1.2 NB	RCP	2	54”	8	8	7-8	8-9	8-8	9-9	8	End section has exposed reinforcement, minor riprap in ditches is blocking outlet, barrel has sag/sediment in ditches.
	7/26/16	4.2 NB	RCP	1	42”	9	11	9	7	8	8	8	Slope sag, vegetation in ditches.
	7/26/16	4.2 SB	RCP	1	42”	8	8	13	13	13	13	13	Slope is ¾ full of stagnant water, ditches have stagnant water 2’ deep.
16	7/26/16	4.1 NB	RCP	1	48”	9	8	13	13	13	13	13/7	Wingwall needs to be repointed, ditches have standing water, slope barrel is half full.
	7/26/16	4.1 SB	RCP	1	48”	9	8	8	13	13	8	-	Barrel is ¼ full of water, ditches have slow moving stagnant water at pipe.
	7/26/16	5.4 North side	RCP	2	36”	9	9	9-9	9-9	8-9	9-9	8	Barrel has silt, ditches are heavily vegetated.

Date	Mile Marker	Type	Number of Pipes	Size	Head wall	Wing wall	End Section	Slope	Barrel	Barrel Joints	Ditches	Comments
7/26/16	5.1 SB	RCP	1	36”	8	8	11	11	11	11	7	Ditches have stagnant water and are heavily vegetated, slope is half full of water.
7/26/16	13.8 NB	RCP	1	36”	8	8	9	9	8	8	8	Barrel is 1/3 full with water and sediment, ditches have stagnant water.
7/26/16	17.6 NB	RCP	1	48”	9	8	8	13	13	13	8	End section has minor spalling, ditches are silty and have low flow.
7/26/16	27.4 NB	RCP	1	60”	8	8	8	9	9	8	8	Ditches have minor debris and sedimentation.
7/26/16	29 NB	RCP	2	72”	8	N/A	9	9	9	9	9	
7/26/16	11.45 SB	RCP	1	60”	8	7	9	7	8	8	7	RW fence is down in slope and ditch, with debris in front of pipe. Barrel is sagging. There is debris in front of the inlet, and there is slope erosion by the wingwall.
7/26/16	9.65 SB	RCP	1	36”	8	8	8	11	11	11	7	2:1 slopes. Large skew towards WB off plaza. Ditches have silt and are heavily vegetated.
7/26/16	35 NB	RCP	1	36”	11	11	11	11	11	11	7	Cast head/side wall. RCP with grate under turnpike. Ditch is heavily vegetated.
7/26/16	35 SB	RCP	1	36”	8	8	9	9	9	8	7	Under Grand View Road.
7/26/16	32.1 NB	RCP	2	72”	8	8	9-9	8-9	8-9	11-11	9	Rocks are loose at base of wingwall. Slope has minor sag and is misaligned.
7/26/16	32.5 NB	RCP	2	66”	8	8	9-9	8-9	9-9	9-9	8	Ditches have minor vegetation.
7/26/16	2.5 SB	RCP	1	36”	9	9	9	8	8	9	9	4:1 slope at 170 feet.

	Date	Mile Marker	Type	Number of Pipes	Size	Head wall	Wing wall	End Section	Slope	Barrel	Barrel Joints	Ditches	Comments
Blue Star	7/19/16	4.5 SB	RCP	1	36”	9	9	9	9	No Access	No Access	9	
	7/19/16	6.3 NB	RCP	1	48”	9	9	9	9	9	9	9	Ditches appear to have stone weir at tailwater.
	7/19/16	6.3 SB	RCP	1	48”	9	8	9	9	No Access	No Access	8	Wingwall needs to be repointed. Ditches have six inches of silt.
	7/19/16	6.4 NB	RCP	2	36”	9	9	13	9	13	13	13	
	7/19/16	6.4 SB	RCP	2	36”	13	13	13	9	13	13	13	
9	7/19/16	7.0 NB	RCP	1	36”	N/A	N/A	9		9	Not Visible	Wetland	No headwall or wingwall.
	7/19/16	7.0 SB	RCP	1	36”	13	13	13	9	13	13	13	
	7/19/16	7.3 NB	RCP	2	36”	9	9	13	6	13	13	9	Stone headwall. Slope is only 22 feet from travel-way.
	7/19/16	7.3 SB	RCP	2	36”	13	13	13	9	13	13	13	
	7/19/16	7.9 NB	RCP	2	36”	9	9	13		13	13	13	Slope is only 26 feet from travel-way.
	7/19/16	7.9 SB	RCP	2	36”	13	13	13	13	13	13	13	
	7/19/16	8.1 NB	RCP	1	36”	9	9	9	9	Not Visible	8	9	Four inches of standing silt at end section. Some sag (minor) less than six inches. Silt in ditches.
	7/19/16	8.1 SB	RCP	1	36”	9	9	9	9	No Access	No Access		Ditches are half full with sediment.
	7/19/16	9.1 NB	RCP	1	72”	8	8	9	9	9	9	9	Stone wall needs pointing.

