FINAL REPORT
MAINE-NEW HAMPSHIRE CONNECTIONS STUDY

Prepared for

Maine Department of Transportation
New Hampshire Department of Transportation

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ACRONYMS

- AASHTO – American Association of State Highway and Transportation Officials
- ACHP – Advisory Council on Historic Preservation
- ACS – American Community Survey
- ADT – Average Daily Traffic
- APE - Area of Potential Effect
- AREMA – American Railway Engineering and Maintenance-of-Way Association
- ATR - Automatic Traffic Recorder
- BICA – Bridge Inspection and Cost Analysis
- BM – Boston and Maine Corporation
- CE – Categorical Exclusion
- CFR – Code of Federal Regulations
- CO – Carbon Monoxide
- COAST - Cooperative Alliance for Seacoast Transportation
- CRF – Critical Rate Factor
- dbA – Decibel A
- DEP – Department of Environmental Protection
- DES – Department of Environmental Services
- DOE – Determination of Effects
- DOT'S – Departments of Transportation
- EA – Environmental Assessment
- ECG - East Coast Greenway
- EFH – Essential Fish Habitat
- EIS – Environmental Impact Statement
- EPA – Environmental Protection Agency
- ET – Eastern Trail
- FEMA – Federal Emergency Management Agency
- FHWA – Federal Highway Administration
- FPPA – Farmland Protection Policy Act
- FRA – Federal Railroad Administration
- FTA – Federal Transit Administration
- GIS – Geographic Information System
- HCL – High Crash Location
- HCM – Highway Capacity Manual
- HDR – HDR Engineering, Inc.
- HNTB – HNTB Corporation
- HOV – High Occupancy Vehicle
- Hoyle, Tanner - Hoyle Tanner and Associates, Inc

- IBA – Interstate Bridge Authority
- lb - pound
- LCCA – Life Cycle Cost Analysis
- LMA – Labor Market Area
- LOS – Level of Service
- LRFR - Load Resistant Factored Rating
- MaineDOT – Maine Department of Transportation
- MBTA – Massachusetts Bay Transportation Authority
- MB – Memorial Bridge
- MEGIS – Maine's Office of Geographic Information Systems
- MHPC – Maine Historic Preservation Commission
- MOA – Memorandum of Agreement
- MOE - Measure of Effectiveness
- mph – miles per hour
- MRSA – Maine Revised Statutes Annotated
- NAAQS – National Ambient Air Quality Standard
- NAC – Noise Abatement Criteria
- NBIS – National Bridge Inspection Standards
- NEPA – National Environmental Policy Act
- NGVD - National Geodetic Vertical Datum
- NH DHR – New Hampshire Division of Historic Resources
- NH DOT – New Hampshire Department of Transportation
- NH GRANIT – New Hampshire Geographically Referenced Analysis and Information Transfer System
- NH RSA - New Hampshire Revised Statutes Annotated
- NHS – National Highway System (Federal funding category & established system of roads)
- NHSG – New Hampshire Seacoast Greenway
- NHSHPO – New Hampshire State Historic Preservation Office
- NMFS – National Marine Fisheries Service
- NNEPRA – Northern New England Passenger Rail Authority
- NOAA – National Oceanographic and Atmospheric Administration
- NR – National Register
- NRCS - National Resource Conservation Service
- NRHP - National Register of Historic Places
- NWI – National Wetlands Inventory
- O&D – Origin and Destination
- O&M - Operation and Maintenance

- PAR – Pan Am Railway
- P&N – Purpose and Need
- PHF – peak hour factor
- PM – Particulate Matter
- PNSY – Portsmouth Naval Shipyard
- Q&A – Question and Answer
- R&R – Capital Repair and Rehabilitation
- ROW – Right of Way
- RSA – Revised Statutes Annotated
- SHPO – State Historic Preservation Office
- SML – Sarah Mildred Long Bridge
- STPA – Maine's Sensible Transportation Policy Act
- STRY – Springfield Terminal Railway Company
- TAZ – Traffic Analysis Zone
- T&E – Threatened and Endangered Species
- TIGER - Transportation Investment Generating Economic Recovery
- TNM - Traffic Noise Model
- USACOE - United States Army Corps of Engineers
- USCG - United States Coast Guard
- USDA - United States Department of Agriculture
- USDOT – United States Department of Transportation
- USFWS – United States Fish and Wildlife Service
- USGS – United States Geologic Survey
- V/C – Volume to Capacity
- VHT – Vehicle Hours Traveled
- VMT – Vehicle Miles Traveled
- vph – Vehicles per hour
- YCCAC – York County Community Action Center

