FINAL REPORT


State Project Numbers 16317 and 68067-A

December 2014




# New Hampshire

## Capitol Corridor Rail & Transit Alternatives Analysis (Parts A & B)

New Hampshire DOT
Department of Transportation

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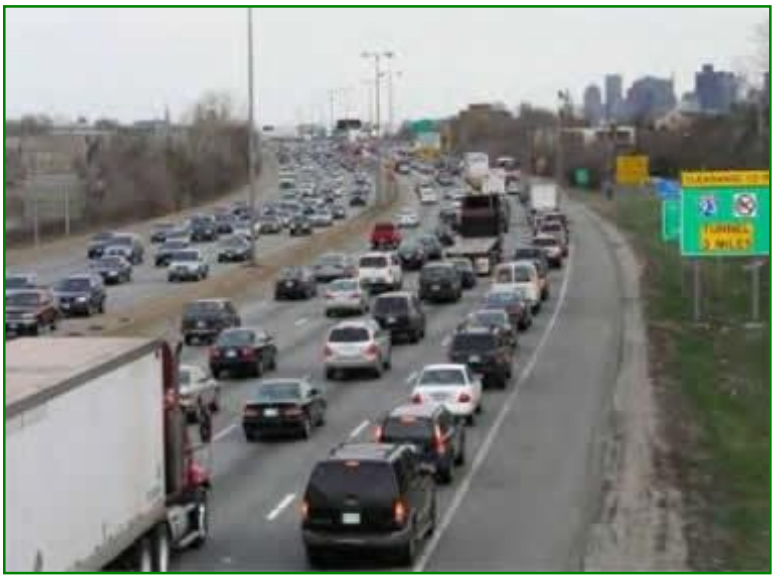
# Table of Acronyms

| | |
|---|---|
| AA | Alternatives Analysis |
| ARRF2 | Aggregate Rail Ridership Forecasting Model 2.0 |
| BX | Boston Express |
| CAA | Clean Air Act |
| CE | Categorical Exclusion |
| CEQ | Council on Environmental Quality |
| CIG | Capital Investment Grant |
| CMAQ | Congestion Mitigation and Air Quality Improvement Program |
| CWA | Clean Water Act |
| EA | Environmental Assessment |
| EIS | Environmental Impact Assessment |
| EJ | Environmental Justice |
| ESA | Environmental Site Assessment |
| FHWA | Federal Highway Administration |
| FRA | Federal Railroad Administration |
| FTA | Federal Transit Administration |
| HSIPR | High-Speed Intercity Passenger Rail |
| JTW | journey-to-work |
| LPA | Locally Preferred Alternative |
| MassDOT | Massachusetts Department of Transportation |
| MBTA | Massachusetts Bay Transportation Authority |
| mph | miles per hour |
| MPO | Metropolitan Planning Organization |
| NEPA | National Environmental Policy Act |
| NHDES | New Hampshire Department of Environmental Services |
| NHDOT | New Hampshire Department of Transportation |
| NHPA | National Historic Preservation Act |
| NHPP | National Highway Performance Program |
| O&M | Operations and Maintenance |
| PAC | Project Advisory Committee |
| PAR | Pan Am Railways |
| RRIF | Railroad Rehabilitation and Improvement Financing |
| SDP | Service Development Plan |
| SGR | State of Good Repair |
| TCRP | Transit Cooperative Research Program |
| TIFIA | Transportation Infrastructure Finance and Innovation Act |
| TIGER | Transportation Investment Generating Economic Recovery |
| TOD | Transit-Oriented Development |
| USDOT | U.S. Department of Transportation |
| VMT | Vehicle Miles Travelled |

# Executive Summary

## *Background*



*Lessening severe traffic along the highways connecting New Hampshire and Massachusetts is a main project goal*

The need for this Capitol Corridor Rail and Transit Alternatives Analysis (AA) along the 73-mile stretch from Concord, New Hampshire to Boston, Massachusetts has been growing for decades. While the Massachusetts Bay Transportation Authority (MBTA) commuter rail service currently operates between Boston and Lowell, commuter rail passenger service north of Lowell ceased in 1967. Since then, however, the Boston commuter-shed steadily expanded north into Nashua and Salem, and is continuing even further northward into Manchester and Concord. Sprawl-type suburban residential development patterns, which rely heavily on auto travel, have emerged, yet business development and job creation, especially in high-technology sectors, have been stagnant in the corridor's northern half. The Capitol Corridor's robust transportation network includes roadways, highways, transit services, intercity passenger rail service, freight railroads, airport, and pedestrian and bicyclist facilities. Despite the dense, multi-modal nature of this transportation network, demand is exceeding capacity – particularly within the highway network.

As Boston stands strong as the region's largest economic hub, people living north of Lowell and working in metropolitan Boston are singularly reliant on roadways to commute to work. The result is severe traffic congestion along limited access highways connecting New Hampshire's major population centers to metropolitan Boston – I-93, Route 3/Everett Turnpike, Route 128/ I-95, I-293, and I-495. During peak morning hours, southbound travel speeds average less than 30 miles per hour (mph), traffic volumes exceed roadway capacity by more than 25 percent, and average speeds within eight miles of Boston dip to as low as 12 mph. Based on historical data, traffic volumes are projected to continually increase and additional highway expansion is unlikely due to financial and environmental constraints.

# Project Goals and Objectives

Increasing transportation demand and growing concerns about mobility, economic development, and quality-of-life led New Hampshire and Massachusetts citizens and officials to explore options to improve transit service along the Capitol Corridor's northern end.

Early in 2013, the New Hampshire Department of Transportation (NHDOT), working in concert with its counterparts in Massachusetts, started this 21-month Capitol Corridor AA with support and funding from the Federal Railroad Administration (FRA) and Federal Transit Administration (FTA). The Study evaluated a diverse set of rail and bus options for improving connectivity in the corridor by leveraging existing transportation infrastructure and integrating transportation and land use planning.

AA Study goals and objectives (Figure 1 on the next page) reflect an understanding of how this integrated planning can support economically, environmentally, and socially sustainable communities within the corridor.

# Project Organization and Funding

This 21-month AA Study was supported and funded by the FTA and FRA so the broadest possible set of alternatives (bus- or rail-based transit service and intercity passenger rail service) was considered to meet corridor transportation needs. While these two funding streams support the one AA Study, each agency designated use of their funds for specific tasks and geographies:

1. **FTA** funding was limited to AA tasks related to transit service in the Concord-Boston corridor and included developing a range of alternatives for travel from Concord, Manchester, and Nashua to Boston; soliciting and evaluating public outreach and input on those alternatives; and developing recommended strategies along with an Environmental Assessment (EA) of those alternatives.

2. To fully evaluate the intercity rail alternative, **FRA** funding was used to develop and screen alternatives, identify and analyze travel markets, and review existing services for the full 73-mile corridor. Tasks were limited to examining intercity rail alternatives in the corridor between Boston and Concord and included developing a Service Development Plan (SDP) and an EA, both of which require FRA approval.

## Figure 1 – AA Goals and Objectives

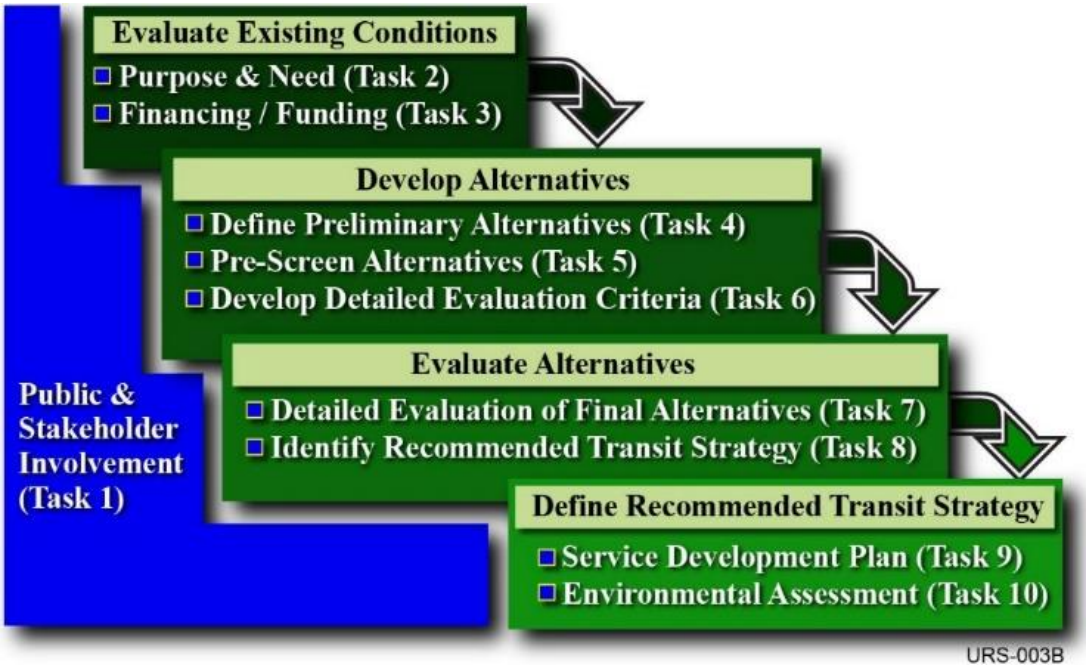
| Goals | Objectives |
|---|---|
| **Transportation and Mobility**<br>*Leverage the existing transportation network to improve access and mobility within the corridor and throughout the region* | ▪ Provide alternatives to address congestion within the Study corridor<br>▪ Expand transit network capacity<br>▪ Increase transit ridership/mode-share by expanding existing rider base and attracting new riders<br>▪ Provide travel time savings<br>▪ Improve transit service efficiency, convenience, and reliability |
| **System Integration**<br>*Invest in transportation improvements that complement the existing multi-modal transportation network* | ▪ Increase corridor modal connectivity<br>▪ Provide connections to other corridors within the region<br>▪ Increase access to Manchester-Boston Regional Airport (Manchester Airport) through additional transit service<br>▪ Balance system capacity (MBTA, Boston Express [BX], Concord Coach)<br>▪ Ensure operating efficiency |
| **Economic Development and Land Use**<br>*Support the vision for growth laid out in local/regional development plans* | ▪ Improve access to higher-paying jobs in greater Boston<br>▪ Support development patterns/lifestyle choices that attract younger, highly educated professionals to New Hampshire<br>▪ Leverage younger, highly educated employee base to attract new businesses/grow existing ones<br>▪ Promote Transit-Oriented Development (TOD) to mitigate sprawl development patterns<br>▪ Improve the potential for additional freight rail business through infrastructure upgrades |
| **Sustainability**<br>*Support transportation investments that contribute to an environmentally, economically, and socially sustainable community* | ▪ Leverage existing infrastructure to qualify for federal transportation investment dollars<br>▪ Mitigate potential adverse environmental impacts resulting from anticipated development<br>▪ Support growth patterns that attract/retain residents from childhood through retirement<br>▪ Improve access to other tourism, recreation, and cultural attractions in greater Boston and New Hampshire |

# *Project Process*

To develop a preferred transit investment strategy for the Capitol Corridor, the Study team and NHDOT conducted 10 tasks in four phases (Figure 2):

1. Evaluate Existing Conditions
2. Develop Alternatives
3. Evaluate Alternatives
4. Define Recommended Transit Strategy

**Figure 2 – AA Study Process**




Task 1, Public and Stakeholder Involvement, spanned all four phases.

Each task is briefly described below, in more detail in sections of this Final Report, and in greater detail in all Appendices.