Date	Mile Marker	Type	Number of Pipes	Size	Head wall	Wing wall	End Section	Slope	Barrel	Barrel Joints	Ditches	Comments
7/19/16	9.1 SB	RCP	1	72”	8	8	9	9	Not Visible	Not Visible	9	Stone walls need pointing.
7/19/16	11.95 NB	RCP	1	60”	7	7	13	7	13	13	13	Stone wall needs pointing. Slope is only 27 feet from travel-way.
7/19/16	11.95 SB	RCP	1	60”	9	9	13	9	13	13	13	

Culvert Assessment Rating Guide

RATING	DESCRIPTION
1	Critical condition – facility is closed and is beyond repair.
2	Critical condition – facility is closed. Study should determine the feasibility for repair.
3	Critical condition – the need for rehabilitation is urgent. Facility should be closed until repair.
4	Poor condition – repair or rehabilitation required immediately.
5	Marginal condition – potential exists for major rehabilitation such as full reconstruction.
6	Generally fair condition – potential exists for minor rehabilitation such as partial reconstruction.
7	Fair condition – potential exists for major maintenance such as wearing surface replacement.
8	Generally good condition – potential exists for minor maintenance such as crack sealing.
9	Good condition – no repairs needed.
10	New condition.
11	Not applicable and/or no repair rating.
12	Under repair by contract.
13	Stagnant water - not inspected.

Appendix C

Bridge R&R Candidates

2016 BRIDGE INSPECTION CANDIDATE LIST

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Previous R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Concord 42	201/096	005202010009600	FEET	FEET SB over Hall Street 201/096	IB-C	Red List	Inspected 2016	11/9/2015	X	X	X (future)	X		X (done)	7	6	4	N		**Capital Improvement Program** Bridges already programmed in 2016 (2017 CIP has decreased due to work in 2015).
Concord 42	201/097	005202010009700	FEET	FEET NB over Hall St. 201/097	IB-C	Red List		11/9/2015	X		X (future)	X		X (done)	7	6	4	N	Repaired in 2016.	
Dover-Newigton	200/023	006502000002300	SPAULDING	General Sullivan Bridge overlittle bay 200/023	HT	Red List		11/9/2015	X	X	X	X		X	1	1	1	N		
Hampton I95-5	120/102	011101200010200	BLUE STAR	I-95 over Taylor river 120/102	CS	Red List	Inspected 2006	11/17/2015	X	X	X	X			N	N	N	4		
Manchester 29	099/066	016100990006600	FEET	Feet SB over Black Brook 099/066	IB-C	Red List	Inspected 2006	11/17/2015	X	X	X (future)	X	X	X	5	5	4	N		
Manchester 29	099/067	016100990006700	FEET	Feet NB over Black Brook 099/067	IB-C	Red List	Inspected 2011*	11/17/2015	X	X	X (future)	X	X	X	5	6	4	N		
Manchester 23	144/066	016101440006600	FEET	FEET & I-293 over N. Branch Piscataquog River St. 144/066	IB-C	Red List		11/17/2015	X		X				5	6	4	N	Re-built in 2016. New bridge number is 143/066.	
Manchester 22	146/064	016101460006400	FEET	FEET & I-293 over S. Branch Piscataquog River St. 146/064	IB-C	Red List		11/16/2015	X		X				5	6	5	N	Re-built in 2016. New bridge number is 145/065.	

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges	Red List Bridges	Capital Program	Capital Program	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings				Comments	
									2016	2017	2016	2017			ITEM 58	ITEM 59	ITEM 60	ITEM 62		
Manchester 22A	146/065	016101460006500	FEET	FEET & I-293 Spur over S. Branch Piscatquog River 146/065	IB-C	Red List		11/16/2015	X		X				4	6	5	N	Rehabilitated in 2016.	
Manchester 21	149/063	016101490006300	FEET	FEET & I-293 over Spur D 149/063	IB-C	Red List		11/16/2015	X		X				5	6	5	N	Re-built in 2016. New bridge number is 149/062.	
Manchester 19	153/061	016101530006100	FEET	FEET & I-293 over FEET & I293 (Exit 4) 153/061	IB-C	Red List		11/16/2015	X		X				5	6	5	N	New bridge constructed under CIP 14966 in March 2016. New bridge number is 152/062.	
Merrimack 14	107/131	016801070013100	FEET	Baboosic Road over FEET 107/131	IB-C	Red List	Inspected 2011	11/13/2015	X	X	X (future)	X			4	6	4	N		
Concord 41	203/090	005202030009000	FEET	FEET NB over B&M RR 203/090	IB-C			5/13/2015			X (future)	X			7	7	5	N		
Dover-Newigton 2	201/025	006502010002500	SPAULDING	SB SP over Little Bay 201/025	IB-C			4/22/2015			X	X			5	7	7	N		
Manchester 30	091/063	016100910006300	FEET	FEET over Stark Lane 091/063	CRF		Inspected 2006	4/15/2015			X (future)	X			5	5	6	N		
Merrimack 11	106/042	016801060004200	FEET	FEET SB over Pennichuck Brook 106/042	IB-C		Inspected 2011*	4/27/2015			X (future)	X		X	6	5	5	N		