EXECUTIVE SUMMARY

BACKGROUND

The Memorial and Sarah Mildred Long Bridges provide two of the three crossings over the Piscataqua River between Portsmouth, New Hampshire and Kittery, Maine. The effective operation of the two bridges, both of which are eligible for listing on the National Register of Historic Places (NR), provides a multi-modal transportation system that impacts trade and commerce, tourism, community life and the historic and aesthetic character of Kittery and Portsmouth. Both bridges are owned and maintained by a 50-50 joint responsibility agreement between Maine and New Hampshire Departments of Transportation (DOTs). The bridges have been determined to be structurally deficient by both Maine and New Hampshire DOTs and their continued operation requires increasing maintenance costs of over one million dollars per year for each bridge. It has been determined that, without improvements, the Memorial Bridge would likely be closed within one to three years. Similarly, without improvements, the Sarah Mildred Long Bridge would likely need to close within seven to ten years. This near-term timeframe necessitated immediate actions by both Maine and New Hampshire DOTs described below.

The major function of the three bridges serve different transportation roles with the I-95 High Level Bridge serving the region's Interstate river crossing needs, the Sarah Mildred Long Bridge serving the regional Maine and New Hampshire river crossing needs and the Memorial Bridge serving the local Kittery and Portsmouth river crossing needs. This study focused primarily on the needs for addressing the functional and structural deficiencies of the Memorial Bridge and the Sarah Mildred Long Bridge.

In 2008, the two states went out to bid for a major rehabilitation of the Memorial Bridge. The final bid costs for this work were 30 percent higher than anticipated. As a result, knowing that the Sarah Mildred Long Bridge would soon also need major rehabilitation, the two states joined in a Memorandum of Agreement (MOA) in December 2008 to conduct a bi-state planning study to conduct detailed bridge inspections. The purpose of the study was to assess the region's long-term transportation needs of the host communities and region and determine the best long-term solution for connecting the two states. MaineDOT took the lead on the planning study and NH DOT took the lead on the bridge inspections.

The Planning Study Request for Proposals was issued in January 2009 and the study was awarded to HNTB Corporation in February 2009. Work commenced in March. The contract for the inspection report was awarded to HDR Corporation in March 2009. Maine and New Hampshire DOTs partnered fully in terms of study management, study direction, and decision-making. The Study Team, comprised of the two DOTs, HNTB and their sub consultants, managed and implemented the study. The Maine and New Hampshire Divisions of the Federal Highway Administration provided procedural guidance and document review for the study.

PUBLIC OUTREACH

The Study's public outreach process communicated the purpose of the Study and provided details on the analysis and ultimate screening of each proposed alternative. It gave the general public and stakeholders the maximum opportunity to provide opinions and input. A study web site, newsletters, ongoing media access and multiple meetings in large and small groups allowed direct and easy input to study decisions and processes. Detailed minutes were reported from every meeting, noting committee and public comments and encouraging transparency in terms of understanding the Study's progress. The media was invited to attend all meetings.

Two committees, the Steering Committee and the Stakeholder Committee, provided feedback at regular intervals, significantly improving study process and direction. The Steering Committee, primarily responsible for directing the study, included representatives from Maine and New Hampshire DOTs, Maine and New Hampshire Historic Preservation Offices, the Town of Kittery, the City of Portsmouth, Pan Am Railways, and, as resources, the Rockingham County Planning Commission, the Southern Maine Regional Planning Commission and Maine and New Hampshire Divisions of the Federal Highway Administration. The Stakeholder Committee, responsible for helping the Steering Committee to interpret public feedback, included the Steering Committee and those representing business, navigation, community groups, multi-modal organizations, emergency services, individuals, conservation/sustainability groups and utilities, and included Section 106 Consulting Parties[1]. Public informational meetings were also held to allow members of the public the opportunity to ask questions, comment on study findings, and provide insight on alternatives relative to community needs.