1. **Task 1 Public and Stakeholder Involvement** – As is typical with transit alternative studies, the Capitol Corridor AA attracted significant interest from public and private stakeholders throughout the region; members of the general public; and federal, state, and local regulatory agencies. The stakeholder outreach process was proactive and consistent over the 21-month Study. NHDOT and the Study team conducted 91 stakeholder meetings, three Project Advisory Committee (PAC) meetings, and three public meetings (in Concord, Manchester, and Nashua); developed a project website; and held frequent informal discussions to solicit input from all stakeholders.

2. **Task 2 Purpose and Need Statement** – To meet FTA/FRA expectations and as a foundation for eventual National Environmental Policy Act (NEPA) documentation, the Study team developed a clear, defensible definition of transportation and related problems that transit alternatives would address. Past forecasting studies were reviewed, the existing transportation network was defined and documented, demographic data was compiled, and surveys of existing corridor bus and rail service were conducted (market analysis).

3. **Task 3 Financial Plan** – The corridor investment financial plan identified realistic sources of federal and non-federal funding for capital and operations and maintenance (O&M) costs. The plan satisfies FTA requirements for a New Starts submittal and FRA requirements for a SDP, and is politically realistic in terms of existing and future conditions at state and local levels.

4. **Task 4 Initial Conceptual Transit Alternatives** – Conceptual alternatives build upon previous work, including the *Nashua Commuter Rail Study*, the *I-93 Transit Investment Study*, and several Manchester passenger rail studies. The team analyzed rail and highway/bus infrastructure upgrades to address the conditions, problems, and goals and objectives described in the Purpose and Need Statement, and developed 12 initial bus and rail alternatives.

5. **Task 5 Evaluation of Conceptual Alternatives and Recommended Alternatives for Detailed Evaluation** – The 12 initial alternatives were rated against several criteria: capital and O&M costs, ridership, land use and economic development impacts, environmental fatal flaws, and a cost-benefit ratio (i.e., how successfully an alternative delivers greater benefits at a comparatively low cost); this evaluation formed the basis for refinement and advancement into seven intermediate alternatives that would undergo a more detailed evaluation.

6. **Task 6 Evaluation Criteria and Methodology** – To evaluate the seven intermediate alternatives, five criteria categories were identified and defined: economic impacts, land use (including environmental impacts), equity impacts, financial considerations (costs and feasibility of a financial plan/public support of that plan), and mobility impacts (including ridership forecasts).

7. **Task 7 Detailed Evaluation of Alternatives** – Seven of the strongest alternatives were ranked, compared, and assessed against the refined evaluation criteria defined in Task 6.

8. **Task 8 Identification of the Recommended Strategy** – The logical, sequential, analytical selection process (Tasks 4 through 7) culminated in selection of a corridor transit investment strategy that meets NHDOT and stakeholder objectives, is likely to receive state and local financial support, and is likely to qualify for federal capital funding.

9. **Task 9 Service Development Plan (SDP)** – Based on the preferred corridor transit investment strategy, the Study team integrated results of previous tasks into an FRA SDP that complements the AA report. The SDP summarizes AA Study rationale, existing conditions, preliminary and final alternatives analysis, the rationale for selecting the intercity rail option, and an operations strategy and implementation plan.

10. **Task 10 Environmental Assessments (EAs)** – Two EAs were prepared: one to satisfy FRA funding requirements to develop an intercity preferred option and the other to satisfy FTA funding requirements in narrowing transit alternatives.

    Both EAs accomplish four objectives:

    1. Provide for preparation of required NEPA documentation for submission by NHDOT to determine which aspects of transit and intercity rail alternatives have potential for social, economic, or environmental impact
    2. Identify measures that might mitigate adverse environmental impacts
    3. Identify other environmental review and consultation requirements that should be performed concurrently with the EA
    4. Summarize public involvement and the results of agency coordination

# *Summary of Recommended Strategies*

As the Study progressed, 12 conceptual transit alternatives were reduced to seven, and then to five – No Build, Manchester Regional Commuter Rail, Nashua Minimum Commuter Rail, Intercity 8, and Bus on Shoulder (for existing intercity bus service) – which represent the recommended potential transit investment strategies (see Figure 3).

### Figure 3 – Rationale for Alternatives Recommended for Further Review and Analysis

| Alternative | Rationale for Selection |
|---|---|
| **No Build** | Maintenance of the status quo, including existing intercity bus service, is the lowest-cost (in terms of new investment dollars) alternative of all those considered. |
| **Manchester Regional Commuter Rail** | Considering the complete range of benefits, this option is the strongest alternative: Manchester Regional Commuter Rail performs very well in terms of ridership, economic development, and land-use impact; however, it is one of the most expensive options. |
| **Nashua Minimum Commuter Rail** | Lowest-cost commuter rail option: while it does not stand out in terms of ridership and economic or land-use impacts, Nashua Minimum Commuter Rail could serve as the first phase of Manchester Regional Commuter Rail service implementation. |
| **Intercity 8** | Lowest-cost intercity rail option; if implemented, Intercity 8 could serve as the first phase of more robust service similar to the original Amtrak Portland-Boston *Downeaster* service. As a relatively expensive alternative, Intercity 8 would require federal support for capital costs; while there is currently no source for such funds, if that situation changes, then Intercity 8 may be feasible. |
| **Bus on Shoulder** | Low on cost, low on benefits, and dependent on a decision by Massachusetts – as construction of any required Bus on Shoulder lanes on I-93 would be close to Boston. The possibility of New Hampshire financial support and reducing existing bus service if rail is implemented should be part of future policy discussions. |

These recommended options do not have to be considered as singular investment packages. Bus on Shoulder could be implemented without movement on passenger rail, and rail could be recommended without Bus on Shoulder action. Similarly, Nashua Minimum Commuter Rail could be adopted as the first phase of the Manchester Regional Commuter Rail service – or as an independent project, and Nashua Minimum could be recommended with or without phasing.

# *Satisfying Regulatory Requirements and Project Stakeholders*

A broad spectrum of federal and state regulatory requirements and/or guidance were considered and addressed during development of the Financial Plan (Task 3), SDP (Task 9), and EAs (Tasks 10a and 10b).

For example, to prepare EAs for build and no-build alternatives for intercity rail services (FRA) between Boston and Concord and commuter rail services (FTA) between Boston and Manchester, the Study team followed the Council on Environmental Quality's (CEQ) regulations for *Implementing the Procedural Provisions of NEPA* (40 CFR 1500-1508); the FRA's *Procedures for Considering Environmental Impacts*, 64 FR 28545 (May 26, 1999); and the FRA's guidance on compliance with Service-level NEPA in *Implementing the High-Speed Intercity Passenger Rail Program*, issued August 13, 2009.

Service-level NEPA "typically addresses the broader questions relating to the type of service(s) being proposed, including cities and stations served, route alternatives, service levels, types of operations (speed, electric, or diesel powered, etc.), ridership projections, and major infrastructure components."

The EAs were further prepared in accordance with these requirements:

**Examples of Regulatory Requirements and Guidance Reviewed / Followed Throughout the AA Study**

- ✓ FTA 5309 Capital Investment Grant (CIG) (New and Small Starts) Program
- ✓ FTA 5337 State of Good Repair (SGR) Grants
- ✓ Federal Highway Administration (FHWA) National Highway Performance Program (NHPP)
- ✓ FHWA Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- ✓ FRA High-Speed Intercity Passenger Rail Program (HSIPR)
- ✓ FRA Railroad Rehabilitation and Improvement Financing (RRIF)
- ✓ U.S. Department of Transportation (USDOT) Transportation Investment Generating Economic Recovery (TIGER)
- ✓ NEPA and NHPA
- ✓ CAA and CWA
- ✓ National Ambient Air Quality Standards
- ✓ Various state regulations (e.g., New Hampshire Department of Environmental Services (NHDES) Env-Wq 1700 and Massachusetts Surface Water Quality Standards, 314 CMR 4.00)

- Section 106 of the National Historic Preservation Act of 1966 (NHPA), as revised in 36 CFR Part 800 (August 5, 2004)
- Section 4(f) of the Department of Transportation Act
- The Clean Air Act (CAA)
- The Endangered Species Act
- The Clean Water Act (CWA)

- Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*
- Executive Order 11990, *Protection of Wetlands*; Executive Order 11988, *Floodplain Management*
- Other relevant requirements for the protection and stewardship of the environment

The project selected for advancement (i.e., either intercity or commuter rail) may undergo additional analysis, which may be an Environmental Impact Statement (EIS), EA, or Categorical Exclusion (CE), depending on project details and the significance of the impact.

***Public and stakeholder outreach began at Study initiation and was proactive, consistent, and timely over the 21-month Study lifecycle to fully engage the public and key stakeholders.***

In addition to satisfying regulatory requirements, the AA Study sought to inform project stakeholders, and keep them informed. Due to the Capitol Corridor's geographic span (73 miles between Boston and Concord, New Hampshire), the Study attracted significant interest from public and private stakeholders throughout the region, as well as members of the general public. Federal, state, and local agencies with regulatory authority were contacted throughout the process to provide input and comment. In addition, NHDOT identified quasi- and non-governmental stakeholders, and solicited comments through public information meetings, Project Advisory Committee (PAC) meetings, a project website, and other outreach activities.

# *Next Steps*

Based on the analysis completed for this Study and on progress made in the decision-making process in New Hampshire, the Study team concluded that additional discussion, debate, and input by state policymakers is required before a definitive decision on a recommended strategy is made.

In the context of moving toward and making that recommendation, it is especially important that further progress be made on a financial plan, or plans, that could include federal, state (New Hampshire and Massachusetts), and local support. Specific project development actions will emerge as policymakers get closer to a recommended strategy, since alternative strategies can have very different requirements for engineering and project development/management, including identification of governance entities to lead implementation activities and operations.

# *Report Organization*

This New Hampshire Capitol Corridor Rail and Transit AA (Parts A & B) Final Report is a summary of research and analysis conducted over the last 21 months.

Eleven individual technical reports, reflecting 10 project tasks (2 EAs), were produced during that time; therefore, cost and other estimates provided in the technical reports reflect the date they were calculated (see Figure 4).

Each Final Report Section corresponds to each task and technical report, and complete technical reports are provided in corresponding Final Report Appendices as summarized in Figure 4.

**Figure 4 – Final Report Organization**

| Final Report Section/Appendix | Task Number | Report Title, Date |
|---|---|---|
| **1** | 1 | Task 1: Public Involvement Report, December 2014 |
| **2** | 2 | Task 2: Project Purpose and Need, October 2013 |
| **3** | 3 | Task 3: Financial Plan, October 2014 |
| **4** | 4 | Task 4: Initial Conceptual Transit Alternatives, December 2013 |
| **5** | 5 | Task 5: Preliminary Evaluation of Conceptual Alternatives and Recommended Alternatives for Detailed Evaluation, April 2014 |
| **6** | 6 | Task 6: Evaluation Criteria and Methodology, July 2014 |
| **7** | 7 | Task 7: Detailed Evaluation of Alternatives, September 2014 |
| **8** | 8 | Task 8: Identification of the Recommended Strategy, November 2014 |
| **9** | 9 | Task 9: Service Development Plan, November 2014 |
| **10a** | 10 | Task 10a: Federal Railroad Administration Environmental Assessment, December 2014 |
| **10b** | 10 | Task 10b: Federal Transit Administration Environmental Assessment, December 2014 |

# Section 1: Public Involvement Report

## *Task Objective*

To convey information about this AA and gain an understanding of stakeholders'/the public's perception of the Study, the Study team and NHDOT conducted three PAC meetings, 91 stakeholder meetings, and three public meetings (in Concord, Manchester, and Nashua) over 21 months.

