

# Interstate 93 Bow Concord Improvements Rail and Transit Assessment Report

State Project #13742

Prepared for:

Federal Highway Administration &  
New Hampshire Department of Transportation

October 5, 2018



EXPERIENCE | Transportation

101 Arch Street  
Suite 301  
Boston, MA 02110  
857-453-5450

## TABLE OF CONTENTS

1.0	Introduction.....	1
2.0	Description of Project Area and Current Planning .....	2
2.1	Bow – Concord I-93 Project Area .....	2
2.2	Summary / Classification Report .....	4
2.3	New Hampshire State Rail Plan .....	4
2.4	New Hampshire Capitol Corridor Rail & Transit Alternative Analysis .....	4
3.0	Existing Conditions .....	7
3.1	Concord Railroad History.....	7
3.2	Railroad Right-of-Way and Ownership/Lease Descriptions .....	7
3.3	Railroad Physical Plant.....	9
3.4	New England Southern (NEGS) Equipment and Facilities .....	11
3.5	Sidetrack Customers .....	11
4.0	Existing Railroad Operations .....	13
4.1	PAR Operations.....	13
4.2	NEGS Operations.....	13
5.0	Proposed Future Rail Operations .....	14
5.1	High Speed Rail.....	14
5.2	Commuter Rail.....	14
5.3	Freight Rail .....	15
6.0	Possible Future Rail Facilities in the I-93 Project Area .....	16
6.1	High Speed Rail Station.....	16
6.2	Commuter Rail Station, Parking, and Layover Facility.....	16
6.3	PAR and Sidetrack Facilities .....	16
6.4	Freight Rail Reconfiguration .....	17
7.0	Railroad Design Criteria.....	18
7.1	Railroad Clearance Criteria .....	18
7.2	Freight Railroad Design Criteria .....	19
7.3	Passenger Railroad Design Criteria.....	19
7.4	Commuter Rail Layover Facilities .....	20
8.0	Summary .....	21
8.1	Project Purpose and Need.....	21
8.2	Screening Criteria .....	23
8.3	Future Opportunities.....	23
Appendices		
	Excerpts from AREMA <i>Manual for Railway Engineering</i> .....	A-1
	Excerpts from the NHDOT Bridge Design Manual.....	A-4
	References .....	A-5

## 1.0 Introduction

The purpose of the I-93 Bow-Concord project is to address the existing and future needs for all users of this four-mile segment of I-93, while balancing the needs of the surrounding communities, by providing a safe and efficient transportation corridor for people, goods and services.

I-93 is the principal north-south arterial highway within New Hampshire and is part of the National System of Interstate and Defense Highways. I-93 extends a distance of approximately 132 miles through New Hampshire from the Massachusetts border to the northern Vermont border. This study covers a distance of approximately 4.5 miles from just south of the I-93/I-89 Interchange in Bow to just north of the I-93/I-393 Interchange (Exit 15) in Concord. The segment of I-93 from the south to Exit 14 is also part of the Central Turnpike, commonly known as the F.E. Everett Turnpike.

The I-93 Bow-Concord project is in the alternatives development phase where alternatives for the corridor are being evaluated based on their ability to meet the criteria defined in the projects' purpose and need statement (shown in section 8.1).

In developing this alternatives document for the railroad corridor, consideration was given to collecting information on the existing ownership, operations and condition of the railroad. In addition, information was collected on future projects planned for this area as well as railroad operational plans that would affect the railroad corridor.

The *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* dated December 2014 studied alternatives to improve the transit corridor from Concord to Boston. Three of the five alternatives recommended for further analysis including the construction of a regional commuter rail connecting the corridor and provide service similar to the MBTA Commuter Rail or Amtrak *Downeaster*.

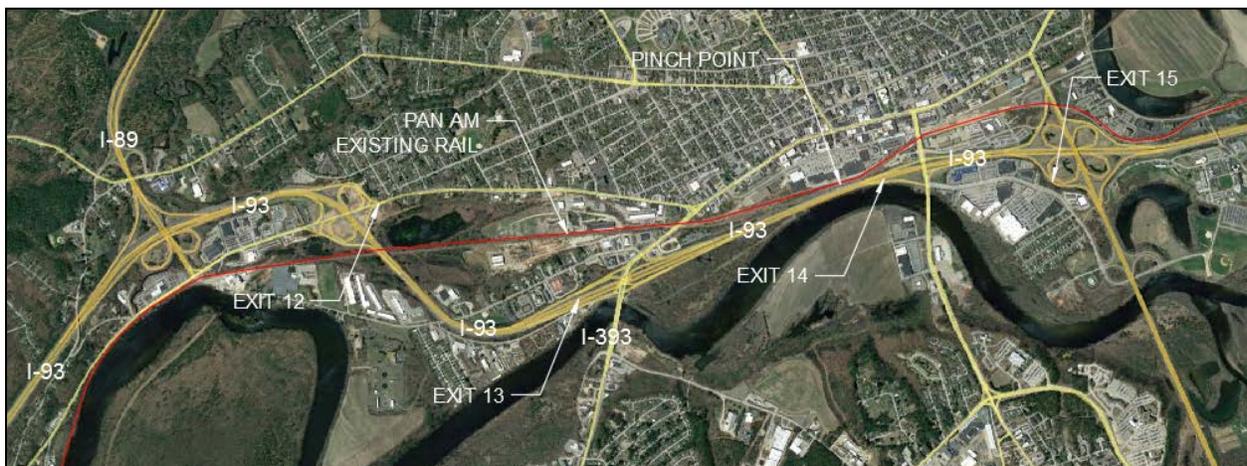
At this time there is no plan to expand north to Montreal through Concord with high speed rail. An FRA press release dated July 20, 2016 details a central Massachusetts/Vermont connection to provide service between Montreal and Boston.

## 2.0 Description of Project Area and Current Planning

A clear understanding of the I-93 Bow-Concord project area is necessary to identify appropriate problems, concerns and opportunities. The railroad is an important aspect of this corridor and is therefore included in the planning and development. Proposed rail alternatives for this area are discussed in the *Summary/Classification Report Bow-Concord Interstate 93 Transportation Planning Study* dated April 2008, *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* dated December 2014, and the *2012 New Hampshire State Rail Plan* dated June 2012.

### 2.1 Bow-Concord I-93 Project Area

The Bow-Concord section of Interstate 93, from the I-89/I-93 interchange in Bow to the I-93/I-393 interchange on the north side of Concord, serves as a critical link for statewide travel to the White Mountains and the Lakes Region, as well as an important local route within Concord. Within that area and adjacent to I-93 is a railroad corridor that currently serves as the only link for rail travel and rail freight shipments to and through Concord to central New Hampshire. In Figure 1 below, the rail corridor can be seen in red directly adjacent to and paralleling I-93.<sup>1</sup>



**Figure 1 – Project Area**

The April 2008 Summary/Classification report refers to the downtown Concord project area as the Opportunity Corridor, which has been identified as one of the most valuable assets in Concord. The Opportunity Corridor is a north-south area in downtown Concord bounded by Exit 12 to the south, Exit 15 to the north, Fort Eddy Road and Merrimack River to the east, and North Main and South Main Streets to the west. The orange hatching in Figure 2 on the following page details the location of the Opportunity Corridor.

---

<sup>1</sup> *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* dated December, 2014



Figure 2 – Downtown Concord – within limits of orange hatching

Along I-93, south of the Exit 14 ramps and between I-93 and the Storrs Street Market Basket there is an area referred to as the “Pinch Point” of the corridor. At this location the railroad right-of way is of limited width and is only able to accommodate one track without impacting existing development, and I-93 is currently limited to four travel lanes. Figure 3 shows the “Pinch Point” location. This location previously carried two tracks, and reinstatement of a second track will need to be considered for future rail concepts.