PURPOSE AND NEED STATEMENT

The Study Purpose and Need Statement was developed from a collaboration of MaineDOT, NH DOT, FHWA, Steering and Stakeholder Committee members, Consulting Parties, other interested parties, and the general public.

The Study Purpose was framed around a positive outcome, and it avoided stating solutions. It was focused on the condition of the transportation system. The purpose statement was broad enough to ensure multi-modal solutions were not dismissed prematurely.

The Study Need established evidence that a transportation problem exists, or would exist if issues are not addressed; was factual and results based; and supported the assertions made in the purpose statement.

Study Goals included other broader elements such as maintaining access to downtowns, maintaining or improving economic growth and stability, and conserving the aesthetic and environmental quality of the river and its setting. Goals sought to balance environmental and transportation values.

[1] Section 106 Consulting Parties are included under the National Historic Preservation Act. This act requires Federal agencies to take into account the effects of their actions on historic properties, whether publicly or privately owned.

The following is the Final Study Purpose and Need Statement for the Maine-New Hampshire Connections Study as agreed to by all participants:

STATEMENT OF PURPOSE:

The purpose of the Maine-New Hampshire Connections Study is to identify and evaluate feasible long-term (2035) transportation strategies that facilitate the safe, secure and effective multi-modal movement of people and goods across and upon the Piscataqua River between Kittery, Maine and Portsmouth, New Hampshire and which support the region's economic, cultural, historic, archeological and natural resources objectives and its community quality of life.

STATEMENT OF NEED: (Statement of Transportation Deficiencies)
The Need for the Study is based on present and future transportation deficiencies, specifically:

1. *Structural deficiencies exist that threaten accessibility and mobility to the region and require load postings on the Memorial Bridge and the Sarah Mildred Long Bridge,*
2. *Decreased reliability of the lift spans and increasing maintenance needs of the Memorial and Sarah Mildred Long Bridges are causing unnecessary delays to marine and land transportation, including response times of emergency vehicles,*
3. *Inadequate or outdated design features of these two bridges potentially adversely affect marine and land transportation safety,*
4. *Multi-modal (pedestrian, bicycle, rail, maritime traffic, vehicular) opportunity is limited by inadequate or outdated facilities.*

GOALS:
In order to achieve the stated Purpose and Need, the Study would strive to achieve the following goals:

a. *Improve local and regional economic growth and stability, tourism and recreational opportunities.*
b. *Maintain or improve access to Portsmouth and Kittery downtowns and Portsmouth Naval Shipyard.*
c. *Improve local connections to regional transportation modes, for example the Portsmouth International Airport at Pease.*
d. *Minimize long-term costs for the regional transportation system.*
e. *Improve bicycle and pedestrian access across the Piscataqua River.*
f. *Reduce operational and maintenance costs (currently $1.1+ M per year per bridge).*
g. *Avoid or minimize detrimental impacts to the historic significance and integrity of the Kittery-Portsmouth area.*
h. *Conserve the aesthetic setting of the Piscataqua River.*
i. *Conserve the environmental quality of the Piscataqua River.*
j. *Avoid or minimize detrimental impacts to residential neighborhoods in Kittery, Portsmouth and neighboring areas.*
k. *Reduce or maintain emissions of pollutants, including greenhouse gases.*

l. Comply with applicable federal and state regulations, for example Section 106 of the National Historic Preservation Act[2].
m. Maintain or improve emergency evacuation efficiency across the Piscataqua River.
n. Do not preclude future transportation opportunities, for example, providing for passenger rail service or bus service across the Piscataqua River.

DEVELOPMENT OF INITIAL ALTERNATIVES

The Study Team developed an initial list of alternatives that was presented to the committees and the public for input. In total, 63 alternatives were identified through this process, including a No-Build Alternative. An alternative was defined as a combination of an option for the Memorial Bridge and an option for the Sarah Mildred Long Bridge. Because the decision involving one bridge impacts the effects on the other bridge, each option had to be evaluated in combination with a proposed option for the other bridge. Proposed alternatives included rehabilitation for both bridges as well as a range of low, mid and high-level replacement options, both on and off the current alignment. Alternatives also included such suggestions as a tunnel, ferry service, or new bridge on new alignment that would replace both bridges.