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Previous R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Merrimack 11	107/042	016801070004200	FEET	FEET NB over Pennichuck Brook 107/042	IB-C		Inspected 2006	4/27/2015			X (future)	X			6	5	5	N		
Merrimack 15	114/140	016801140014000	FEET	Wire Road over FEET SB114/140	IB-C		Inspected 2006	4/24/2015			X (future)	X			5	6	5	N		
Bow 39	168/120	002701680012000	FEET	FEET Over Robinson Road 168/120	CRF		Inspected 2006	4/2/2014							6	6	6	N	Repairs: Abutment concrete, deck overhang.	**R&R Candidates** Bridges with multiple components that need to be addressed but do not fall under future CIPs.
Bow 38	158/137	002701580013700	FEET	FEET Over Dow Road 158/137	CRF			4/7/2014							N	N	N	5	Near Red List Bridge - Flagged as future R&R in current plan. Prioritize. Repairs: Abutment and deck concrete (Culvert).	
Dover 11	105/133	006501050013300	SPAULDING	SP.TPK SB overCocheco River 105/133	IB-C		Inspected 2016	4/20/2015							6	6	6	N	Repairs: Substructure concrete, deck overhang, bearing and girder painting. RR FY 2021	

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Dover 11	106/133	006501060013300	SPAULDING	SP.TPK NB overCocheco River 106/133	IB-C		Inspected 2011	4/20/2015							6	6	6	N	Repairs: Abutment concrete, deck overhang, joint armor and seals, bearing and girder painting. RR FY 2021	
Hampton I95-7	113/168	011101130016800	BLUE STAR	NH 27 Over I-95 113/168	IB-C		Inspected 2016	5/26/2015							6	6	7	N	Repairs: Abutment concrete, wearing surface.	
Hooksett 36	069/162	012800690016200	FEET	Pine street over I-93 069/162	IB-C		Inspected 2011	6/4/2014							6	6	7	N	Repairs: Deck overhanges, bearing alignment/cracked welds.	
Manchester 32-A	062/062	016100620006200	FEET	FEET over Hackett Hill Road 062/062	CRF			4/15/2015							N	N	N	5	Near Red List Bridge - Flagged as future R&R in current plan. Prioritize. Repairs: Abutment and deck concrete (Culvert).	
North HamptonI-95-9	079/079	019700790007900	BLUE STAR	South rd over I-95 079/079	IB-C		Inspected 2016	7/15/2015							6	6	7	N	Repair: Deck overhang, bearing and girder painting.	

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Hampton I95-6A	115/157	011101150015700	BLUE STAR	I-95 Over Access Road 115/157	CRF		Inspected 2011	5/28/2015						X	5	5	7	N	Near Red List Bridge - Flagged as future R&R in current plan. Prioritize. Repairs: Abutment and deck concrete.	
Portsmouth Section Loss 19	197/122	021701970012200	BLUE STAR	I-95 NB over Sp. Tpk 197/122	IB-C		Inspected 2016	6/3/2015							6	7	6	N	Repairs: Joints (APJ & Gland), Abutement concrete.	
Portsmouth	222/121	021702220012100	BLUE STAR	I-95 over Maplewood Avenue 222/121	CRF			6/11/2015							6	6	7	N	Repairs: Deck concrete.	
Portsmouth 258/128	258/128	021702580012800	BLUE STAR	I-95 over PISCATAQUA RIVER,RD,BMRR 258/128	HT			6/10/2015							6	6	6	N	High Level Bridge - Separate R&R assesment (part of report)>	
Dover 4	174/060	006501740006000	SPAULDING	SP TPK over New Bellamy Lane 174/060	CRF			4/27/2015						X	N	N	N	6		**Scheduled for Maintenance** Maintenance already scheduled for 2016 and future, should address most of the issues flagged. Condition ratings should
Milton 35	162/110	017301620011000	SPAULDING	Sp. Tpk. over TeneriffeRoad 162/110	IB-C		Inspected 2016	6/22/2015						X	6	7	7	N		
Milton 34	187/109	017301870010900	SPAULDING	Sp. Tpk. Over Silver St. 187/109	IB-C			6/22/2015						X	6	7	8	N		