Figure 3 – Location of “Pinch Point”

## 2.2 Summary/Classification Report

The April 2008 Summary/Classification Report discusses the roadway alternatives and screening processes used to define and evaluate potential improvements to the corridor. The outcome of this report was to develop reasonable alternatives to be reviewed for scope and preliminary design in “Part B”. The report stated that several project components should be part of all build alternatives developed in Part B, including preservation of the existing rail corridor. The concepts currently under consideration in Part B all preserve the rail corridor.

However, passenger rail service is still seen as a favorable component to other reasonable alternatives as there is already an existing rail corridor with active freight traffic through Concord.

The likelihood of commuter rail service and high speed rail service from Boston to Concord still is a reasonable future possibility.

## 2.3 New Hampshire State Rail Plan

The *2012 New Hampshire State Rail Plan* in coordination with the *NH Long Range Transportation Plan 2010-2030* dated July 2010 identified and evaluated issues and opportunities related to rail transportation in New Hampshire. The state rail plan identifies nine core goals as follows:

1. Maintain the New Hampshire rail system in a state of good repair.
2. Provide a rail system that is financially stable and sustainable.
3. Expand the rail system and its capacity to promote growth in freight and passenger demand.
4. Provide a rail system that is environmentally supportive and sustainable.
5. Facilitate the ability of New Hampshire railroads to be competitive regionally, nationally and globally.
6. Support economic initiatives.
7. Realize public benefits for public investments.
8. Encourage public-private partnerships related to rail services.
9. Educate New Hampshire residents and businesses on the rail system in New Hampshire.

The report details the objectives, actions and policies related to each of these goals to identify achievement criteria. The report also presents descriptions for potential funding that local communities can apply for to for railroad improvements.

## 2.4 New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis

The *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* dated December 2014, studied alternatives to alleviate traffic congestion between Concord and Boston. This 73-mile stretch

between the cities is referred to as the Capital Corridor. The purpose of this study was to explore options to improve transit service along the Capital Corridor's northern end.

The study developed 12 conceptual alternatives which were then reduced to five for further review and analysis:

- No Build
- Manchester Regional Commuter Rail
- Nashua Minimum Commuter Rail
- Intercity 8
- Bus on Shoulder

Of these five alternatives, three involve a significant investment in commuter rail.

#### Manchester Regional Commuter Rail

This alternative would extend MBTA commuter rail service from its current terminus in Lowell, MA to Manchester, a distance of approximately 30 miles. This alternative would provide full day commuter rail service between Nashua and Boston (34 trains daily) with less frequent service north to Manchester (14 trains daily).

Under this alternative BX I-93 bus service (serving Manchester, North Londonderry, Londonderry and Salem) and BX Route 3 bus service (serving Manchester, Nashua and Tyngsborough, MA) would both be retained. Also, additional BX I-93 trips between Nashua and Manchester could be included to supplement the commuter rail schedule.

Four new stations would be added for this alternative: Tyngsborough, MA, Nashua, MHT/Bedford and Manchester. A new layover facility would also be constructed in the Manchester area.

The new trains would travel at an anticipated speed of 60 mph. Upgrades to existing track, bridges, signals and crossings would be required on the 30 mile segment between Lowell and Manchester. Installation of a 3.5 mile section of second track and three industrial sidings would also be required to provide double track service throughout the corridor and coordinate commuter rail and freight operations.

#### Nashua Minimum Commuter Rail

This alternative would extend MBTA commuter rail service from its current terminus in Lowell to South Nashua, a distance of approximately 13.5 miles. This alternative would provide peak-period only service between South Nashua and Boston (up to 11 trains in each direction daily).

Under this alternative BX I-93 bus service (serving Manchester, North Londonderry, Londonderry and Salem) and BX Route 3 bus service (serving Manchester, Nashua and Tyngsborough, MA) would both be

retained. Also, additional BX Route 3 trips between Nashua and Lowell could be included to supplement this new peak-period only commuter rail service.

One new station would be added, in South Nashua, and a new layover facility would also be constructed in the South Nashua area.

The new trains would travel at an anticipated maximum speed of 60 mph. Upgrades to existing track, bridges, signals and crossings would be required on the 13.5 mile segment between Lowell and South Nashua. Installation of a 3.5 mile section of second track would also be required to provide double track service throughout, however no new industrial sidings would be needed.

### Intercity 8

This alternative would provide limited commuter rail service from its current terminus in Lowell to Concord, a distance of approximately 48 miles. This alternative would provide four daily round trips between Concord and Boston.

Also, BX I-93 bus service (serving Manchester, North Londonderry, Londonderry and Salem) and BX Route 3 bus service (serving Manchester, Nashua and Tyngsborough, MA) would both be retained. However, unlike the other two commuter rail alternatives, no additional BX bus service is included as a supplement to the proposed commuter rail service.

Four new stations would be added for this alternative: Nashua, MHT/Bedford, Manchester and Concord. A new layover facility would also be constructed in the Manchester area, which would require dead head moves to and from Concord.

Upgrades to existing track, bridges, signals and crossings would be required on the 48 mile segment between Lowell and Concord. The track upgrades for this alternative are more significant than the previous commuter rail alternatives as the Intercity 8 alternative would operate at higher speeds: up to 79 mph if alignment allows between MHT/Bedford and Nashua and 70 mph at many other locations. Unlike the other commuter rail alternatives, no new sections of second track are required, however three industrial sidings would be required to coordinate commuter rail and freight operations.

### **3.0 Existing Conditions**

The existing conditions of the railroad corridor fall into a number of categories: ownership and leasing, physical plant, equipment and facilities, sidetracks and industrial parks. Preceding a discussion of each category is a short history of the rail industry in the Concord area.

#### **3.1 Concord Railroad History**

The history of railroading in Concord and the State of New Hampshire is linked to that of the Boston and Maine (B&M) Corporation. By 1900, the B&M controlled 90% of all rail mileage in the state, and had located one of its principal shops in Concord. The Concord Shops was a major employer in the Concord area and performed heavy locomotive engine and car repairs along with yard operations that supported freight shipping of commodities such as paper and lumber for local area industries.

However, since the end of World War II, the overall rail economy has declined due to the changing industry base, construction of the Interstate Highway System, a growing airline industry and the American passion for automobile use (*New Hampshire State Rail Plan 2001* – dated April 2001, page 11). This is evidenced by the B&M total net revenue ton miles per mile through Concord, which was 21.5 million net tons in 1944, dropping to 5.1 million net tons in 1955. Such declines in rail shipment have resulted in a restructuring of the New Hampshire rail system to one third of its early 1900 size. The restructuring included the closing of the Concord Shops in the 1950's and the abandonment of freight operations between Concord and Lebanon/White River Junction, Vermont in the 1990's.

The State of New Hampshire, through the Department of Transportation's Division of Rail and Transit, has been actively monitoring rail line abandonments in past years. Where it has been determined to be in the public good the state has attempted to maintain rail operations on such lines through purchase and leases or preserving rail corridors for future needs (such as the Northern Railroad from Concord to Lebanon).

#### **3.2 Railroad Right-of-Way and Ownership/Lease Descriptions**

The railroad lines in the Concord area of the I-93 Bow-Concord corridor study are owned by two parties, the Pan Am Railways, Inc. (PAR), formerly the B&M Corporation, and the State of New Hampshire. The New England Southern (NEGS) interchanges with the PAR and operates on the NHDOT White Mountain Branch. Figure 4, on the next page, shows the current map of railroads in New Hampshire as published by the NHDOT.