FATAL FLAW ANALYSIS

Each of the 63 alternatives then went through a Fatal Flaw Analysis, in which the Study Team evaluated if the alternative:

- Did not satisfy Study Purpose and Need;
- Had significant environmental impacts;
- Was not permittable;
- Was not financially feasible;
- Was not physically feasible; and/or
- Was clearly inferior in comparison to other alternatives.

Of the 63 alternatives evaluated in the Final Fatal Flaw Report, the Study Team recommended six options be carried forward for a detailed evaluation as listed below. The remaining options and alternatives did not meet all of the Fatal Flaw criteria listed above and therefore were not advanced for further study.

The Memorial Bridge (MB) options carried forward from the Fatal Flaw Analysis included:

- **Option MB1**: Rehabilitate the existing bridge on existing alignment, including replacing the lift span, with existing clearances and reuse of the existing abutments and piers.
- **Option MB2**: Replace the superstructure of the existing bridge, including the lift span, with similar navigational clearances and reuse of the existing abutments and piers.
- **Option MB6**: Similar to Option MB2 above, except that the replacement bridge would only accommodate bicycle and pedestrian traffic.

[2] Compliance with applicable federal and state regulations are not goals, but requirements of the NEPA, Section 106 and Section 4(f) processes. However, the language has not been modified to preserve the final Purpose and Need statement as approved.

The Sarah Mildred Long Bridge (SL) Options carried forward from the Fatal Flaw Analysis included:

- **Option SL1**: Rehabilitate the existing bridge on existing alignment, consists of complete demolition and replacement of the approach spans, piers and foundations and the rehabilitation of the fixed span trusses, towers, the lift span truss, and the associated foundations and rehabilitation of the rail component.
- **Option SL2**: Replace the existing bridge on existing alignment with a new two-lane or four-lane bridge, including the lift span and substructure, with improved horizontal navigational clearances; and, replace the rail component.
- **Options SL2A**: Replace the existing bridge with a new two-lane or four-lane bridge, including the lift span and rail line, on a new alignment immediately upstream with improved horizontal navigational clearances to improve vessel passage.

These options combined into the newly labeled twelve alternatives, plus No-Build Alternative listed below:

- The No-Build Alternative = Memorial Bridge Closed, Sarah Mildred Long Bridge remains open with reduced posting
- Alternative 1 = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Rehabilitated
- Alternative 2a = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment (two-lane)
- Alternative 2b = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane)
- Alternative 3a = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment (two-lane)
- Alternative 3b = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane)
- Alternative 4 = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Rehabilitated
- Alternative 5a = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (two-lane)
- Alternative 5b = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane)
- Alternative 6a = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (two-lane)
- Alternative 6b = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane)
- Alternative 7 = Memorial Bridge Bicycle/Pedestrian Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane)
- Alternative 8 = Memorial Bridge Bicycle/Pedestrian Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane)

As a benchmark, the No-Build Alternative was advanced throughout the study. The No-Build Alternative assumed that the existing Memorial Bridge would not be available for use due to age and structural issues, as it has been determined that without improvements, the Memorial Bridge would likely be closed within one to three years. The Sarah Mildred Long Bridge would remain open but would be posted with limiting load restrictions.

Subsequent to the completion of the Final Fatal Flaw Report, three additional alternatives were proposed by MaineDOT and were developed and evaluated in the same manner as the previous 63 alternatives that had been screened in the Final Fatal Flaw Report. These three additional alternatives were comprised of an additional Memorial Bridge Option, identified as MB7 and an additional Sarah Mildred Long Bridge Option, identified as SL2B (6 percent grade hybrid) and SL2C (5percent grade hybrid). The three additional alternatives are described as follows:

- ***Alternative 9*** = Memorial Bridge Replaced on existing alignment. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 6 percent road grade would be constructed on a new alignment immediately upstream with an 86-foot± vertical clearance moveable span (in the closed position) to reduce the number of lift openings and provide greater lift span opening (approximately 270 feet versus 200 feet) to improve vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB2 with Sarah Mildred Long Bridge Option SL2B.)
- ***Alternative 10*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 6 percent road grade would be constructed on a new alignment immediately upstream with an 86-foot± vertical clearance moveable span (in the closed position) to reduce the number of lift openings and provide greater lift span opening (approximately 270 feet versus 200 feet) to improve vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB6 with Sarah Mildred Long Bridge Option SL2B.)
- ***Alternative 11*** = Memorial Bridge would be closed and removed, with the bridge between Kittery and Badgers Island remaining open. A free bus transit system would operate seven days per week, 365 days per year from 5:00 AM to 11:00 PM for providing bicycle/pedestrian river crossing connections that were provided by the Memorial Bridge. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 5percent road grade, adequate shoulders for bicyclists and a sidewalk for pedestrians would be constructed on a new alignment immediately upstream with a 74-foot± vertical clearance moveable span (in the closed position) to reduce the number of lift openings and provide greater lift span opening (approximately 270 feet versus 200 feet) to improve vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB7 with Sarah Mildred Long Bridge Option SL2C.)