*Three public meetings held over the course of the AA Study enabled NHDOT and the Study team to share project progress and gain an understanding of the public's concerns*

1. The PAC consisted of 20 organizations (e.g., Amtrak; the Cities of Concord, Manchester, and Nashua, New Hampshire; Manchester Airport; MBTA; Pan Am Railways [PAR]; and several planning commissions) who met at the conclusion of major Study milestones
2. One-on-one interviews and group briefings were held early in the Study with representatives of 51 stakeholder groups identified by the Study team in consultation with NHDOT
3. Public meetings were held in June 2013, March 2014, and November 2014 in Manchester, Concord, and Nashua, New Hampshire

Other outreach activities included developing and maintaining a project-specific website, http://www.nhcapitolcorridor.com, to disseminate and receive information and sending notices to local media outlets (print [e.g., the Concord Monitor and Nashua Telegraph], broadcast television [e.g., WBIN, Concord and WMUR, Manchester], and radio [e.g., WEVO 89.1 FM, Concord and WGIR 610 AM, Manchester]) to provide notice of upcoming meetings.

A full listing of all 20 PAC members, 51 stakeholder groups, and the 97 outreach activities conducted from Study inception to conclusion is provided in Appendix 1.

In addition to the need for a transparent project process, the following are 10 of the most frequent agency and stakeholder comments and concerns (for a more complete compilation, see Appendix 1):

1. New Hampshire would benefit from a transportation system that provides multiple transit options, is less focused on single occupancy vehicles, and provides an increase in options that have the potential to ease traffic congestion and save commuting time.
2. The Manchester Airport is an important cog in the New Hampshire economy and a rail connection to the airport should be part of the Study.
3. The State needs to work to attract and retain young professionals, who are now leaving New Hampshire at a faster rate than they are moving to the State.
4. It is important to demonstrate the impacts and benefits of passenger rail to the State (economic, social, and environmental).
5. The project needs to have a solid financial plan.
6. State demographics are changing (the population is getting older), and the transportation system needs to address the needs of this changing demographic.
7. The location of potential rail stations is important to many of the communities, and they would like to be part of the discussion in identifying appropriate locations.
8. System safety needs to be analyzed.
9. The fare structure for any system needs to be competitive with other forms of transportation.
10. The frequency of operation needs to be competitive with other forms of transportation.

# Section 2: Project Purpose and Need

## *Study Impetus and Task Objective*

While regular passenger rail service between Concord, New Hampshire and Boston, Massachusetts (the Capitol Corridor) ended in 1967, the Boston commuter-shed steadily and continually expanded north into Nashua and Salem, New Hampshire over the past 37 years – and shows no signs of slowing. Perversely, people moved, but businesses did not: job creation in the corridor's northern half (New Hampshire) has not kept pace with residential growth, especially in high-technology sectors flourishing in the corridor's southern half (Massachusetts).

Although the corridor is serviced by roughly 50 daily bus round trips, bus service is not attractive to a broad enough market and cannot keep pace with commuters' needs. Traffic congestion along the five major highways connecting New Hampshire and Massachusetts has increased dramatically despite highway expansion: for example, during the peak morning commute, southbound traffic speeds average less than 30 mph, traffic volumes exceed roadway capacity by more than 25 percent, and average speeds within eight miles of Boston dip as low as 12 mph.

**Why Conduct This Study?**

- ✓ Projected population growth will increase roadway congestion
- ✓ New Hampshire's existing transportation network does not effectively connect modes
- ✓ The regional economy is singularly dependent on roads for movement of goods and passengers
- ✓ Improved transportation options will attract employers to New Hampshire and improve employment options for residents
- ✓ Improved transit connectivity will help attract and retain young professionals in New Hampshire
- ✓ New Hampshire's growing senior population needs shared transportation accommodations that support "car-light" mobility
- ✓ Growing residential development patterns may negatively impact the region's existing quality-of-life
- ✓ The existing transportation network cannot accommodate increased levels-of-demand without negative environmental consequences

Increased transportation demand, concerns about mobility and quality-of-life, and the residential/employment disconnect led New Hampshire and Massachusetts citizens and officials to embark on this Study as a first step in improving transit service along the Capitol Corridor.

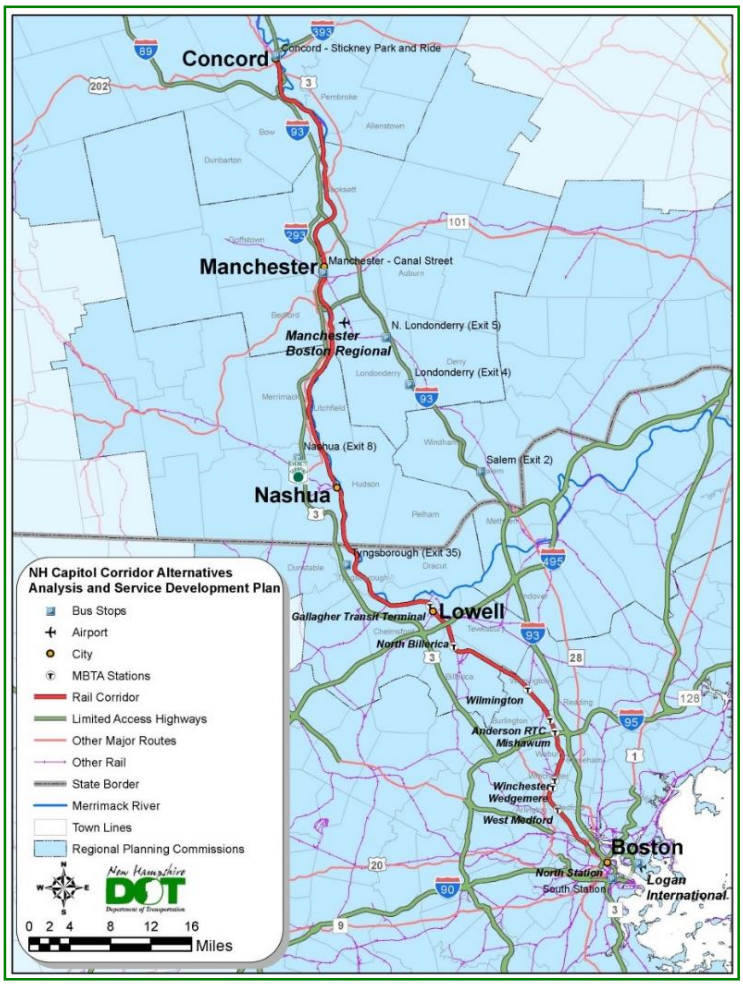
In Task 2, the Study team conducted in-depth research on the corridor's historical and current demographics, travel demand, and land use and sustainability goals to define the project's purpose and need. The AA Study is designed to identify a transit and/or intercity passenger rail investment strategy that leverages existing infrastructure to improve connectivity to and from Boston, diversify options and reduce single-mode reliance on roadways to move people and goods, support mobility options that match emerging demographic trends, and maintain the region's high quality-of-life through strategic infrastructure investments.

## *Corridor Description*

The 73-mile Capitol Corridor (Figure 5) stretches from Boston to Concord. Corridor demographics can be summed as follows:

- Population in this area is increasing – projected growth over 2010-2035 is expected at 10.2 percent.[1]
- Historical patterns based on U.S. Census data from 2000 and 2011 indicate that the percent of New Hampshire's population that falls between the ages of 35-64 is higher than in the U.S., New England, or Massachusettts – and this trend is expected to continue; it is also expected that the over-65 population will continue to grow in New Hampshire – as it increased nearly 20 percent from 2000-

**Figure 5 – 73-Mile Capitol Corridor from Boston, MA to Concord, NH**




[1] Metropolitan Planning Council, Northern Middlesex Council of Government, Merrimack Valley Planning Commission, New Hampshire Office of Energy and Planning/Central New Hampshire Regional Planning Commission

2011 (about five percent faster than in the U.S. overall and 15 percent faster than in Massachusetts).

- 14 percent of Massachusetts corridor households are zero-car households compared to four percent in New Hampshire.
- The population living below the poverty line is expected to increase, as the New Hampshire population in the corridor living below the poverty line rose 18 percent from 2000-2011.

As demographic trends reflect economic trends, the difference in Massachusetts and New Hampshire corridor employment opportunities is noteworthy: the fastest growing industries in Massachusetts are finance, professional, and scientific/technical, but in New Hampshire they are health care and social assistance, likely reflecting employment choices by "Millennials." Like the Baby Boomers before them, the sheer size of the Millennial generation, those born between approximately 1982 and 2003, means their preferences (e.g., built environments that support a car-light or car-free existence in urban, walkable neighborhoods) will shape every aspect of the region's economy and culture in the coming decades.

Millennials are the rising "creative class" – workers whose career orientation leans towards ideas and innovation rather than heavy manufacturing. As businesses, particularly technology-oriented businesses, look for lower-cost alternatives to downtown Boston and more Millennial-friendly environments than in the Route 128 corridor, Capitol Corridor communities can increase their attractiveness through transit investment. Improved connectivity will improve access to Boston-based employment and draw "creative class" workers, and the companies that want to hire them, into the New Hampshire corridor.

## *Travel Demand, Land Use, and Sustainability*

Capitol Corridor transit investment can be the tool that implements a regional, multi-discipline vision to maintain and promote a high quality-of-life. To do that, the improved corridor transit investment strategy resulting from this AA Study must account for increased travel demand, efficient land use, and sustainability.

## Travel Demand

Travel from New Hampshire to Boston is predominately made by auto trips in one of two main corridors: either I-93 or a combination of US Route 3, Route 128/I-95/I-93 – and that travel is expected to increase significantly between now and 2030.

For example, the Boston Metropolitan Planning Organization's (MPO's) travel demand model forecasts that average daily highway trips into Boston from the north and northwest, which include the Massachusetts portion of the Study corridor, will increase approximately six percent; travel on Route 3 is expected to rise by 37 percent; and I-93 traffic volumes by 19 percent.[2]

In the New Hampshire portion of the Study corridor, the Manchester MPO forecasts traffic volumes to increase by 15 percent along I-93 in Manchester and 76 percent in Derry by 2040. Along Route 3 in Bedford it is expected to increase by 55 percent by 2040.[3] Simply expanding the roadway network is not a solution as it would likely induce additional demand, which would exacerbate congestion.

## Land Use

While mobility problems are most directly solved by transportation investment, land use plays a critical role in supporting the efficient movement of people and goods. In addition to using transit system investment to expand transportation network capacity, strategic land use planning that focuses higher-density, mixed-use development near transit stations can reduce demand on the

[2] *Paths to a Sustainable Region*, the current Long Range Transportation Plan for the Boston metropolitan region, adopted by the MPO on September 22, 2011

[3] *FY 2013-FY 2040 Regional Transportation Plan, Southern New Hampshire Planning Commission*, October 23, 2012

transportation network by supporting trip efficiencies. More efficient land use patterns can also result in employment opportunity expansion closer to home, which could reduce overall demand on the transportation network (because of shorter travel distances) and reduce overall travel times (shorter distances and reduced congestion).

## Sustainability

Part of New Hampshire's character is its mountain ranges, chains of lakes, sea coast, and protected forest land. Increased levels of development and corresponding growth in transportation network demand may negatively impact these environmental assets.

The optimal transportation infrastructure network considers the interconnection between development patterns, availability of housing choices, and transportation diversity as a means to preserve natural resources and community vitality and promote energy efficiency.

# Section 3: Financial Plan

## *Task Objective*

Identifying stable and reliable funding sources is critical to advancing a transit alternative, as investing in an improved transit infrastructure incurs two types of costs:

1. **Capital Costs** – the up-front costs of implementing a new or enhanced transit system
2. **O&M Costs** – the annual costs incurred after the system is active

Since the pool of federal funding options is more robust than state and local options, leveraging available federal funds is a key objective of the Capitol Corridor Financial Plan.

Federal funds of most interest to cover capital costs are those considered "discretionary," i.e., funds not otherwise available to New Hampshire for other purposes; other types of federal dollars, "formula funds," are available to pay for O&M. Receipt of federal funds is subject to a variety of eligibility rules, and most federal funds must be "matched" (typically by 20 percent) by state and/or local funds. Given the match requirement, the Study team also identified potential state and local funding sources that could provide this match.