The PAR currently owns the New Hampshire Main Line, yard tracks and right-of-way between Manchester and Concord (former Main Line South). To the north of Concord Center the PAR also owns a portion of the track and right-of-way of the former White Mountain Line (Northern Railroad) and the former Concord and Claremont (C&C). Pan Am Railway's ownership of the Northern Railroad ends near the Boscawen Town Line.

The NHDOT owns the Northern Railroad from Boscawen to Lebanon. This section of former railroad right-of-way is currently abandoned except for a two mile section in West Lebanon which is operated by the NECRR.

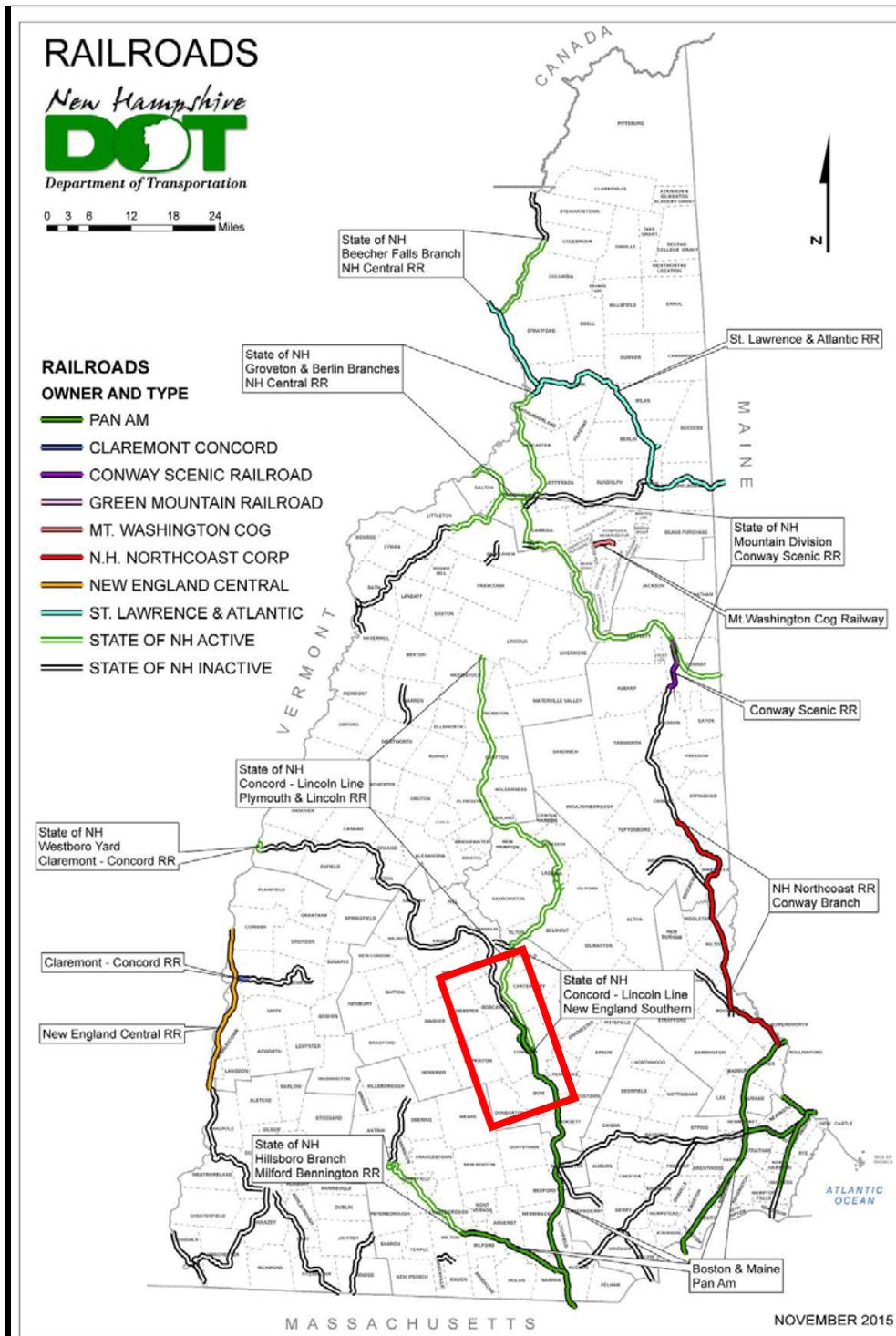
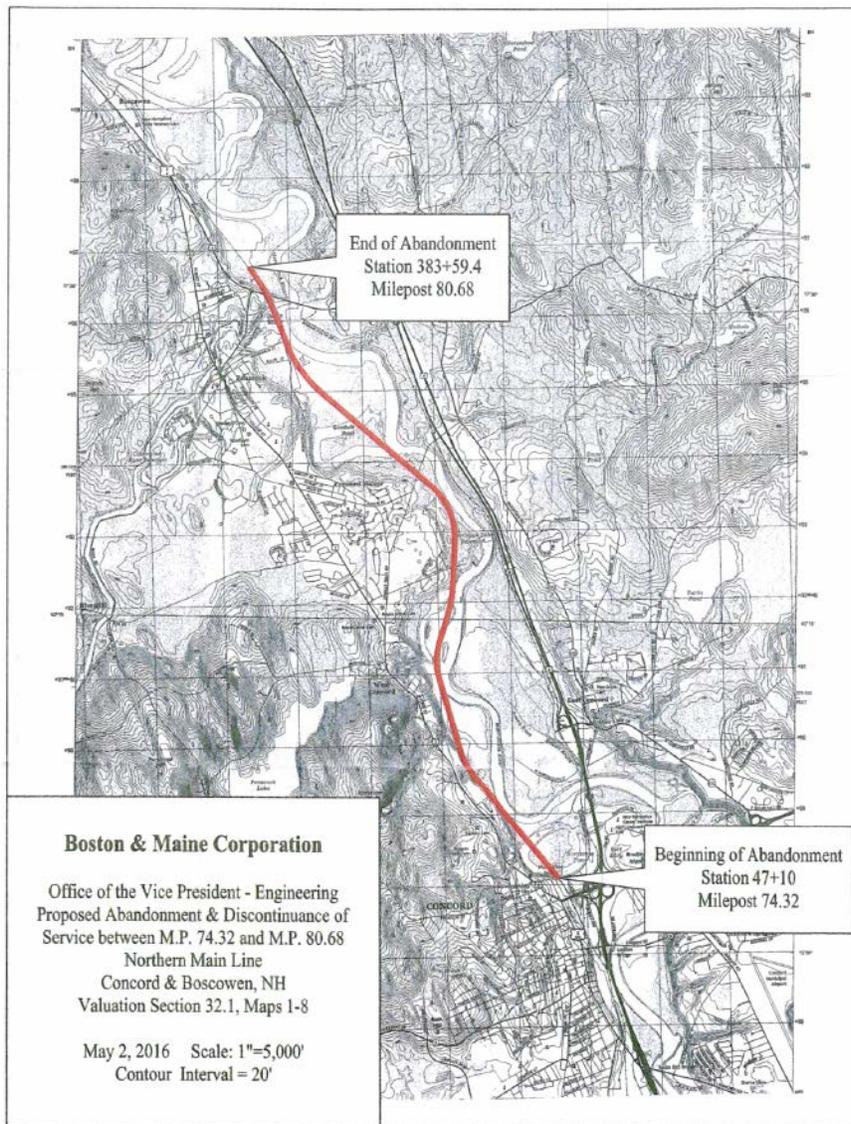


Figure 4 – Current Rail Systems in New Hampshire

The NEGS has a contract with the NHDOT to operate on the White Mountain Branch. The contract is for ten years, renewable in ten year increments.