INSPECTION REPORTS

Also subsequent to the completion of the Final Fatal Flaw Report, a detailed inspection report of the Memorial Bridge provided the basis for NH DOT and MaineDOT determination that rehabilitation of the Memorial Bridge was not reasonable and viable due to its poor structural

condition. FHWA determined the rehabilitation is not prudent to fund as a major rehabilitation would provide a much reduced service life. The rehabilitation option for the Memorial Bridge will be considered in the Section 106, 4(f), and NEPA analyses. Based on this report, MaineDOT and NH DOT are recommending that all alternatives involving the rehabilitation of the Memorial Bridge be dismissed from further analysis, subject to review and approval of all documentation. This recommendation removes the five alternatives (Alternatives 1, 2a, 2b, 3a, and 3b) that include the Memorial Bridge rehabilitation option from detailed evaluation as a part of this report.

The Inspection Report for the Sarah Mildred Long Bridge indicated that while deterioration had occurred, particularly in the approach spans, rehabilitation of the truss portion of the bridge was feasible, though the approach spans should be replaced and other work would be needed as well.

Additionally, the inspection reports determined that, without improvements, the Memorial Bridge would likely be closed within one to three years. Similarly, without improvements, the Sarah Mildred Long Bridge would likely be closed within seven to ten years.

EVALUATION CRITERIA

Based on the Purpose and Need Statement and working with the committees and the public, a detailed list of evaluation criteria was developed by and presented to the committees and the public and was modified based on feedback. The final list of criteria used to evaluate the remaining alternatives was:

Structural Improvement

- ***Satisfy Structural and Functional Needs:*** This criterion evaluated two things: the physical condition of the structure and the functional life of the proposed bridge alternatives. The functional life of a bridge is indicated by the ability of the bridge to accommodate vehicle, pedestrian, bicycle and marine needs safely and reliably over the desired timeframe.
- ***Lift Span Reliability:*** The proposed condition of the lift span was assessed to evaluate its dependability over the desired timeframe.

Mobility

- ***2035 Vehicle Miles Traveled (VMT):*** Vehicle miles traveled is the total number of miles driven by all vehicles within a given time period in the study area.
- ***2035 Vehicle Hours Traveled (VHT):*** Vehicle hours traveled is the total number of hours driven within a given time period in the study area. VHT primarily measures level of congestion within the study area.
- ***Level of Service*** **(LOS):** LOS is commonly used to analyze highways and is also used to analyze intersections, transit, bicycle and pedestrian facilities. LOS is graded using the letters A through F, with A being the most efficient and F the most congested.

- ***Available Bridge Vehicular Capacity:*** Available bridge capacity is determined by estimating how many vehicles (volume) are using a bridge at a certain time compared to the maximum number that could use the bridge if it was at full capacity (capacity).
- ***Local Road Traffic Impacts:*** Three local (not state subsidized) residential roads in close proximity to the Sarah Mildred Long and Memorial Bridges were identified. This criterion measured whether an alternative would increase traffic volumes along those roads, thereby potentially increasing local maintenance costs.
- ***Mobility During Construction*****:** The study assumed that the Memorial Bridge is closed during any future construction. This criterion measured the positive impacts of keeping the Sarah Mildred Long Bridge open during construction of a rehabilitation or replacement bridge.
- ***Emergency Access:*** Emergency access relates to the alternatives' ability to accommodate fire, ambulance, and other emergency services.
- ***Evacuation Access:*** Evacuation access relates to existing evacuation route plans and the ability of the alternatives to accommodate these plans under the various alternatives.