## *Capital and O&M Funding Needs by Alternative*

For each of the seven intermediate alternatives (Section 5, Appendix 5), capital and O&M costs were estimated in 2014 dollars and 2012 dollars, respectively (Section 7, Appendix 7).

For the rail alternatives, a four-year construction period was assumed, beginning in 2019. Annual O&M costs for each alternative were also estimated based on costs for similar services provided elsewhere in New England or based on recent historic expenditures for similar services in New Hampshire.

Note that the cost figures contain substantial "contingency costs," which are added to actual cost estimates to reflect uncertainty regarding costs developed during early planning in any project. This is a standard procedure.

The No Build alternative is not shown in Figure 6, as this option does not incur capital costs and O&M costs remain unchanged.

### Figure 6 – Final Capital and O&M Costs for the Seven Intermediate Alternatives

| Alternative | Capital Costs (In Millions, 2014$) | Annual O&M Costs (In Millions, 2012$) |
|---|---|---|
| **Manchester Regional Commuter Rail** | $245.6 | $10.8 |
| **Nashua Minimum Commuter Rail** | $120.3 | $4.1 |
| **Intercity 8** | $256.5 | $7.7 |
| **Expanded Base** | $9.6 | $3.0 |
| **Bus on Shoulder** | $7.4 | $0.0 |
| **Expanded Bus on Shoulder** | $17.0 | $3.0 |

## *Federal Funding Sources*

Within USDOT, FTA administers the primary funding programs available for public transportation investments; FHWA administers some federal-aid highway programs with flexible provisions that allow transfer of funds for public transportation investments; and FRA administers the RRIF program, which can be used for passenger rail projects, and in the past has provided capital funding through the HSIPR program.

In addition, federal finance tools are available that can be used to advance project implementation by leveraging future revenue streams of dedicated funding.

Figure 7 is a high-level summary of these federal funding sources and tools, including potential eligibility for commuter rail, intercity rail, and intercity bus alternatives.

### Figure 7 – Federal Funding Sources and Tools Summary

| Funding Source/Tool | Capital, O&M or Both | Eligible Alternative |
|---|---|---|
| **FTA 5311(f) Intercity Bus** | Both | Intercity Bus |
| **FTA 5309 CIG (New and Small Starts Program)** | Capital | Commuter Rail |
| **FTA 5307 Urbanized Area Formula Grants** | Capital | Commuter Rail, Intercity Bus |
| **FTA 5337 SGR Grants** | Capital | Commuter Rail |
| **FHWA NHPP** | Capital | Intercity Bus |
| **FHWA STP** | Capital | Commuter Rail, Intercity Bus |
| **FHWA CMAQ** | Both | Commuter Rail, Intercity Rail, Intercity Bus |
| **FRA HSIPR** | Capital | Intercity Rail |
| **USDOT TIGER** | Capital | Commuter Rail, Intercity Rail |
| **USDOT Transportation Infrastructure Finance and Innovation Act (TIFIA)** | Capital | Intercity Rail, Commuter Rail, Intercity Bus |
| **FRA RRIF** | Capital | Intercity Rail, Commuter Rail |

## *Non-Federal Funding Sources*

As evident in Figure 7, federal funds typically contribute a large share of transit project capital costs. O&M costs are typically financed through state and local funding sources. Most state transit funding comes from General Fund appropriations or through traditional taxes and fees, such as motor fuel taxes, sales taxes, and vehicle fees. State transit funding provides both operating assistance and capital funds, but only a few states provide dedicated funding either for capital expenses (Arkansas, Idaho, Kentucky, and Nevada) or operating expenses (Maine, South Dakota, and Wisconsin). Local transit funding is primarily provided through General Fund allocations, dedicated local option taxes and fees (sales taxes, property taxes, motor fuel taxes, vehicle fees, employer/payroll taxes, utility taxes/fees, room/occupancy taxes) and value capture mechanisms (impact fees, Tax Increment Financing, special assessment districts, and joint development).

Figure 8 summarizes potential New Hampshire funding sources for a Capitol Corridor project, each of which is discussed in detail in Appendix 3, Financial Plan. For each option, a definition is provided, followed by an assessment of the feasibility and potential revenue estimate for each

source. Ratings for feasibility reflect an assessment of 1) whether the source currently exists in New Hampshire, 2) whether transit is an eligible expenditure for the funding source, 3) the extent of likely support for the source, and 4) actions (e.g., legislative) that would be required for use of the source as part of the project's financial plan to cover costs.

The amount of revenue that might be generated from each source also is estimated. All of these estimated yields are subject to change based on changes to input assumptions and charge rates. Annual yield rating ranges: estimates greater than $5 million = High; $1-$5 million = Medium; less than $1 million = Low.

### Figure 8 – Summary of Non-Federal Funding Options for Capitol Corridor Alternatives

| Funding Source | Feasibility | Yield | Annual Estimate (In Millions) | Comments |
|---|---|---|---|---|
| **NH State Capital Program** | High | High | $10.0 | 7.6% of 2014 debt payment (principal + interest) |
| **NH Parking Fees** | High | Low | $0.7 | Based on $4.00 per day parking fee |
| **Vehicle Registration Fees** | Medium | High | $5.9 | $5.00 fee on passenger vehicles and trucks statewide |
| **Municipal Contribution** | Medium | Medium | $1.0-3.0 | $1 million/city with new stations; city discretion regarding source |
| **Regional Greenhouse Gas Initiative (RGGI)** | Medium | Low | $0.5 | Based on historical awards |
| **Property Tax** | Low | High | $15.7 | 0.1 mill applied statewide |
| **Lottery Revenues** | Low | Medium | $3.7 | 5% of net proceeds |
| **Passenger Facility Charges** | Low | Medium | $1.0 | ½ of $1.50 passenger facility charge (PFC) increase beginning in 2016 |
| **Value Capture** | Low | Low | -- | Need more study to estimate |

# *Funding Summary by Alternative*

Figure 9 summarizes federal-funding potential for the three final rail alternatives.

None of the three intermediate bus alternatives require significant new capital investment (estimates for new buses and infrastructure improvements range from $9.6 million to $17.0 million); the capital required likely could be covered by federal formula programs such as Section 5307 or CMAQ. Other new revenue sources are unlikely, given the limited additional mobility and economic benefits anticipated by increasing or otherwise enhancing existing bus service.

### Figure 9 – Federal Funding Potential for the Three Final Rail Alternatives

| Final Alternative | Description |
|---|---|
| **Manchester Regional Commuter Rail** | Candidate for New Starts funding established under FTA's CIG program. Eligible New Starts projects that meet certain criteria receive on average 50 percent of their capital costs. The remaining costs could be covered by other federal funding programs, such as CMAQ, as well as parking revenue and contributions from MBTA (track work and trackage rights, rolling stock) and the municipalities that will have commuter rail stations (Nashua, Bedford (Manchester Airport station), and Manchester). |
| **Nashua Minimum Commuter Rail** | Candidate for Small Starts funding established under FTA's CIG program. Eligible Small Starts projects that meet certain criteria receive up to $75 million of their capital costs. The remaining costs could be covered by other federal funding programs, such as CMAQ and TIGER grants, as well as parking revenue and contributions from the MBTA (track work, rolling stock) and from Nashua. |
| **Intercity 8** | Will rely on federal programs, namely FRA's HSIPR. However, the HSIPR currently has no funding available. For purposes of this assessment, it is assumed that half the capital costs of the project might be paid for by a future HSIPR appropriation. Similar to the two commuter rail alternatives, local sources could include CMAQ, parking revenue, and contributions from the three municipalities with stations (Nashua, Manchester, and Concord). |

# Section 4: Initial Conceptual Transit Alternatives

## *Task Objective*

Initial conceptual transit alternatives were developed to accomplish two objectives:

1. Address key transportation and related issues identified in the Study's purpose and need
2. Provide commuter bus (BX), commuter rail (MBTA), and intercity rail (possibly Amtrak) service and operating plans to accommodate FTA and FRA funding sources

**Preliminary Costs for 12 Initial Alternatives**

**Six Commuter Rail Alternatives**

- ✓ Capital costs range from $124 to $226 million
- ✓ Annual O&M costs range from $5.2 to $13.3 million

**Three Intercity Rail Alternatives**

- ✓ Capital costs range from $162 to $174 million
- ✓ Annual O&M costs range from $7.7 to $17.3 million

**Three Express Bus Alternatives**

- ✓ Capital costs range from $2.2 to $8.6 million
- ✓ Annual O&M costs range from $5.9 to $9 million

## *Preliminary Alternatives*

Figure 10 shows all 12 initial alternatives (and the No Build option), their service levels, preliminary capital costs (including locomotives and passenger cars, track and signal improvements, and stations), and preliminary O&M costs.

Cost estimates included in Figure 9 were developed for *preliminary* evaluations. They were then refined based on additional engineering analysis, which explains differences between the preliminary estimates and later more detailed cost data – and will be refined again if a project moves forward. This is standard procedure in transit planning studies.

## Figure 10 – Preliminary Capital and O&M Costs for the 12 Preliminary Alternatives (and No Build Option)

| Alternative | Daily Service | Capital Cost (In Millions, 2014$) | Annual O&M Cost (In Millions, 2009$ Commuter Rail, 2012$ Intercity/Bus) |
|---|---|---|---|
| **No Build** | Status Quo - Total buses (inbound/outbound): Manchester 18, N. Londonderry (Exit 5) 46, Londonderry (Exit 4) 17, Salem (Exit 2) 39, Nashua (Exit 8) 24, Tyngsborough (Exit 35) 23, South Station 80, Logan Airport 58 | $0 | $5.9 |
| **Commuter Rail** | | | |
| **Concord Regional** | 8 trains (4 round trips) to Concord and Manchester<br>30 trains to Nashua | $226 | $11.1 |
| **Concord Commuter** | 18 trains to Concord<br>22 trains to Manchester<br>26 trains to Nashua | $206 | $13.3 |
| **Manchester Regional** | 16 trains to Manchester<br>34 trains to Nashua | $164 | $9.7 |
| **Manchester Commuter** | 20 trains to Manchester<br>30 trains to Nashua | $164 | $9.9 |
| **Nashua Commuter** | 34 trains to Nashua only | $124 | $6.8 |
| **Nashua Minimum** | 16 trains to Nashua only | $124 | $5.2 |
| **Intercity Rail** | | | |
| **Intercity 18** | 18 trains (9 round trips) to Nashua, Manchester, and Concord | $174 | $17.3 |
| **Intercity 12** | 12 daily trains to Nashua, Manchester, and Concord | $174 | $11.6 |
| **Intercity 8** | 8 trains to Nashua, Manchester, and Concord | $162 | $7.7 |
| **Express Bus** | | | |
| **Expanded Base** | Total buses (inbound/outbound): Manchester 32, N. Londonderry (Exit 5) 40, Londonderry (Exit 4) 39, Salem (Exit 2) 40, Nashua (Exit 8) 38, Tyngsborough (Exit 35) 38, South Station 120, Logan Airport 120 | $6.4 | $9 |
| **Bus on Shoulder** | Total buses (inbound/outbound): Manchester 18, N. Londonderry (Exit 5) 46, Londonderry (Exit 4) 17, Salem (Exit 2) 39, Nashua (Exit 8) 24, Tyngsborough (Exit 35) 23, South Station 80, Logan Airport 58 | $2.2 | $5.9 |
| **Expanded Bus on Shoulder** | Total buses (inbound/outbound): Manchester 32, N. Londonderry (Exit 5) 40, Londonderry (Exit 4) 39, Salem (Exit 2) 40, Nashua (Exit 8) 38, Tyngsborough (Exit 35) 38, South Station 120, Logan Airport 120 | $8.6 | $9 |

## Developing Preliminary Capital and O&M Costs

**Rail Alternatives**: For each rail option (MBTA and Amtrak), conceptual schedules were designed, existing track configuration analyzed, and schematic track diagrams prepared. The Study team consulted an array of sources (e.g., Nashua Regional Planning Commission Passenger Rail Study), considered their experience working for and with the MBTA on passenger rail renewal projects, accounted for cost drivers and made educated assumptions (such as new track and number of tie replacements), and received feedback from MBTA and Amtrak. Costs for rolling stock were excluded from preliminary commuter rail estimates (MBTA indicated they would supply necessary rolling stock), but included in preliminary intercity rail estimates (Amtrak indicated they could not operate the new service from within their existing fleet). MBTA 2009 cost reports to FTA were used to estimate O&M cost drivers (increased train miles, increased rolling stock [locomotives and coaches], and increased track miles), and Amtrak officials were consulted for guidance predicting O&M costs based on their historical data.