The NHDOT owns the Concord to Lincoln Line (White Mountain Branch) from the point of clearance of the Northern Main Line to Lincoln. A portion of the line was acquired in 1976 from the then B&M Railroad (now PAR) from the point of clearance (of the Northern Main Line) to approximately mile post 0.72. This portion was acquired by the Department from a request made by a developer of property along Commercial Street.

In September 2016 the PAR gave notice to abandon a 6.36 mile segment of Northern Main Line Track beginning at milepost 74.32 (immediately North of Horseshoe Pond Lane) to milepost 80.68 where the track currently ends.

*Figure 5 – PAR Abandoned Track*

### 3.3 Railroad Physical Plant

The existing railroad right-of-way from Bow through Concord has a width ranging in size from 50 feet to 200 feet, except for a spot location (approximate engineering station 1820+00 on valuation section 21 map 35) where the right-of-way width has been reduced and can currently accommodate only one track. This location corresponds to the “pinch point” described in Section 2.2. At this same location there is a 5 degree horizontal curve, with the remainder of the curves in the Bow/Concord area being less than 2 degrees. The existing grade in the Concord area is relatively flat with the maximum grade being 0.21% just north of Water Street.



### 3.4 New England Southern (NEGS) Equipment and Facilities

NEGS Equipment: The NEGS currently has the following equipment to perform their railroad operations. The equipment is normally located in Canterbury, but may be used elsewhere, as work requires:

- 1 – SW1500 Locomotive
- 10 – Box/Flat/Ballast Cars (for worktrain and storage)
- 1 – RPO Passenger Car (used for office space, not for rail service)
- 1 – Tamper
- 1 – Tie Inserter
- 1 – Tie Crane (Handler)

NEGS Facilities: The NEGS current facilities are located off I-93 in the Concord Exit 18 area and consist of a field office and workshop. The NEGS corporate office is at 143 New Boston Road, Goffstown, NH 03045.

### 3.5 Sidetrack Customers

The PAR handles all of the sidetrack customers north of Manchester to Concord. Listed below are the sidetrack customers with rail access:

Origination	Product	Sidetrack Customer	Location	Status	Car/YR
Inbound	Cement	Ciment Quebec Inc.	Bow	Active	-
Outbound	Rail Equip.	Perini Corporation	Bow	Closed	-
Inbound	Tele. Poles/ Hydrous Ammonia	Eversource	Bow	Active	-
Outbound	Process Slag	Reed Minerals	Bow	Closed	-
Inbound	Grain	Blue Seal Feeds	Bow	Active	-
Inbound	Wine/Beer	Amoskeag Beverages	Bow	Inactive	-
Outbound	Steel/ASR	Schnitzer Steel	Concord	Active	-
Inbound	Steel	Cohen Steel	Concord	Inactive	-
Inbound	Tel. Poles	Fortek	Concord	Closed	-
Inbound	Lumber	Saxsonvil' USA	Concord	Closed	-
Inbound	Lumber	National Lumber	Concord	Inactive	-
Inbound	Chemicals	Allstate Asphalt	Concord	Active	-
Inbound	Fertilizer	Concord Crop Center	Concord	Closed	-
Inbound	Clay	3M	Concord	Active	12
Inbound	Rail Equip.	Plymouth and Lincoln	Lincoln	Active	5
Total Car Loads per Year					17*

\* The National Guard has one additional train (outbound and inbound) served by NEGS every two to three years in Canterbury.

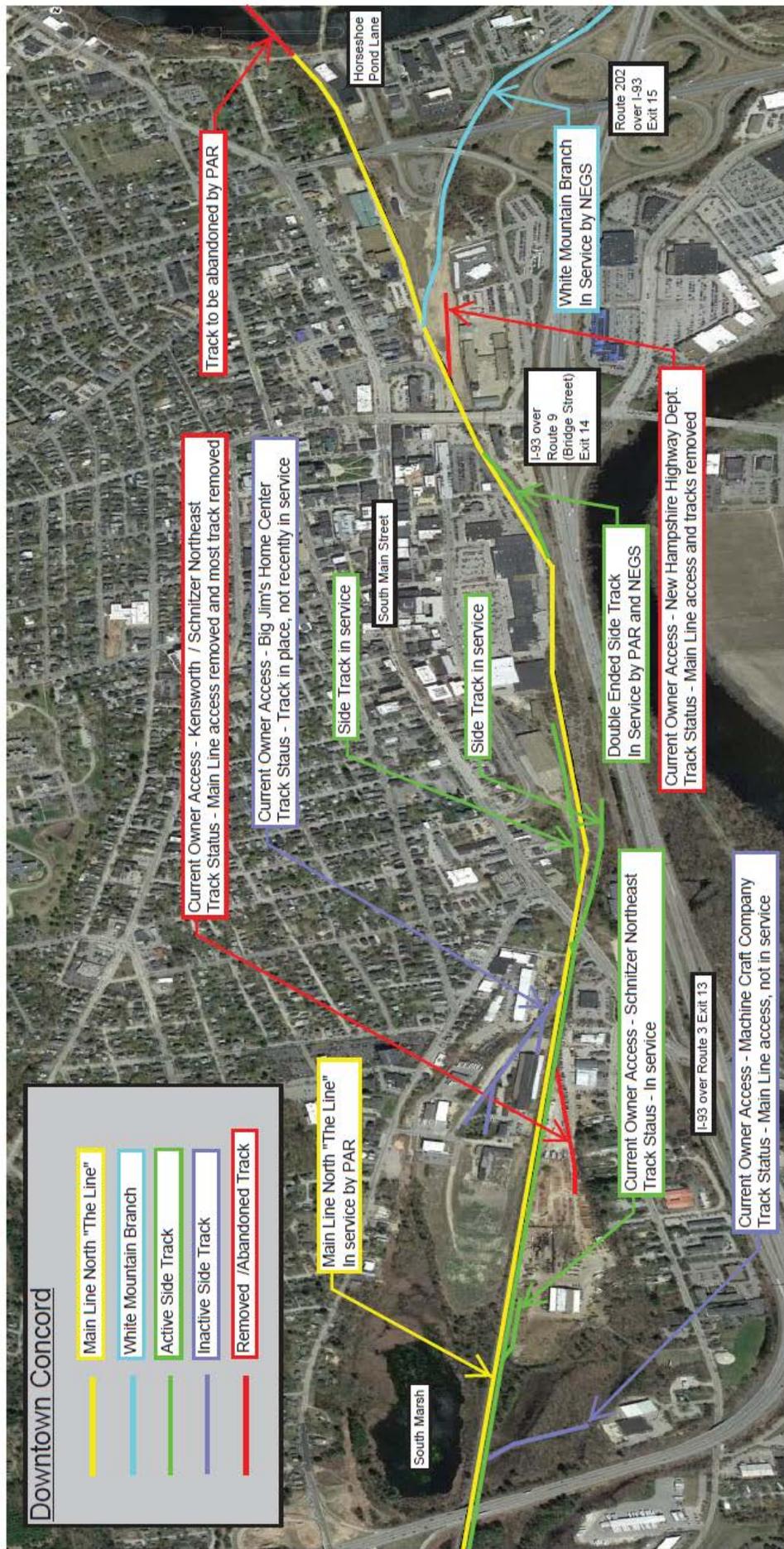


Figure 7 – Rail Access within Downtown Concord

## **4.0 Existing Railroad Operations**

The existing railroad operations of PAR and NEGS are described below. The existing operations of PAR and NEGS have become greatly reduced in the Bow-Concord area over time. Refer to Figure 7 on Page 12 for rail access within the Opportunity Corridor in Concord.