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Milton 33	216/112	017302160011200	SPAULDING	Sp. Tpk. Over Relocated Farmington Road 216/112	IB-C			6/15/2015						X	6	8	7	N		improve due to maintenance.
Nashua 1-D	151/056	017701510005600	FEET	Eastbound Connector over D.W.Highway 151/056	IB-C		Inspected 2016	4/23/2014						X	8	8	6	N		
North HamptonI-95-8A	078/070	019700780007000	BLUE STAR	Ramp B-D over I-95 078/070	IB-C		Inspected 2016	7/15/2015						X	7	6	7	N		
Rochester 28-A	089/112	022200890011200	SPAULDING	NH 125 (Ramp D0 over US202 & NH 11 WB (Ramp A)089/112	IB-C		Inspected 2016	7/14/2015						X	6	6	7	N		
Rochester 26-A	095/106	022200950010600	SPAULDING	US 202 & NH 11 over B&M RR 095/106	IB-C		Inspected 2011	7/13/2015						X	7	7	6	N		
Rochester 16	194/149	022201940014900	SPAULDING	Sp. Tpk. Over Blackwater Rd. 194/149	CRF		Inspected 2011	7/20/2015						X	6	6	7	N		
Bedford	198/086	001901980008600	FEET	Toll Plaza Access Road overRamp A 198/086	PIB		Inspected 2016	4/20/2015							8	6	8	N		**Maintenance Candidates** Bridges with only one component (deck, super, or sub) that needs to be addressed, could be considered
Concord 41	203/089	005202030008900	FEET	FEET SB over B&M RR 203/089	IB-C		Inspected 2016	5/13/2015							7	7	6	N		
Dover 15	084/165	006500840016500	SPAULDING	SP TPK over long Hill Road 084/165	IB-C		Inspected 2016	4/20/2015							7	6	7	N		

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Dover 6	132/101	006501320010100	SPAULDING	Sp. Tpk. SB over NH 108 and RR Spur 132/101	IB-C		Inspected 2016	4/22/2015							7	7	6	N		for maintenance activities over the next few years.
Dover 6	132/102	006501320010200	SPAULDING	Sp. Tpk. NB over NH 108 and RR Spur 132/102	IB-C		Inspected 2011	4/22/2015							7	7	6	N		
Dover-Newigton 2	201/024	006502010002400	SPAULDING	NB SP over Little Bay 201/024	IB-C			4/22/2015				X			6	7	7	N		
Hooksett 33B	067/090	012800670009000	FEET	I-93 over FEET 067/090	IB-C			6/3/2014							7	7	6	N		
Manchester 27	111/066	016101110006600	FEET	South Ramp (Ramp K) over FEET 111/066	IB-C		Inspected 2006	4/14/2015							7	6	7	N		
Nashua 8	101/129	017701010012900	FEET	B & M RR over FEET and ramps 101/129	TPG		Inspected 2016	3/27/2015							8	6	7	N		
Newington 1-B	103/124	018501030012400	SPAULDING	Sp Tpk US 4 & NH 16 over Underpass ramp 103/124	CRF			4/28/2015							7	7	6	N		
North HamptonI-95-10	081/093	019700810009300	BLUE STAR	NH 111 over I-95 081/093	IB-C		Inspected 2016	7/15/2015							7	6	7	N		
North HamptonI-95-12	099/144	019700990014400	BLUE STAR	NH 151 over I-95 099/144	IB-C		Inspected 2016	7/15/2015							7	6	7	N		
Portsmouth 16	136/127	021701360012700	BLUE STAR	NH 33 over I-95 136/127	IB-C		Inspected 2011*	6/8/2015							6	7	7	N		

Location in Alphabetical Order	Bridge Number	Structure Number	Turnpike / Assoc. Tpk	Description	Type	Condition	Prev-ious R&R Inspection	Inspection Date (Deck, Superstructure, Substructure)	Red List Bridges 2016	Red List Bridges 2017	Capital Program 2016	Capital Program 2017	R & R Project Program	2016 Maint.	2015 Insp. Condition Ratings ITEM 58	ITEM 59	ITEM 60	ITEM 62	Comments	
Portsmouth Section Loss 18	183/121	021701830012100	BLUE STAR	SB Connector over I-95 NB183/121	IB-C		Inspected 2016	6/3/2015							7	7	6	N		
Portsmouth 16A	190/118	021701900011800	BLUE STAR	I-95 over Hodgson Brook 190/118	CB		Inspected 2016	6/3/2015							N	N	N	6		

(*) = bridge inspected in 2006 & 2011