**Bus Alternatives**: Preliminary estimates of capital costs for the bus options were driven by two factors:

1. Additional buses required to operate more frequent service
2. Roadway upgrades required to allow for Bus on Shoulder operations, which would provide more reliable peak service

The Study team consulted several sources (e.g., Merrimack Valley Planning Commission's 2014 Study on Bus Use of Shoulders); analyzed existing right-of-way conditions; met with NHDOT and BX officials; and made educated assumptions based on past experience in upgrading drainage, striping, and signage along the route.

O&M costs were estimated by developing weekday service schedules, including estimates of vehicle requirements and bus miles, and reviewing these schedules with BX; BX also provided service statistics and cost summaries.

# Section 5: Preliminary Evaluation of Conceptual Alternatives and Recommended Alternatives for Detailed Evaluation

## *Task Objective*

The 12 conceptual/preliminary alternatives were evaluated against six criteria:

1. Capital Costs
2. Ridership
3. Land Use and Economic Development Impacts
4. Environmental Fatal Flaws
5. Opportunity Cost (the financial savings from doing nothing, or relatively little, weighed against resulting opportunities lost)
6. Cost-Benefit Ratio (how successfully an alternative delivers greater benefits at a comparatively low cost)

Based on this evaluation, seven of the 12 alternatives were selected as candidates for detailed evaluation (see Section 7, Appendix 7).

## *Preliminary Evaluation Criteria*

### The Cost of Doing Nothing

In addition to studying the financial, economic, land use, and environmental costs of making a transit investment in the Capitol Corridor, this Study also evaluated environmental costs and costs to individuals, the broader population, and the economy that would result from *not* making a transit investment.

## Costs and Ridership

Preliminary capital costs and ridership data (Figure 11) were collected to guide the early screening process. Capital costs for each alternative include construction, equipment, stations, track right-of-way and signal upgrades, and highway improvements (see Appendix 4, Preliminary Capital Cost Methodology Memo); ridership is defined as the average weekday ridership in terms of total boardings (see Appendix 6, Rail Ridership Forecast Methodology Memo).[4]

### Figure 11 – Preliminary Capital Costs and Ridership Data

| Alternative | Capital Cost (In Millions, 2014$) | Incremental Ridership (Total Weekday Boardings) |
|---|---|---|
| **No Build/No Transit Improvement** | $0 | --- |
| **Concord Regional Rail** | $226 | 2,700 |
| **Concord Commuter Rail** | $206 | 3,020 |
| **Manchester Regional Commuter Rail** | $164 | 3,120 |
| **Manchester Commuter Rail** | $164 | 3,060 |
| **Nashua Commuter Rail** | $124 | 2,040 |
| **Nashua Minimum Commuter Rail** | $124 | 1,480 |
| **Intercity 8** | $162 | 1,460 |
| **Intercity 12** | $174 | 1,720 |
| **Intercity 18** | $174 | 2,040 |
| **Expanded Base** | $6 | 346 |
| **Bus on Shoulder** | $2 | 692 |
| **Expanded Bus on Shoulder** | $9 | 1,038 |

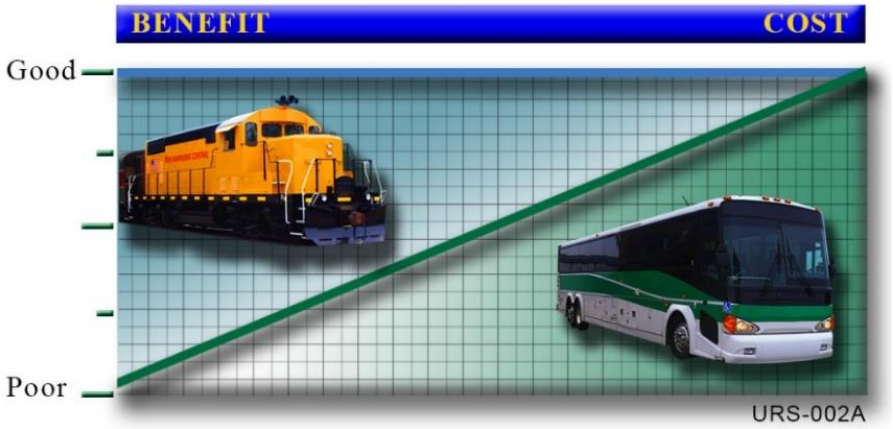
[4] Cost estimates for the preliminary alternatives were refined based on additional engineering analysis, which explains differences between the preliminary estimates and later more detailed cost data – and will be refined again if a project moves forward. This is standard procedure in transit planning studies.

## Land Use and Economic Development Impacts

Because strategic land use planning that focuses higher-density, mixed-use development near transit stations can reduce demand on the transportation network and also result in employment opportunity expansion closer to home, the Study team considered how likely each alternative would help promote desirable TOD development patterns.

## Cost-Benefit Ratio

In general, bus alternatives are far less expensive than rail projects. However, in transit planning, benefits often rise with costs, and this is certainly true with the rail-bus tradeoffs in the Capitol Corridor. While rail costs are significantly higher than those for bus-based strategies, the benefits resulting from rail are also considerably greater, especially regarding beneficial land use and TOD impacts.




*Benefits rise as costs rise. The inverse is also true: low costs, low benefits*

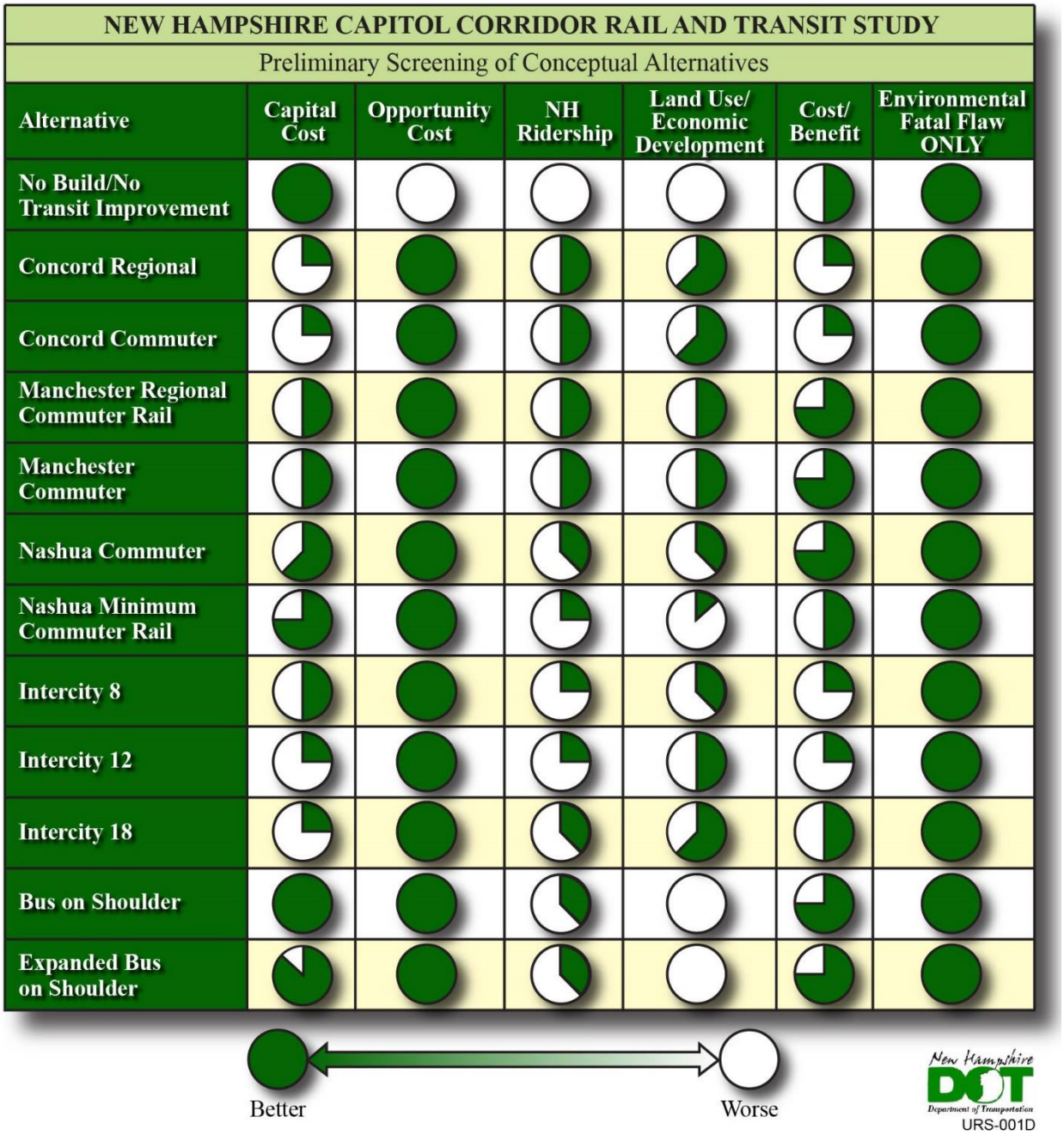
## Environmental Fatal Flaws

While environmental impacts (positive and negative) are important, for the purposes of screening alternatives in this early Study phase, the Study team considered only major negative impacts and environmental fatal flaws – flaws that by themselves would disqualify alternatives. None were found.

# *Preliminary Evaluation Results*

Figure 12 on the next page shows evaluation results. Each preliminary alternative received a qualitative rating from best (full circle) to worst (empty circle), or, in most cases, somewhere in between. Ratings (and therefore rankings) are *relative to the other alternatives in the Capitol Corridor Study – rather than to any national standards or projects in other regions around the country.*

## Figure 12 – Preliminary Evaluation Results



# *Preliminary Evaluation Conclusions*

This preliminary assessment, input from two public meetings in Manchester and Concord (the third public meeting presented final alternatives for further consideration), discussions with New Hampshire and Massachusetts stakeholders (Section 1, Appendix 1), and extensive consultation with FTA and FRA resulted in selection of seven intermediate alternatives to advance into more detailed analysis.

Figure 13 lists these seven intermediate alternatives and qualifies their selection.