### **4.1 PAR Operations**

The PAR operates a coal train to the Public Service of New Hampshire (PSNH) Bow Power Plant in an “on-demand” status. The PAR operation starts in New York where interchange is made with the Norfolk Southern (NS). The coal train normally is approximately 106 cars in length. The PAR move to the PSNH requires the use of the main line to Garvan’s Falls (just south of the Hall Street at-grade crossing) in order to set the loads into the plant and pull the empties out. The PAR service to the Bow Power Plant and Concord area (operating “on-demand”) utilizes regular switching on the double ended siding near Bridge Street.

The PAR conducts switching on the double-ended siding south of Bridge Street (Exit 14) on average once per week. The trains are assembled by pushing cars under Bridge Street during runaround moves reversing the train at this siding south of Bridge Street.

The PAR no longer operates on the Northern Main Line past milepost 74.32, north of Route 202.

### **4.2 NEGS Operations**

The NEGS currently is only serving customers north of Concord as needed (no regular service).

## **5.0 Proposed Future Rail Operations**

The *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* dated December 2014, details potential regional commuter rail operations proposed for this railroad corridor. This will have impacts on the portion of the railroad corridor adjacent to I-93. Additionally, if freight rail capacity improvement is desired in the future, improvements to the rail corridor may be necessary to provide for operational conflicts between future passenger and existing freight modes.

### **5.1 High Speed Rail**

The Federal Railroad Administration (FRA) issued a press release dated July 20, 2016 detailing a central Massachusetts/Vermont connection to provide high speed rail service between Montreal and Boston. There is no current plan at this time to incorporate Concord in a high speed corridor to Montreal.

The *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* also proposed further study for service similar to the Amtrak *Downeaster* to be utilized on the same commuter rail corridor connecting Concord to Boston.

### **5.2 Commuter Rail**

The *2012 New Hampshire State Rail Plan* reports on page 81 that in June of 1999, the Nashua Regional Planning Commission completed a Major Investment Study (MIS) to evaluate alternatives for extending the MBTA commuter rail service to connect Boston with Nashua and to meet the requirements for filing an application for the FTA New Starts program. The MIS examined rail alternatives to help reduce congestion, particularly during peak-hour commuting.

The *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis* has defined land-use policies to protect the existing rail corridors to retain the capacity for future rail. The probability of commuter service extensions from Boston to Nashua was discussed as a good first step but would not see the ridership or economic development as a line to Manchester which provides the most benefit at a high expense.

*Summary/Classification Report Bow-Concord Interstate 93 Transportation Planning Study* dated April 2008 included alternatives to incorporate the *Master Plan 2030 Concord* defined land-use policies to protect the existing rail corridors to retain the capacity for future rail service. The passenger rail service was a stand-alone alternative to provide passenger rail service to Concord instead of widening I-93. However, this alternative was considered unfavorable because of costly expense to implement passenger rail service where there currently is no service provided in the region. Also this would only address a small portion of the I-93 congestion. Moving forward from the summary/classification report, passenger rail service is still seen as a favorable component to other reasonable alternatives stated in the report and the likelihood of commuter rail service and high speed rail service from Boston to Concord still is a reasonable future possibility.

### 5.3 Freight Rail

The *New Hampshire State Rail Plan 2012* indicates that the total reported tonnage moved by rail in the State of New Hampshire in 2009 was 4.7 MGT and is projected to increase by 160% by 2040. The rail industry in general is experiencing a resurgence in rail traffic on both the passenger and freight sides as the benefits to public transportation are being realized in cleaner air, less highway traffic, and safer roads.

## **6.0 Possible Future Rail Facilities in the I-93 Project Area**

The development of any commuter rail operations will require the provision for fixed plant facilities supporting those operations in the Concord area. It is anticipated that these ancillary facilities may likely be located within the Opportunity Corridor as presented in Section 2.3. In addition the increased use of the rail corridor by commuter rail operations may require modifications to the existing rail physical plant to improve the existing freight yard and switching operations (i.e. rebuilding track, relocating turnaround siding/spur, etc.) in order to reduce possible future conflicts between passenger and freight operations.

### **6.1 High Speed Rail Station**

*The New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report* proposed further study for service similar to the Amtrak *Downeaster* to be utilized on the same commuter rail corridor connecting Concord to Boston. Multimodal stations between Nashua and Manchester would be designed for high speed rail, commuter rail and freight requiring wide clearances for oversize loads. The *2012 State Rail Plan* and *Boston to Montreal High-Speed Rail Planning and Feasibility Study Phase 1*, dated April 2003, identified Concord as an Urban Intermediate Station with access to a major economic or tourism center. The station design criterion (in the study) indicates that the station should be located adjacent to the main line of the high-speed rail corridor. The report identifies that a basic premise of the high-speed rail design is that at-grade rail crossings shall be reduced or eliminated. The study also indicates (pages 2-43) that consideration should be given to expansion opportunities on a specific site that would include above and/or below ground parking garages (taking into account this area is within a floodplain). The economics of potential on-site versus off-site expansion should be considered for each station. The purchase of necessary areas for present and future needs should be considered as part of the first phase of project implementation.

### **6.2 Commuter Rail Station, Parking, and Layover Facility**

In the *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis*, cost were discussed to build and operate commuter stations and infrastructure throughout the I-93 area. The report also discussed the development of strategic land use planning that focuses on higher-density, mixed-use development near stations to reduce demand on the transportation network.

### **6.3 PAR and Sidetrack Facilities**

Any rearrangement of rail facilities in the I-93 project area will have to provide for the existing PAR and current sidetrack customer operations and facilities, described in Section 3. Proposed relocations of these facilities required by the I-93 Bow-Concord project should be performed in a manner that protects the continued viability of the affected industry and is economically feasible for that industry. Scheduling of the rearrangement of such rail facilities would be incorporated into the project construction schedule during the final design stage of the I-93 Bow-Concord project.

## 6.4 Freight Rail Reconfiguration

Discussions with PAR found that the current freight yard operations use a five car passing track located south of Bridge Street. The PAR freight yard operations could be improved significantly by installing a cross over at the south end of the existing double track south of Water Street. This would allow the entire train to be run around at one time. PAR also proposed relocating the Team 1 and 2 tracks to a location at the south end of the Opportunity Corridor. However, any proposed reconfiguration would have to provide a track (similar to Track 10 north of Water Street) for the making up of trains. In addition, the reconstruction of a passing siding on the White Mountain Branch near the switch from the main line (a previous siding was removed during a hotel development project) would improve freight operations on the White Mountain Branch.

In order not to preclude future passenger rail service to and through this area, the existing rail corridor should be preserved and improved to provide a two track right-of-way with a minimum width of 50 feet. With this in mind, at-grade crossings should be eliminated and the horizontal geometry improved through the use of maximum 3 degree curves. Freight operations will need to be protected, possibly through the use of relocations that provide economically feasible rail service for sidetrack customers.

## **7.0 Railroad Design Criteria**

Appropriate railroad design criteria have been taken from several different areas that provide for railroad facilities and railroad operations. These areas include criteria that protect railroad clearance and future railroad operations.