Accessibility

- ***Accessibility to Portsmouth, Kittery Downtowns*****:** The ability of the transportation system to address needs of all people using multiple transportation modes to get to the community centers of Kittery and Portsmouth was evaluated/measured.
- ***Accessibility to Portsmouth Naval Shipyard (PNSY):*** The ability of the transportation system to provide safe and efficient access to PNSY was evaluated/measured.
- ***Bridge Design Features/Vehicle:*** This criterion measured whether the proposed alternatives would improve, maintain or reduce the width of travel lanes.
- ***Bridge Design Features/Marine:*** This criterion measured whether the alternatives would reduce, maintain or improve navigational clearances at the Sarah Mildred Long Bridge. (The US Coast Guard and study area marine pilots have indicated the Memorial Bridge poses no navigational hazard).
- ***Bridge Design Features/Bicycle:*** This criterion measured whether the alternative does or does not meet current bicycle guidelines for shoulder widths.
- ***Bridge Design Features/Pedestrian:*** This criterion measured whether the alternative does or does not meet pedestrian guidelines in terms of sidewalk presence and widths.
- ***Bridge Design/Rail Line:*** A rail line is required for PNSY and is maintained for all alternatives.

Planning Level Costs

The planning level costs developed are not based on engineering plans or designs for the alternatives concepts, but rather are based on a compilation of assumptions, unit costs from other projects, percentage factors and best estimates of what the work may cost. No alternatives were dismissed based on the planning level costs developed. Actual costs may vary from these planning level costs once design engineering is completed and cost estimates are developed based on these designs.

- ***Capital Costs*:** Capital cost included all initial construction costs associated with a given build alternative, including all engineering, construction and right of way, but excluding wetland and other mitigation costs, permitting and miscellaneous capital costs.
- ***Operation and Maintenance Costs:*** Operation and maintenance costs included all ongoing costs after completion of construction, including those associated with capital reinvestment and preventative maintenance to extend and preserve the life of the alternative, such as painting, redecking, etc., over a 100-year bridge life cycle.
- ***Life Cycle Costs:*** Life cycle costs included both initial capital cost of construction as well as all 100-year operation and maintenance costs.
- ***Travel Time Delay Cost:*** The inability of a transportation system to adequately accommodate the public's travel needs results in increased travel time. The Travel Time Delay Cost measure quantified changes in travel time and the associated costs.
- ***Benefit/Cost Ratio*:** This ratio compared the change in costs from increases or decreases in Vehicle Miles Traveled, Vehicle Hours Traveled (Travel Time Delay) and safety versus the annualized Life Cycle Cost for each alternative. Marine costs or savings were not calculated. Ratios that are less than 1.0 are not usually considered financially feasible because the costs of the alternative have been determined to be greater than the associated transportation user benefits. Ratios that are equal or greater than 1.0 are considered to provide transportation user benefits that are greater than the cost of the alternative.
- ***Local Business Impacts:*** This criterion measured any impacts to businesses adjacent to the Memorial Bridge should vehicle and/or other modes of traffic be prohibited across the bridge based on results of local business survey.
- ***Regional Economic Impacts:*** This criterion measured any overall regional economic impact on the area should vehicle traffic be prohibited across the Memorial Bridge. The region under this measure of effectiveness is defined as the Labor Market Areas (LMA) of coastal Maine and New Hampshire that includes Kittery and Portsmouth. It was determined that the closing of the Memorial Bridge would not have a measurable regional economic impact.

Preliminary Historic

- ***Impacts to National Register-Listed or Eligible Historic Bridges:*** Both the Memorial and the Sarah Mildred Long Bridges are eligible for listing on the National Register of Historic Places (NR). This criterion identified whether none, one, or both of these bridges are replaced or removed.
- ***Other Historic Resource Impacts*:** This criterion measured potential impacts to other historic resources for each alternative.
- ***Archaeological Resource Impacts:*** This criterion measured potential impacts to archeologically sensitive areas for each alternative.