### Figure 13 – Rationale for Selecting the Seven Intermediate Alternatives

| Selected Alternative | Description | Primary Reason for Selection |
|---|---|---|
| **No Build** | Existing bus service from Concord and Manchester to Boston via I-93 and Route 3 | Lowest capital cost alternative |
| **Manchester Regional Commuter Rail** | Extension of MBTA Lowell line terminating in downtown Manchester; retains existing bus service on I-93 and Route 3 | Most cost-effective initial option |
| **Nashua Minimum Commuter Rail** | Commuter rail service from a South Nashua terminus to North Station in Boston, an extension of the current MBTA Boston-Lowell line; retains existing bus service on I-93 between Concord and Manchester, and South Station and Logan Airport in Boston, and on Route 3 | Lowest-cost rail alternative of initial 12 alternatives |
| **Intercity 8** | Intercity service from Concord to North Station added onto existing MBTA Lowell-Boston service, similar to the original Amtrak Boston-Portland *Downeaster* service; retains all existing bus service on I-93 and Route 3 | Lowest cost of original intercity alternatives |
| **Expanded Base** | Additional service on existing system | Increases bus frequency and provides non-stop peak-period service |
| **Bus on Shoulder** | Existing bus service using I-93 shoulders in Massachusetts | Improves service reliability by bypassing congestion |
| **Expanded Bus on Shoulder** | Additional service using I-93 shoulders on I-93 in Massachusetts | Improves service reliability, increases bus service frequency, and provides non-stop peak-period service |

# Section 6: Evaluation Criteria and Methodology

## *Task Objective*

To evaluate each of the seven intermediate alternatives, the Study team developed eight criteria:

| | | |
|---|---|---|
| 1. | **Ridership** | What is the average weekday ridership for each alternative? |
| 2. | **Costs (Capital and O&M)** | What is the cost to build and operate each alternative? |
| 3. | **Land use impacts** | To what degree does an alternative result in relatively compact, environmentally sensitive development patterns? |
| 4. | **Economic development impacts** | How does the alternative contribute to the economy of the corridor and region? |
| 5. | **Equity and environmental justice** | What are the relative impacts of an alternative on lower-income and minority communities? |
| 6. | **Environmental impacts** | How does the alternative affect the natural, social, and economic environments? |
| 7. | **Financial feasibility** | What is the likelihood of developing a financial plan that will fund the construction and operation of the alternative? |
| 8. | **Public support** | How strong is the support for the alternative, to the point of moving it into implementation, including the acceptance of a feasible financial plan? |

These eight criteria were then grouped into broader categories – e.g., "financial considerations" includes costs (capital and O&M) and feasibility of a financial plan and public support of that plan.

Performance of each intermediate alternative against the detailed evaluation criteria is discussed in Section 7 and detailed in Appendix 7. Environmental impacts are further discussed in Section 10 and detailed in Appendices 10a and 10b.

# *Technical Methodologies*

Four technical methodologies were used to produce data and other non-quantitative assessments of the seven intermediate alternatives' relative impacts:

1. Capital costs
2. O&M costs
3. Travel demand forecasting (ridership)
4. Equity

Ridership and equity are summarized here and in Appendix 6. Detail on final cost methodologies and estimates can be found in Section 7 and Appendix 7.

## Travel Demand Forecasting (Ridership)

Rail ridership forecasts for the Manchester Regional and Nashua Minimum Commuter Rail alternatives were developed using existing MBTA commuter rail system data. Multiple models were estimated using rail operations data, station characteristics, socio-economic data, U.S. Census Transportation Planning Package journey-to-work (JTW) data, and available MBTA system boarding data.

The resultant daily ridership estimates are provided in Figure 14. The upper and lower bound are the 95 percent confidence interval around the forecast data.

### Figure 14 – Daily Ridership Estimates for Intermediate Commuter Rail Alternatives

| Alternative | Ridership | Lower Bound | Upper Bound |
|---|---|---|---|
| **Manchester Regional Commuter Rail** | 3,130 | 2,350 | 4,170 |
| **Nashua Minimum Commuter Rail** | 1,170 | 890 | 1,540 |

## Equity Methodology

USDOT has directed federal agencies, including FRA and FTA to "ensure that all federally funded transportation-related programs, policies, or activities having the potential to adversely affect human health or the environment involve a planning and programming process that explicitly considers the effects on minority populations and low-income populations." (http://www.fta.dot.gov/12347_2238.html)

This AA Study therefore includes a high-level assessment (environmental justice analysis) of each intermediate and final alternative's potential for disproportionally adverse impacts on households below the poverty line, minorities, and households living in affordable units, as well as mobility and access benefits conferred to these households by each alternative. The Study team used U.S. Census Five-Year American Community Survey (2007-2011) data, online research, and interviews with municipal officials to perform the analysis.

Results are detailed in Section 7 and Appendix 7.

# Section 7: Detailed Alternatives Evaluation

## *Task Objective*

In Task 7, the seven intermediate alternatives selected in Task 5 (Section 5, Appendix 5) were evaluated using criteria developed in Task 6 (Section 6, Appendix 6):[5]

1. Economic impacts
2. Land use, including environmental impacts
3. Equity impacts
4. Financial considerations, including costs and feasibility of a financial plan/public support of that plan
5. Mobility impacts, including ridership forecasts

These are summarized below (with the exception of ridership forecasts since the preliminary estimates did not change) and provided in detail in Appendix 7. Detailed technical memoranda supporting criteria application – ridership forecasting, O&M costs, capital costs, sustainable land use, and corridor and regional equity – are also provided in Appendix 7.

## *Economic Development Impacts*

**Economic Development Impact Evaluation Results:**

- ✓ Rail – high potential for positive impact
- ✓ Bus – no potential for positive impact

The Study team's economic assessment of the seven intermediate alternatives examined two types of economic benefit:

1. The amount of new development that might occur locally around new station areas
2. The impact of this new development, plus the investment in new or upgraded transit infrastructure measured in terms of employment and economic output in the Capitol Corridor region

[5] The eight criteria in Task 6 were grouped into five broader categories

Results show benefits associated with the three rail alternatives (Manchester Regional Commuter Rail, Nashua Minimum Commuter Rail, and Intercity 8) – all of which provide new permanent infrastructure (stations) – and no benefits associated with bus alternatives as none involve new stations (see Figure 15).

### Figure 15 – Economic Impact Results Summary

| Alternative | Station Area Development | | Employment Impacts | | |
|---|---|---|---|---|---|
| | Commercial (sq. ft.) | Residential (sq. ft.) | Project Construction (2019-2022) | Real Estate Development (2021-2030) | Reinvested New Resident Earnings (Annual, 2030+) |
| **Manchester Regional Commuter Rail** | 1,898,000 | 3,600 | 230 | 3,390 | 1,730 |
| **Nashua Minimum Commuter Rail** | 930,000 | 1,100 | 80 | 850 | 380 |
| **Intercity 8** | 819,000 | 1,640 | 350 | 2,460 | 1,140 |
| **Bus on Shoulder** | 0 | 0 | 0 | 0 | 0 |
| **No Build** | 0 | 0 | 0 | 0 | 0 |

**Land Use Evaluation Results:**

✓ Rail – medium potential for positive impact

✓ Bus – low potential for positive impact

## *Land Use*

Each alternative was also evaluated for its ability to support local land use goals:

- **Environmental Goals:**
  - Catalyze more compact, transit-supportive land use and development patterns, thereby reducing the need for additional infrastructure (sewer, water, power)
  - Reduce reliance on cars for trips/errands

- **Social Goals:**
  - Expand mobility and transportation choices for all age groups
  - Support low-income households through increased access to jobs

- **Economic Goals:**
  - Create more opportunities for people to move efficiently from place-to-place and establish more connections to transportation services to increase access and mobility
  - Access and mobility also affect the economies of the places served by transportation at local and regional levels (attract employers to New Hampshire, attract and retain regional employers to New Hampshire and Boston, and provide improved residency location choices in New Hampshire for commuters to Boston)

The bus alternatives rate relatively low on all goal categories, as does the Nashua Minimum Commuter Rail alternative. The Manchester Regional Commuter Rail and Intercity 8 rate "medium," indicating that their potential to spur development, generate jobs, and improve mobility along the corridor is greater than that of the bus or Nashua Minimum Commuter Rail options.

## *Equity Impacts*

Public transit investment supports broad improvements in mobility, but is a particularly critical tool in increasing the mobility of transit-reliant or dependent populations, including households below the poverty line, minorities, and households in affordable housing units. The Study team used U.S. Census data to calculate statistics related to income, race, and housing for households and individuals in Census Tracts within a half-mile of each of the seven alternatives. This data was also collected for the States of New Hampshire and Massachusetts and the U.S. for comparative purposes.

Results (Appendix 7) indicate that the rail alternatives offer comparatively higher levels of service and transit access to households below the poverty line, minorities, and households in affordable housing units with minimal adverse impacts. The equity of and access to the rail alternatives improves as transit service extends north from Nashua (to Manchester and/or Concord) because those alternatives (Manchester Regional Commuter Rail and Intercity 8) reach more of those three populations.

The bus alternatives would not adversely impact households below the poverty line, minorities, and households in affordable housing units, but also would not offer expanded access to these populations through new station locations.

## *Final Capital and O&M Cost Estimates*

As discussed in Section 4, the Study team consulted a variety of sources to estimate capital costs for each of the 12 alternatives. In estimating capital costs for the seven intermediate alternatives, detailed analysis led to a few changes. Here are two examples:

**Financial Evaluation Results:**

- ✓ Rail – final capital costs range from $120.3-$256.5 million, incremental O&M from $4.1 to $10.8 million
- ✓ Bus – final capital costs range from $7.4-$17 million, incremental O&M from $0-$3 million

1. During preliminary screening, it was assumed that the costs for developing commuter stations in Nashua, Manchester, and Concord would be local municipal expenses – so they were excluded from the project costs for screening purposes. This assumption was reversed in developing final cost estimates based on feedback from stakeholders and elected officials. While funding support for stations may be sought from municipalities, it was decided at this point that total project costs should be accounted for in the final cost estimates.
2. For the bus options, an allowance of $100,000 per route mile was included for upgrades to drainage, striping, and signage required for each of the 22 affected route miles; that estimate was revised to $250,000 per route mile for final screening based on unit costs encountered by the large Bus on Shoulder network in Minnesota and reported in a Transportation Research Board Transit Cooperative Research Program (TCRP) report from 2012.[6]

[6] Martin, Peter C. and Levinson, Herbert S.; *TCRP Report 151: A Guide for Implementing Bus On Shoulder (BOS) Systems*; Transportation Research Board; 2012

Figure 16 shows the final capital and O&M incremental cost estimates for each of the seven intermediate alternatives. Figure 17 provides a more detailed breakdown of capital costs for the three final rail alternatives. See Appendix 7, Final Capital Costs Methodology and Results and Final O&M Costs Methodology and Results, for detail.

## Figure 16 – Final Capital and O&M Cost Estimates for the Seven Intermediate Alternatives

| Intermediate Alternatives | Capital Cost (In Millions, 2014$) | Annual Incremental O&M Costs (In Millions, 2012$) |
|---|---|---|
| **Manchester Regional Commuter Rail** | $245.6 | $10.8 |
| **Nashua Minimum Commuter Rail** | $120.3 | $4.1 |
| **Intercity 8** | $256.5 | $7.7 |
| **No Build** | $0 | $5.9 |
| **Expanded Base** | $9.6 | $3 |
| **Bus on Shoulder** | $7.4 | $0 |
| **Expanded Bus on Shoulder** | $17 | $3 |

## Figure 17 – Detailed Breakdown of Capital Costs for the Three Final Rail Alternatives

| | Manchester Regional Commuter Rail | Nashua Minimum Commuter Rail | Intercity 8 |
|---|---|---|---|
| Railway and Signal Improvements | $69.2 | $31.7 | $96.3 |
| Bridges | $10.7 | $2.1 | $15.4 |
| Stations | $20.8 | $6.3 | $18.7 |
| Layover Yards | $12.4 | $13.4 | $4.8 |
| **Direct Construction Expense Subtotal** | **$113.3** | **$53.7** | **$135.2** |
| Construction Allowances and Railroad Staff Support | $24.9 | $11.8 | $30.0 |
| Land including Assemblage | $5.9 | $7.8 | $7.5 |
| Contingency (35%) | **$50.0** | **$25.6** | **$60.5** |
| Rolling Stock | $33.2 | $20.5 | $23.3 |
| Trackage Rights | $18.0 | $0.9 | $0.0 |
| **Total Project Value** | **$245.6** | **$120.3** | **$256.5** |

# Section 8: Identification of the Recommended Strategy

## *Task Objective*

The logical, sequential, analytical selection process (from Tasks 4 through 7) culminated in identification of a recommended transit strategy. While the term Locally Preferred Alternative (LPA) is commonly used to describe a recommended transit strategy resulting from an alternatives analysis such as the Capitol Corridor Study, it is probably more accurate to describe the recommended course-of-action as a comprehensive locally selected transit or intercity rail investment strategy, consisting of discrete investments, that may be implemented over a defined period of time.