The criterion for track geometric design varies for freight and passenger rail operations and facilities. Generally accepted geometric design criteria, for each type of operation, is presented below. The sources for these criteria are the Massachusetts Bay Transportation Authority (MBTA) and the American Railway Engineering and Maintenance of Way Association (AREMA). The final design criteria will have to be determined and verified with the operating/owning railroad during the preliminary design stages of the project. The most restrictive criteria (freight or passenger) would be the controlling criteria for the design of the facility.

Considering the possible combinations of freight train, freight yard, freight sidetrack, commuter train, commuter stations, and commuter layover operations in the Concord Opportunity Corridor area, it would appear that a two track corridor through the Concord area should be reinstated. A two track corridor would provide the ability to design an efficient future rail operation in the Concord area to accommodate both freight and passenger rail. The possibility of reinstating two tracks through Concord is not currently possible at the "pinch point", identified in Section 2.2, where there is one single track alignment existing and the current railroad right-of-way width cannot accommodate more than one track without impacting existing development.

### **7.1 Railroad Clearance Criteria**

The current *NHDOT Bridge Design Manual* (issued January 2015, revised April 2016) provides vertical clearance requirements in Chapter 2 Section 2.4.3. This manual refers to current AREMA Standards for horizontal track clearances. The pertinent clearances for the purposes of this document are as follows:

Track Centers (Main Line Tracks) .....	15'-0"
Track Centers (Non-Main Line Tracks).....	14'-0"
Private Track adjacent to any Main Track.....	18'-0"
Vertical Clearance .....	22'-6"
Horizontal Clearance (Main and Passing Tracks).....	9'-0"
Horizontal Clearance from Bridge (less requires crash walls) .....	25'-0"
Horizontal Clearance from Crash Wall.....	12'-0"

The above dimensions are given for tangent and level track. They must be increased (as required) for curvature, super elevation, and other facilities such as inter-track fencing.

The *NHDOT Bridge Design Manual* also has included railroad clearance guidelines (Chapter 2, Section 2.4.3 Railroad Crossings Part E Vertical Clearances and Appendix 2.4-A2 issued January, 2015 and revised 4/01/2016). This section and appendix indicate that the minimum vertical clearance above top of rail is 22'-6" from top of high rail to bottom of low edge of bridge to meet the railroad clearance envelope, however 23'-0" is preferred. If site conditions will not allow these clearances for the railroad crossing to be achieved without considerable impacts, clearance may be reduced to 21'-0" with the Design Chief's approval, although this will restrict use of Phase II double stack containers and be a negative impact for corridor freight movements.

It should be noted that the current general outline for tangent track presented in the AREMA, *Manual for Railway Engineering*, Chapter 28 shows a vertical clearance of 23'-0" above top of rail and a side clearance of 9'-0" from the centerline of track (see Appendix for AREMA clearance information).

## 7.2 Freight Railroad Design Criteria

The main line freight rail design criteria, based on current industry design standards and AREMA standards, will be as follows:

- Speed: Federal Railroad Administration (FRA) Class 3 Track – 40mph;
- Grade: Maximum main line grade of 1.00%;
- Horizontal Curvature: No greater than existing curvature;
- Vertical Curvature (Rate of Change of Grade): 0.1 %/station (crest), 0.05%/station (sag);
- Superelevation:  $E_a = 0.0007V^2D - E_u$  where  $V$  = Speed in mph,  $D$  = Degree of Curve (chord definition),  $E_a$  = Actual Superelevation, and  $E_u$  = Unbalanced Superelevation (3 inches - PAR); and,
- Capacity: 286,000 lb Phase II (full double stack) rail cars.

## 7.3 Passenger Railroad Design Criteria

The main line passenger rail design criteria, based on current MBTA, High Speed Rail, and AREMA standards will be expected to be as follows:

- Speed: FRA Class 4 Track – 80mph for Commuter Rail operations, FRA Class of Track and speed TBD based on High Speed Rail design criteria;
- Grade: MBTA allows a maximum grade of 1.50%;
- Horizontal Curvature: MBTA – the maximum degree of curve for main line tracks shall be 2 degrees (chord definition) with provisions for spirals;
- Rate of Change of Grade: Suggested maximum of  $r$  not to exceed 0.80%/station;
- Superelevation:  $E_a = 0.0007V^2D - E_u$  where  $V$  = Speed in mph,  $D$  = Degree of Curve (chord definition),  $E_a$  = Actual Superelevation, and  $E_u$  = Unbalanced Superelevation (1.5 inches desirable);

- MBTA Commuter Rail Passenger Platforms: Platform length to provide for a minimum of three cars = 300 feet. The location of the platforms should be on the parking lot side of the main line. Inbound and outbound platform configurations will depend on site specifics; and,
- High Speed Rail Passenger Platforms: TBD based on High Speed Rail design criteria.

#### **7.4 Commuter Rail Layover Facilities**

Commuter Rail layover facilities for Commuter Rail operations should include the following items:

- Storage tracks for at-least two 830 foot long train sets;
- 480 volt standby power hookup for each train set;
- Containment structures at locomotive parking sites, complete with oil/water separator systems to prevent ground contamination;
- Access road alongside all storage tracks (with provisions for turning movements);
- Completely fenced area, including gates at the track entrances;
- Crew building, with attendant utility requirements; and,
- Parking lot for train crews.

## **8.0 Summary**

During the development of the railroad corridor screening criteria, the existing and future conditions of the railroad corridor were studied. Assessment of the existing conditions found a railroad corridor and physical plant that was in fair to poor condition. However, that current condition is still adequate to support the freight operations of the Pan Am Railways and provide freight service to sidetrack customers in the Concord area and through Concord to Central New Hampshire. In addition, assessment of the railroad corridor future uses has found significant emphasis placed on both High Speed and Commuter Rail services. These services will require specific facilities that will need to be incorporated into any planning affecting the railroad corridor so that the future development of the railroad corridor will not be compromised.

Specifically, an assessment of the existing conditions and future needs of the railroad corridor adjacent to the I-93 corridor in the Bow-Concord area has revealed the following items:

- There is an existing freight railroad (PAR) with facilities and freight yard operations occurring in the Opportunity Corridor that supplies freight to rail customers between Manchester and Concord and to the north, to Central New Hampshire, on the White Mountain Branch.
- There are existing freight railroad customers in the Opportunity Corridor that are currently served by the PAR.
- Proposed future passenger operations of High Speed Rail and/or Commuter Rail services will require passenger station, parking, and intermodal transfer facilities within the Opportunity Corridor. Equipment layover facilities for commuter rail operations may be located within or outside of the Opportunity Corridor.

### **8.1 Project Purpose and Need<sup>2</sup>**

#### **8.1.1 Purpose**

The purpose of the Interstate 93 Bow-Concord project is to address the existing and future transportation needs for all users of this four-mile segment of I-93, while balancing the needs of the surrounding communities, by providing a safe and efficient transportation corridor for people, goods and services.

#### **8.1.2 Need**

##### **Mobility:**

Interstate 93 is a principal north-south arterial Interstate highway within the State of New Hampshire and is part of the National System of Interstate and Defense Highways. The segment of Interstate 93 under study intersects two other Interstate highways, Interstate 89 and Interstate 393, providing a vital link for east/west travel, and passes through the City of Concord, the state capital.

---

<sup>2</sup> Bow-Concord Interstate 93 Environmental Assessment, September 16, 2015

Interstates 93, 89 and 393 carry a mix of traffic including trucks, cars and buses. The Interstate 93 corridor serves as an important link for New England wide tourist travel to the White Mountains, Lakes Region and Vermont, a regional commuting route for the Concord area, as well as an important local route. As one of the main arterials in the New Hampshire highway system, it is important to maintain the mobility of people, goods and services through this corridor.