Natural Environment

- ***River Quality Impacts:*** This criterion measured temporary river quality impact as it relates to the number of piers to be removed, replaced, or placed in the river for pier construction or removal as identified for each alternative.
- ***Air Quality:*** This assessment conducted a local air quality analysis to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) by evaluating air quality impacts of 2035 No Build and Build conditions.
- ***Aquatic Resource Impacts:*** This criterion measured permanent aquatic habitat loss as it relates to the number of additional bridge piers to be placed in the river as identified for each alternative versus current number of river bridge piers.
- ***Access to River*****:** This criterion looked at whether any alternative impacted public access to the Piscataqua River.
- ***Threatened and Endangered Species (T&E):*** This criterion measured the potential for impacts to threatened and endangered species of plants and animals for each alternative.
- ***Special Aquatic Sites****:* This criterion measured the quantified impact to special aquatic sites for each alternative.
- ***Floodplain/Floodway****:* This criterion measured the quantified impact on floodplains/floodways for each alternative.

Physical Environment

- ***Neighborhood Traffic Impacts****:* This criteria measured levels of traffic impact in the five neighborhoods identified within close proximity to both the Memorial and Sarah Mildred Long Bridges. Increased traffic through neighborhoods is considered a negative impact.
- ***Publicly Owned Property Impacts:*** This criterion measured the quantified impact to publicly owned property such as a school or municipal office.
- ***Commercial Property Impacts:*** A commercial property is any privately owned business on land zoned for commercial use. This criterion measured the quantified impacts to commercial property. An impact means a portion of the property is acquired.
- ***Residential Property Impacts****:* A residential property is any privately owned dwelling unit on land zoned for residential use. This criterion measured the quantified impact to residential property. An impact means a portion of the property is acquired.
- ***Business or Residential Displacements*****:** A displacement means that the entire property would require complete acquisition. This criterion measured the number of likely acquisitions identified for each alternative.
- ***Noise:*** The Traffic Noise Model (TNM) was used to calculate the existing and future noise levels at all the receptor locations in the study area for each alternative.

Environmental clearances

- ***Permitting/NEPA:*** These criteria evaluated the alternatives' ability to obtain necessary federal (U.S. Coast Guard, US Army Corps of Engineers) and state permits as well as satisfying the procedural requirements of the National Environmental Policy Act (NEPA).

- ***Section 4(f) Properties:*** These criteria measured impacts to historic and other Section 4(f) properties based on direct impacts to these properties.

ALTERNATIVES DISMISSED FROM FURTHER CONSIDERATION

Based on systematic evaluation, the Study Team, with input from the committees and the public, the preceding criteria were used to dismiss the following alternatives from further consideration.

Dismissal #1: Six-lane River Crossing Bridge Alternatives. The Study Team determined that six lanes in addition to the I-95 high level bridge were not needed for accommodating future river crossing traffic needs within the Study timeframe (2035). Therefore, the alternatives that provided six lanes of river crossing capacity at the Memorial Bridge and Sarah Mildred Long Bridge were dismissed: Alternative 5b and Alternative 6b. This reduced the number of build alternatives from ten to eight.

Dismissal #2: On-line Sarah Mildred Long Bridge Alternatives. Two of the remaining eight alternatives would replace the Sarah Mildred Long Bridge on existing alignment. The temporary negative impacts of having to close this crossing during construction of a new bridge led to the dismissal of these two alternatives: Alternative 5a and Alternative 7. This reduced the number of build alternatives from eight to six.

Dismissal #3: One Four-Lane Vehicle Bridge as Compared to One Two-Lane Vehicle Bridge. Based on comparing Alternative 8, a four-lane, low level Sarah Mildred Long Bridge to Alternative 10, a two-lane hybrid, mid-level Sarah Mildred Long Bridge, the Study Team determined that Alternative 10 was superior. The key benefits are improving both horizontal and closed position vertical marine clearance, and reduction in travel time delays. This reduced the number of build alternatives from six to five.

Dismissal #4: Measure of Remaining Alternatives to Study Goals. After further analysis measured against the goals of the study, two alternatives were determined to be inferior to the remaining five. For the reasons set forth below, Alternative 10 (a pedestrian/bicycle replacement for the Memorial Bridge) and Alternative 11 (transit service in place of the Memorial Bridge) will not be analyzed further.

- Alternatives 10 and 11 do not adequately meet the goals established by the Study process. Specifically, these alternatives (a) would not maintain or improve access to Portsmouth and Kittery downtowns and the Portsmouth Naval Shipyard, (b) would not improve bicycle and pedestrian access across the Piscataqua River, (c) would not maintain or improve emergency evacuation efficiency across the Piscataqua River, and (d) could preclude future transportation alternatives.
- NH DOT indicates it has no funding sources for pedestrian/bicycle bridges or transit services.
- There is virtually no community support, as evidenced by Stakeholder and local public meetings, for any option that does not include a highway Memorial Bridge replacement.