In Task 8, the Study team identified factors most important in selecting the preferred strategy – the major differentiators – and described this strategy in detail (see Appendix 8).

## *Key Evaluation Criteria: Major Differentiators*

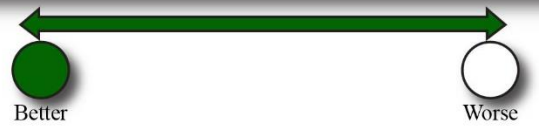
Results of the comparative analysis conducted on the seven intermediate alternatives are shown in Figure 18, where the vertical axis shows the alternatives and the horizontal axis shows key evaluation criteria – the factors most important in drawing critical differences among alternatives or, in some cases, among sets of alternatives.

The final four columns in Figure 18 summarize the relative performance of the alternatives against four important evaluation criteria: new New Hampshire transit riders, costs (capital and O&M), land use impacts, and economic development potential. They reflect relative performance in that the alternatives are judged against each other, not by any national standard. A full circle indicates very strong performance and an empty circle very weak performance, with gradations reflecting intermediate performance; the darker a circle, the stronger an alternative is within that evaluation criterion.

## Figure 18 – Comparative Analysis Summary

**NH Capitol Corridor Rail and Transit Study**

| Alternative | New NH Transit Passenger Trips | Economic Benefits - Residential Units | Economic Benefits - Jobs | Total Capital Cost (In Millions, 2014$) | NH Costs after Federal Grants and MA Contribution | Annual Operating Cost (In Millions, 2012$) | Net Operating Cost (In Millions, 2012$) | Annual NH Debt Service (20 Year Bond) | Annual NH Total Cost (Debt Service and Operating Deficit) | Annual NH Cost per New Rider | Ridership New Riders | Cost Capital/ O&M | Land Use | Economic Development |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No Build | 0 | 0 | 0 | $0 | $0 | $6 | $1 | $0 | $1 | $0 | | | | |
| Manchester Regional Commuter Rail | 2,568 | 3,600 | 5,600 | $246 | $72 | $11 | $1 | $6 | $7 | $10 | | | | |
| Nashua Minimum Commuter Rail | 670 | 1,100 | 2,500 | $120 | $39 | $4 | $1 | $3 | $4 | $22 | | | | |
| Intercity 8 | 946 | 1,600 | 2,400 | $256 | $128 | $8 | $5 | $10 | $15 | $61 | | | | |
| Expanded Base | 338 | 0 | 0 | $10 | $10 | $3 | $2 | $1 | $3 | $32 | | | | |
| Bus on Shoulder | 48 | 0 | 0 | $7 | $1 | $0 | $0 | $1 | $1 | $68 | | | | |
| Expanded Bus on Shoulder | 374 | 0 | 0 | $17 | $17 | $3 | $2 | $2 | $4 | $37 | | | | |

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# *Results – A Recommended Corridor Investment Strategy*

Based on the analysis above, the Study team recommended narrowing the range of options from seven to five: No Build, Manchester Regional Commuter Rail, Nashua Minimum Commuter Rail, Intercity 8, and Bus on Shoulder operation for existing intercity bus service on I-93 in Massachusetts.

The rationale for selecting the recommended alternatives is summarized in Figure 19.

**Figure 19 – Alternatives Recommended for Further Analysis**

| Alternative | Rationale for Selection |
|---|---|
| **No Build** | The maintenance of the status quo, including existing intercity bus service, is the lowest-cost (in terms of new investment dollars) alternative of all those considered. |
| **Manchester Regional Commuter Rail** | Considering the complete range of benefits, this option is the strongest alternative: Manchester Regional performs very well in terms of ridership, economic development, and land-use impact; however, it is one of the most expensive options. |
| **Nashua Minimum Commuter Rail** | The lowest-cost commuter rail option: while it does not stand out in terms of ridership and economic or land-use impacts, Nashua Minimum could serve as the first phase of Manchester Regional Commuter Rail service implementation. |
| **Intercity 8** | The lowest-cost intercity rail option; if implemented, Intercity 8 could serve as the first phase of more robust service similar to the original Amtrak Portland-Boston *Downeaster* service. As a relatively expensive alternative, Intercity 8 would require federal support for capital costs; while there is currently no source for such funds, if that situation changes, then Intercity 8 may be feasible. |
| **Bus on Shoulder** | Low on cost, low on benefits, and dependent on a decision by Massachusetts – as construction of any required Bus on Shoulder lanes on I-93 would be close to Boston. The possibility of New Hampshire financial support and reducing existing bus service if rail is implemented should be part of future policy discussions. |

# Section 9: Service Development Plan

## *Task Objective*

Service development planning is the technical analysis of new passenger rail (and related public transportation) services by progressively narrowing the set of reasonable alternatives that can best meet Capitol Corridor needs. The SDP is required by the FRA, and, therefore, for this Study applies only to intercity rail options, FRA's focus in the Study. FRA must approve the SDP, which responds to the FRA's[7] desire to identify and implement corridor projects and programs that will achieve four results:

1. Serve as a catalyst for growth in regional economic productivity and expansion by stimulating domestic manufacturing, promoting local tourism, and driving commercial and residential development
2. Increase mobility by creating new choices for travelers
3. Reduce national dependence on oil
4. Foster livable urban and rural communities

The SDP lays out the overall scope and approach for the recommended intercity rail alternative, and accomplishes four objectives:

1. Clearly demonstrate the rationale for new or improved passenger rail service
2. Summarize analysis of the proposed new or improved passenger rail service and describe the alternative that would best address project rationale and purpose and need
3. Demonstrate the operational and financial feasibility of the new service
4. As applicable, describe how SDP implementation may be divided into discrete phases

[7] As noted earlier in *Project Organization and Funding*, this Capitol Corridor AA Study was jointly funded by FTA and FRA to ensure the broadest possible set of alternatives was considered to address the corridor's transportation issues.

# *Capitol Corridor Intercity Service Design and Operations Overview*

*Peak-period highway congestion slows Boston-bound travel to a 12 mph crawl for the final eight miles of a typical morning trip into the city.*

The most salient transit problem addressed in developing the alternatives was improving connections between Southern New Hampshire and the regional core in downtown Boston. The principal travel obstacle in the corridor is the extreme peak-period highway congestion that slows Boston-bound travel to a 12 mph crawl for the final eight miles of a typical morning peak trip into the city.

The Study team consulted with MBTA, PAR, NHDOT, Massachusetts Department of Transportation (MassDOT), BX, Amtrak, and others to develop 12 service options for preliminary screening (see Sections 4 and 5, and Appendices 4 and 5) and narrowed those to seven intermediate options for refinement and more detailed analysis (see Sections 6 and 7, and Appendices 6 and 7).

Based on market analyses, ridership forecasts using FTA's Aggregate Rail Ridership Forecasting Model 2.0 (ARRF2), capital and O&M cost estimates, and other factors, Intercity 8 was selected as the recommended FRA alternative and the Manchester and Nashua Commuter Rail options as alternatives best suited to meet FTA requirements.

For the FRA Intercity 8 final ridership forecast, a separate, more refined forecast was prepared in collaboration with Amtrak and its ridership forecasting consultant, which has been supporting Amtrak's Market Research & Analysis Department with ridership and ticket revenue forecasts for all of Amtrak's services across the U.S. For Study purposes, Amtrak estimated ridership on the Intercity 8 service by analogy to the nearby 114 mile 10-train-per-day *Downeaster* service. Each station on the proposed Intercity 8 service was associated with a *Downeaster* "surrogate" station with similar travel time, station demographics, and train service characteristics. The model was then factored for differences between the surrogate *Downeaster* station and the proposed Capitol Corridor station.

In the SDP, the Study team describes the Intercity 8 service design, including stations and layover facilities, and provides an operations' overview; these are summarized below, with detail provided in Appendix 9.

## Intercity 8 Design Summary

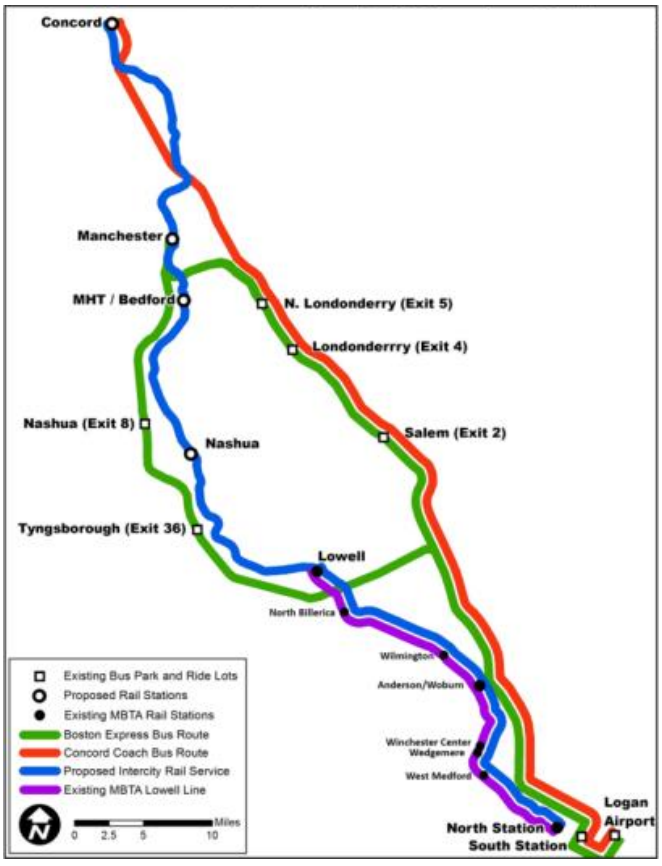
In designing the Intercity 8 option, the Study team worked to maximize the service frequency that could be offered effectively with a single set of equipment and limited crews serving the five major population centers along the corridor: Concord, Manchester, and Nashua in New Hampshire and Lowell and Boston in Massachusetts.

The design also provides service to the suburban Massachusetts intermodal hub in Woburn served by intercity passenger rail service between Portland, Maine and Boston (Amtrak *Downeaster*). The operating characteristics of the successful *Downeaster* service were influential to the Intercity 8 design. Both services (the *Downeaster* and the potential Intercity 8 service) would offer arrivals and departures at North Station at similar times of day.

Design details are summarized as follows:

- Eight trains per day or four daily round trips over the 73-mile route, stopping at five intermediate stations: Manchester, Bedford/Manchester Airport, Nashua, Lowell, and Woburn (Figure 20)
- End-to-end trip time would be approximately 96 minutes
- 586 daily train miles at maximum speeds of 75 mph between Bedford/Manchester Airport and Nashua and 70 mph at many other locations
- Expected to attract 172,645 passengers per year
- Presuming an average cost of $36 per train mile based on recent experience of the Amtrak *Downeaster* service, Intercity 8 would cost approximately $7.7 million per year to operate

**Figure 20 – Intercity 8 Service Route**



Service could be extended with possible connections to private bus services for North Country destinations. No changes are proposed to express bus service for commuting to Boston via I-93 or Route 3. Local bus service to the intercity rail stations could be offered, but would not be integral to the Intercity 8 service design. A BX/Concord Coach/rail fare integration scheme similar to that employed by the *Downeaster* at Portland, Maine could be employed at the Concord and Manchester stations that would be shared by both intercity rail and coach bus services.