#### Capacity:

Interstate 93 was constructed in the 1960's and now serves more than 70,000 vehicles per day with peak summer travel at over 85,000 vehicles per day. Traffic volumes on Interstate 93 through Bow and Concord tripled from 1980 to 2004. However, since 2004, traffic volumes have remained steady. Growth in the region is expected to occur in the coming years and place a greater burden on the transportation system. With an estimated 80,000 vehicle trips per day by the year 2035, increased congestion and increased travel times are expected, unless there is a reduction in demand, implementation of management strategies or improvements to this important regional travel corridor.

#### Regional Plans:

The project corridor is recognized by the State of New Hampshire and the Central New Hampshire Regional Planning Commission (CNHRPC) as a vital link for statewide travel as well as an important local route within Concord and the Central New Hampshire region. In recognition of these deficiencies, the project has been included in the State's Ten-Year Transportation Improvement Plan for years 2015 to 2024 as an unfunded priority, and is a top long-term transportation priority for the Central New Hampshire Regional Planning Commission (CNHRPC).

#### Safety:

The approximately four-mile project corridor currently contains numerous geometric deficiencies based upon current highway design standards. The deficiencies include: inadequate distances between entrance and exit ramps (causing weaving), short deceleration distances at exit ramps and short acceleration distances at entrance ramps. A review of the crash data for the period between 2002 and 2012 indicates many of the crashes occur at ramps or between ramps where the deficiencies exist, causing both property damage as well as injuries to drivers. As traffic volumes increase on Interstate 93, these geometric deficiencies will become more of a problem and crashes are anticipated to increase.

The corridor also contains three bridges currently on the "Red List" of state bridges which indicate the critical need for their replacement due to deterioration. Red-listed bridges are defined as those with "known structural deficiencies, poor structural conditions or weight restrictions."

### Transportation Choice:

This project corridor accommodates various modes of transportation, but could improve access to those modes or accommodate additional modes. This in turn would make travel more efficient for all users. Commuter rail service is a possibility and bus service continues to expand in the region. Bow and Concord have networks of public trails within and near the project corridor and are actively expanding their networks in an effort to complete the Heritage Trail along the Merrimack River. The project has considered access to and augmentation of these trail systems.

## **8.2 Screening Criteria**

The following screening criteria have been developed for the evaluation of I-93 Bow-Concord corridor study alternatives as they effect the railroad corridor. These criteria are considered to be essential for the protection of the existing and future uses of the railroad corridor.

- Alternatives must provide for the design criteria identified in Section 7.0;
- Alternatives must provide for the continued and uninterrupted operations currently occurring on the railroad corridor;
- Alternatives requiring relocation of existing railroad facilities and sidetracks must do so in a manner that will be economically feasible for the industries effected; and,
- Alternatives must provide for the railroad corridor needs consistent with proposed future High Speed Rail and/or Commuter Rail operations that have been included in area planning documents.

## **8.3 Future Considerations**

The following opportunities have been identified from the perspective of protecting the existing railroad corridor and providing for future uses of the corridor:

- Provide for sidetrack relocations consistent with the development of the Opportunity Corridor that are economically feasible for the sidetrack customer;
- Restore a two track right-of-way through the Concord area to provide for efficient future passenger and freight operations;
- Provide improvements to the horizontal geometry of the existing railroad corridor by replacing the 5 degree curve located at the "pinch point" with a lesser degree curve consistent with future development of the corridor;
- Provide for future freight facilities that improve freight yard operations and movement of freight through the City of Concord to Central New Hampshire and Central New England connection points;
- Provide for future railroad passenger facilities (High Speed and Commuter Rail);

- Provide opportunity for the State of New Hampshire to acquire the railroad right-of-way from Bow to Boscawen (acquiring the right-of-way would minimize the number of takings that might be required and would allow the State more flexibility in the development of the I-93 Bow-Concord project);
- Eliminate any proposed at-grade crossings that may have been considered in the past; and,
- Reconstruct interchange runaround and set out track on state owned property.

# Appendices

- Excerpts from AREMA *Manual for Railway Engineering*
- Excerpts from the NHDOT *Bridge Design Manual*
- References

APPENDIX A - AREMA MANUAL FOR RAILWAY ENGINEERING  
SECTION 3.6 LEGAL CLEARANCE REQUIREMENTS  
3.6.1 GENERAL (2004)

Table 28-3-3. Legal Clearance Requirements by State

State	Regulation Reference		Track Centers							
			Main Tracks	Any Two Subsidiary Tracks	Adjacent Subsidiary Track to Any Main Track	Ladder Track Adjacent to Any Parallel Track	Two Adjacent Parallel Ladder Tracks	Lead, Repair and Caboose Tracks	Team Tracks in Pairs	Unloading Tracks at Platforms
	2	3	4	5	6	7	8	9	10	11
NEW HAMPSHIRE	RSA 373:39	1957	14-0	14-0	15-0 C	18-0	18-0	14-0 (Note 18)	13-0	13-0

Table 28-3-3. Legal Clearance Requirements by State (Continued)

State	Vertical						Horizontal		
	General	Thru Bridges	Highway Bridges	Tunnels	Building Doors	In Buildings	General	Thru Bridges	Highway Bridges
	12	13	14	15	16	17	18	19	20
NEW HAMPSHIRE	22-0	22-0	22-0	22-0	17-0 (Note 3)	17-0	8-0 (Note 14)	8-0 (Note 14)	8-0 (Note 14)

Table 28-3-3. Legal Clearance Requirements by State (Continued)

State	Horizontal (Continued)								
	Tunnels	Building Doors	In Buildings	Platforms					
				A	B	C	D	E	F
	21	22	23	24	25	26	27	28	29
NEW HAMPSHIRE	8-0 (Note 14)	7-0 (Note 3)	8-0	0-12	5-4	4-0	5-9 (Note 7)		(Note 10)

**Table 28-3-3. Legal Clearance Requirements by State (Continued)**

State	Horizontal (Continued)											
	Signals				Poles	Mail Cranes	Icing Docks	Ore And Coal Docks	Cattle Chutes	Wires	Pipelines	
	High	Low, Between Tracks		Switch Boxes, Etc.								
		Height	Clearance	Height								Clearance
30	31	32	33	34	35	36	37	38	39	40	41	
<b>NEW HAMPSHIRE</b>	8-6	3-2	5-5	0-4	3-0	8-6	6-1 (Note 11)	6-0	6-0	8-6		

THIS CHART FOR INFORMATION ONLY. NO LIABILITY CAN BE ASSUMED - CONSULT INDIVIDUAL STATE REGULATIONS FOR MORE DETAILED INFORMATION.

Architects, Contractors, etc., should check with railroad involved.

Dimensions:

- shown in feet and inches.
- are for tangent track - most laws specify increases for curved and superelevated track.
- Vertical - measured from top of rail.
- Horizontal - measured from centerline of track.
- apply to new construction, some reconstruction, and some extensions.
- some can be varied upon approval of application by governing body.
- are based on maximum car size for Arizona, California, Idaho, Minnesota, Montana, Nevada, North Dakota, Oregon, Washington, and West Virginia.
- all are minimum except columns 24, 26, 28, 31, and 33 which are maximum.

C = Conditional - See specific regulation

Columns:

- 2 - Shows basic regulation.
- 3 - Shows effective date or date of latest amendment.
- 7 and 8 - Apply to hand- and mechanically-operated switches except as noted.
- 12 and 18 - Prevails for all items not otherwise provided for.
- 13 and 19 - Bridges supporting tracks.
- 14 and 20 - Bridges spanning tracks.
- 24 and 25 - Passenger platforms.
- 26 and 27 - Freight platforms on side tracks except as noted.
- 28 and 29 - Freight platforms on side tracks / stepped platforms are not generally allowed.
- 35 - Other than trolley contact poles.
- 36 - To center of stand except as noted.
- 37 - Applies to both supports and platforms except as noted.

Notes:

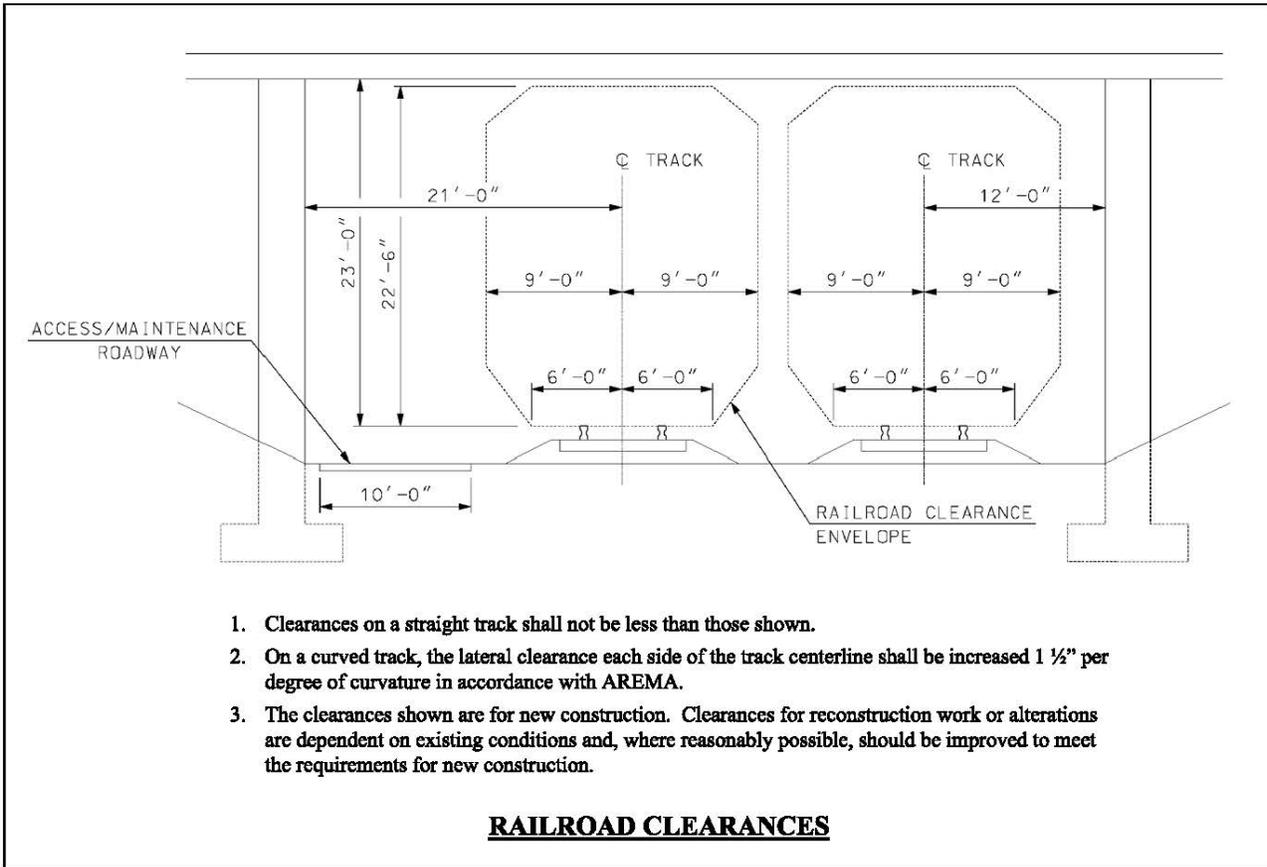
- Note 3: Engine houses, shop buildings, tipples, and loading facilities permitted lesser dimensions.
- Note 7: Only if 8-0 (7-3 for Montana and Wyoming; 8-6 for District of Columbia, Washington, Massachusetts and South Dakota) provided on opposite side.
- Note 10: May be 8-0 at 4-6 for refrigerator car platforms only.
- Note 11: To ends of arms in operating position
- Note 14: 8-6 for main and passing tracks.
- Note 18: Parallel lead tracks: 18-0.
- Note 21: Must have additional side clearance of one-inch per 30 minutes of degree of curvature.

### 3.11.5 CLEARANCE DATA (1991)

- a. Owner railroad should be responsible for maintaining up-to-date clearance data, both permanent and temporary. Adverse changes must be reported to both parties in a timely manner.
- b. In the event tenant is the clearing party, owner railroad should furnish them with current data (i.e. clearance records, operating rules, timetable schedules, track charts, grade and curvature limits, rule books and general orders, etc.).
- c. Future planning and improvement projects should not reduce the critical clearance envelope.

APPENDIX A - NHDOT BRIDGE DESIGN MANUAL RAILROAD CLEARANCES

NHDOT Bridge Design Manual V2.0  
January 2015



1. Clearances on a straight track shall not be less than those shown.
2. On a curved track, the lateral clearance each side of the track centerline shall be increased 1 ½" per degree of curvature in accordance with AREMA.
3. The clearances shown are for new construction. Clearances for reconstruction work or alterations are dependent on existing conditions and, where reasonably possible, should be improved to meet the requirements for new construction.

**RAILROAD CLEARANCES**

Appendix 2.4-A2

Railroad Clearance Guidelines

Page 2.4-A2-1

## APPENDIX A - REFERENCES

1. NHDOT (December, 2014) *New Hampshire Capitol Corridor Rail & Transit Alternatives Analysis – Final Report*. Available: <https://www.nh.gov/dot/org/aerorailtransit/railandtransit/corridor-rail-transit.htm>
2. NHDOT (June, 2012) *2012 New Hampshire State Rail Plan*. Available: <https://www.nh.gov/dot/org/aerorailtransit/railandtransit/documents/nhstaterailplan.pdf>
3. NHDOT (July 2010) *NH Long Range Transportation Plan 2010-2030*. Available: <https://www.nh.gov/dot/org/projectdevelopment/planning/documents/CompleteLRTP083110.pdf>
4. NHDOT (April 2001) *New Hampshire State Rail Plan 2001*. Available: <https://www.nh.gov/dot/org/aerorailtransit/railandtransit/documents/NHRailPlan.pdf>
5. Parsons Brinckerhoff (April 2003) *Boston to Montreal High-Speed Rail Planning and Feasibility Study Phase 1*. Available: <https://www.nh.gov/dot/org/aerorailtransit/railandtransit/documents/BostonMontrealHSR.pdf>
6. AREMA (2017) *2017 Manual for Railway Engineering*. Available: <https://www.arema.org/publications/mre/>
7. NHDOT (issued January 2015, revised April 2016) *NHDOT Bridge Design Manual*. Available: <https://www.nh.gov/dot/org/projectdevelopment/bridgedesign/manual.htm>
8. NHDOT (April 2008) *Bow-Concord Interstate 93 Transportation Planning Study*. Available: <http://www.i93bowconcord.com/Documents/Archives/Final%20Summary%20Classification%20Report.pdf>
9. NHDOT (September 2015) *Bow-Concord Interstate 93 Environmental Assessment*.
10. B&M (September 2016) *Northern Railroad Main Line Abandonment Notice*.
11. City of Concord (April 2005) *Concord Opportunity Master Plan*. Available: <http://www.concordnh.gov/DocumentCenter/View/1663>