## Intercity 8 Operations Overview

For Study purposes, several presumptions were made regarding Intercity 8 operations:

- Operated by Amtrak, although no decision on the operator has been made at this point
- Offered with a single push-pull locomotive hauled train set with four coaches
- Rolling stock would be similar in configuration and performance to the equipment used for the *Downeaster* and MBTA commuter rail service; the train set would be stored and serviced overnight at the Concord Station where a plug-in and basic cleaning and servicing facility would be provided
- Operated from the same pool of equipment used to provide *Downeaster* service with an extra locomotive and control coach added to that pool to offset the additional burden this service would create; Amtrak would provide heavy maintenance at its facilities in Boston's Southampton Street Yard or further south on the Northeast Corridor as is the practice with the *Downeaster* equipment
- Two crews would be required to provide service each day, and a full roster of three crews plus a spare would be necessary to handle routine service requirements; the minimum required crew would be an engineer and conductor, although it is likely that Amtrak would operate the service with a third crew member to assist with operation of doors and management of passengers

Following detailed assessments and evaluations using criteria like market, access, track operational characteristics, land ownership, sensitive receptors, and environmental impacts, four stations (from eight evaluated) and one layover facility (from three evaluated) were recommended for the Intercity 8 service (Figure 21):

- Stations at Crown Street in Nashua, the Manchester Airport site below Ray Wieczorek Drive, Granite Street in Manchester, and Stickney Avenue in Concord
- Layover Facility at the Stickney Avenue site, close to the existing intercity bus terminal

**Figure 21 – Intercity 8 Stations (from left to right: Crown Street, Nashua; Bedford/Manchester Airport; Granite Street, Manchester; and Stickney Avenue, Concord)**

## *Intercity 8 Capital Costs and Benefits*

The Intercity 8 service option is projected to cost $172.7 million for infrastructure and land, plus a $60.5 million contingency allowance and $23.3 million for the purchase of rolling stock that would be NHDOT's responsibility – for a total of $256.5 million. These costs are 2014 dollars.

Constructing and operating Intercity 8 in the Capitol Corridor would provide several benefits:

- **Reduced Vehicle Miles Travelled (VMT)** on the corridor's limited access highways by 44,794 results in reduced congestion and improved air quality
- **Station area benefits** stimulate and support sustainable land use patterns (TOD)
- **Economic development benefits resulting from rail service construction and operation**: 350 new jobs over the construction period (2019-2022), 2,460 jobs related to new real estate development between 2021 and 2030, and 1,140 new jobs annually in

2030 and beyond (with benefits beginning to accrue after 2021) due to reinvested worker earnings

- **Economic development benefits resulting from real estate development**: new real estate development is projected to add $750 million to New Hampshire's output between 2021 and 2030, with reinvested earnings adding $140 million per year beyond 2030
- **Increased service to and resulting positive equity impacts** on New Hampshire low income and minority populations
- **Freight service benefits**: with a passenger rail service on the line, the cost of providing existing freight service would be somewhat reduced

# Section 10: Environmental Assessment

## *Task Objective*

Two EAs were conducted:

- One for the **intercity rail investment strategy** (Intercity 8) to satisfy FRA requirements (Task 10a, Appendix 10a)
- The other for the **commuter rail investment strategy** (Manchester Regional Commuter Rail) to satisfy FTA requirements (Task 10b, Appendix 10b)

The environmental impacts examined in the Manchester Regional Commuter Rail EA cover each of the other final alternatives, Nashua Minimum Commuter Rail and Bus on Shoulder, as well. The focus in the EA on Manchester Regional Commuter Rail is for analytical purposes only, and that alternative should not be seen as the preferred investment, as extended debate and discussion is needed before a decision on an investment is made.

Both EAs follow the Service-level NEPA process to "typically address the broader questions relating to the type of service(s) being proposed, including cities and stations served, route alternatives, service levels, types of operations (speed, electric, or diesel powered, etc.), ridership projections, and major infrastructure components." Regardless of which investment strategy advances, additional analysis (either an EIS, EA, or CE, depending on project details and the significance of the impact) will need to be performed.

Figure 22 identifies potential environmental, social, and economic impacts associated with the transit investment strategies Intercity 8 and Manchester Regional Commuter Rail and summarizes appropriate mitigation measures. Differences in impacts are noted in gray shading; mitigation measures are the same for all impacts across both alternatives. As both EAs are Service-level NEPA documents, some resources will not have mitigation determined at this level of analysis.

## Figure 22 – Summary of Resource Impacts and Proposed Mitigation for Intercity 8 and Manchester Regional Commuter Rail Transit Strategies

| Resource | Intercity 8 Impact | Manchester Regional Commuter Rail Impact | Mitigation |
|---|---|---|---|
| **Air Quality** | Improved air quality through vehicle trips shifting to intercity rail | | A number of sustainable mitigation measures can be implemented to improve air quality |
| **Noise and Vibration** | 707 moderate noise impacts and 75 severe impacts due to warning horns; four potential daytime construction impacts and up to 324 potential nighttime construction impacts have been identified as a result of the analysis conducted pursuant to FTA guidelines; no vibration impacts expected | 453 moderate noise impacts and 630 severe impacts due to warning horns; four potential daytime construction impacts and up to 309 potential nighttime construction impacts have been identified as a result of the analysis conducted pursuant to the FTA guidelines; possible vibration impacts dependent on schedule | Mitigation measures applied for each impact during the next phase of study |
| **Hazardous Waste Sites** | Short-term adverse impacts may occur during construction of rail and station sites due to potential for movement of contaminated soils or material | | Phase I Environmental Site Assessments (ESAs) should be completed for each property acquired to be eligible for Landowner Liability Protections |
| **Water Quality** | Negligible to minor, short-term, localized impacts during construction activities | | All impacts will be mitigated through Best Management Practices, including improvements to drainage and stormwater management |
| **Wetlands** | No impact to wetlands in most areas of the corridor and minor temporary and permanent impacts to jurisdictional wetland resource areas in a few discrete areas of the corridor<br>▪ Bedford/Manchester Airport – Ray Wieczorek Drive station has several wetlands and watercourses<br>▪ North of Ray Wieczorek Drive, the majority of the site is forested wetland<br>▪ South of Ray Wieczorek Drive, there are two small forested wetlands and one emergent/scrub-shrub wetland<br>Minor temporary impacts may occur during construction activities | | As more detail is developed in next phase, these impacts will be defined in greater detail; any wetland impacts would be subject to state and federal permitting requirements |
| **Threatened and Endangered Species** | None | | Neither state agency has ruled on whether the project would qualify as a "take" under the regulations (to be confirmed in future analysis) |
| | | | |

| Resource | Intercity 8 Impact | Manchester Regional Commuter Rail Impact | Mitigation |
|---|---|---|---|
| **Floodplains** | Minor to negligible impacts to floodplains | | In locations where floodplain elevations will be altered, the project will be provided compensatory floodplain storage; through mitigation, adverse impacts to floodplains will be kept to a minimum |
| **Energy Resources** | Beneficial impact: Diverting trips from vehicles to passenger rail will reduce overall VMT and greenhouse emissions; during construction, the project would consume energy through the processing of materials and construction activities | | All impacts during construction will be addressed in the next level of analysis |
| **Visual Resources** | For work associated with the rail line, no impacts; for work associated with the stations and layover facility, negligible impacts | For work associated with the rail line, no impacts as the rail right-of-way historically accommodated double tracking throughout the length of the corridor; for the work associated with the stations and layover facility, negligible impacts | All mitigation measures associated with visual resource impacts will be addressed in the next level of analysis |
| **Accessibility** | None | | None |
| **Property Acquisition** | Minor impacts: Station development would require acquisition of two privately held parcels | | All mitigation measures associated with property acquisitions will be addressed in the next level of analysis |
| **Land Use** | Moderate beneficial impacts associated with increasing transit supportive development around stations, improving access to jobs, reducing the reliance on vehicles for trips, attracting employers to New Hampshire, retaining and attracting employers from New Hampshire to Boston, and improving residency location choice in New Hampshire for commuters to Boston or regional jobs | | None |
| **Environmental Justice (EJ)** | Major beneficial impacts for those EJ populations within proximity to proposed stations in Concord, Manchester, and Nashua, as the project provides increased access to transportation options within the corridor | Major beneficial impacts for those EJ populations within proximity to proposed stations in Manchester and Nashua, as the project provides increased access to transportation options within the corridor | None |
| **Public Safety** | Beneficial impact through mitigation and upgraded safety features | | A number of mitigation measures are recommended to improve the safety of 35 at-grade crossings for Intercity 8 and 22 for Manchester Regional Commuter Rail: upgrade the Centralized Traffic Control signal system; install all new equipment for the Automatic Highway Crossing Warning Systems; and it is assumed that Positive Train Control will be in place by the time route is operational |

| Resource | Intercity 8 Impact | Manchester Regional Commuter Rail Impact | Mitigation |
|---|---|---|---|
| **Cultural Resources** | No impact on Historic Architectural Resources; minor to negligible impacts to Archeological Resources | | As the area's archeological potential is generally high, precautions will be put in place to mitigate adverse impacts |
| **Park and Recreations** | Unknown impact on Section 4(f) Resources in the corridor at Service-level of analysis | | To be determined in future analysis |
| **Socio-economics** | Beneficial impact on New Hampshire economics by potentially generating the following:<br>▪ 1,600 new residential units<br>▪ 819,000 sq. ft. of commercial space<br>▪ 2,480 new station area jobs in 2030 and beyond, plus 1,100 other new jobs due to expansion of the economy<br>▪ 350 new jobs over the construction period (2019-2022) and 2,460 jobs related to new real estate development between 2021 and 2030<br>▪ Real estate development would add $750 million to New Hampshire's output between 2021 and 2030 | Beneficial impact on New Hampshire economics by potentially generating the following:<br>▪ 3,600 new residential units<br>▪ 1,898,000 sq. ft. of commercial space<br>▪ 5,600 new station area jobs in 2030 and beyond<br>▪ 230 new jobs over the construction period (2019-2022) and 3,390 jobs related to new real estate development between 2021 and 2030<br>▪ Real estate development would add $750 million to New Hampshire's output between 2021 and 2030 | None |
| **Transportation** | Beneficial impact on rail options and mobility by increasing transportation options | | None |
| **Indirect Effects and Cumulative Impacts** | Indirect Effects: Beneficial long-term effects due to induced growth and development around station locations; Cumulative Impacts: Incremental beneficial impact through greater access to transportation options and reduction in VMT within Route 3 and I-93 corridor | | |

# Appendices

| Final Report Section/Appendix | Task Number | Report Title, Date |
|---|---|---|
| **1** | 1 | Task 1: Public Involvement Report, December 2014 |
| **2** | 2 | Task 2: Project Purpose and Need, October 2013 |
| **3** | 3 | Task 3: Financial Plan, October 2014 |
| **4** | 4 | Task 4: Initial Conceptual Transit Alternatives, December 2013 |
| **5** | 5 | Task 5: Preliminary Evaluation of Conceptual Alternatives and Recommended Alternatives for Detailed Evaluation, April 2014 |
| **6** | 6 | Task 6: Evaluation Criteria and Methodology, July 2014 |
| **7** | 7 | Task 7: Detailed Evaluation of Alternatives, September 2014 |
| **8** | 8 | Task 8: Identification of the Recommended Strategy, November 2014 |
| **9** | 9 | Task 9: Service Development Plan, November 2014 |
| **10a** | 10 | Task 10a: Federal Railroad Administration Environmental Assessment, December 2014 |
| **10b** | 10 | Task 10b: Federal Transit Administration Environmental Assessment, December 2014 |