ALTERNATIVES RECOMMENDED TO BE CARRIED FORWARD

The following three alternatives are recommended to proceed immediately to further environmental permitting, conceptual design, estimated cost refinement, funding feasibility, and project delivery:

- Alternative 4: Memorial Bridge Replacement with Sarah Mildred Long Bridge Rehabilitation.
- Alternative 6a: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement upstream.
- Alternative 9: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement Hybrid upstream with 6 percent grade.

A summary of the key advantages and disadvantages of each Alternative is noted below:

Alternative 4: Memorial Bridge Replacement with Sarah Mildred Long Bridge Rehabilitation	
Advantages	Disadvantages
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Rehabilitated Sarah Mildred Long does not fully address lift span reliability
• Improvements to Memorial Bridge: vehicle, bicycle, pedestrian	• No improvement to Sarah Mildred Long marine vessel clearances in the open or closed position
• Limited resource impacts	• Removal of Memorial Bridge – National Register eligible bridge
• No impacts to local businesses, except during construction	• Traffic impacts from both bridges being closed separately during construction
• Low Life Cycle cost	• No sidewalk on SML
• Maintains current emergency and evacuation access, and bridge redundancy, except during construction	• Does not accommodate bicycles on lift span section of SML (3 foot shoulder)
• Maintains Sarah Mildred Long Bridge – National Register eligible bridge	• Rehabilitation of Sarah Mildred Long Bridge will require additional operation and maintenance investment compared to a new structure

Alternative 6a: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement upstream	
Advantages	Disadvantages
• Fully addresses structural deficiencies	• Removal of Memorial Bridge and Sarah Mildred Long Bridges – National Register Eligible Bridges
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Greater natural and physical environment impacts
• Improvements to Memorial Bridge (vehicle, bicycle/pedestrian) and Sarah Mildred Long (vehicle, bicycle)	• Memorial Bridge closed to traffic during construction of new Memorial Bridge
• Improves Sarah Mildred Long marine vessel clearances – horizontal only	• No sidewalk on Sarah Mildred Long Bridge
• Traffic maintained on existing Sarah Mildred Long during construction and on new Memorial Bridge	• High Life Cycle Cost
• No impacts to local businesses, except during construction	• No vertical clearance improvement for marine vessels in closed position
• Maintain current emergency and evacuation access and bridge redundancy, except during construction	

Alternative 9: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement Hybrid upstream with 6% grade	
Advantages	Disadvantages
• Fully addresses structural deficiencies	• Removal of Memorial Bridge and Sarah Mildred Long Bridges – National Register Eligible Bridges
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Greater natural and physical environmental impacts
• Improvements to Memorial Bridge (vehicle, bicycle/pedestrian) and Sarah Mildred Long (vehicle, bicycle)	• Sarah Mildred Long Bridge can only accommodate one mode at a time (rail or road)

• Improves Sarah Mildred Long Bridge marine vessel clearances – vertical (closed) and horizontal	• Rail in road at Sarah Mildred Long Bridge
• Reduction in # of Sarah Mildred Long Bridge openings vs. low level two-lane Sarah Mildred Long	• Memorial Bridge closed to traffic during construction of new Memorial Bridge
• Increases bridge vehicle capacity compared to low-level options	• No sidewalk on Sarah Mildred Long Bridge
• Traffic maintained on SL during construction and on new Memorial Bridge	• High Life Cycle Cost
• No impacts to local businesses, except during construction	
• Maintain current emergency and evacuation access and bridge redundancy, except during construction	

Discussions and recommendations regarding proposed bicycle/pedestrian facilities should be considered during the development of final design plans for each bridge.

CONCLUSION/RECOMMENDATION

It is recommended that the remaining alternatives be separated for independent Section 106, Section 4(f), and NEPA analyses. Each of the remaining bridge options appear to have both logical termini and independent utility and may be classified as Categorical Exclusions if the appropriate studies substantiate this classification.

The Maine-New Hampshire Connections Study is a feasibility planning study with no direct FHWA approval or action.

NEXT STEPS

This Report culminates the feasibility analysis phase of the Maine-New Hampshire Connections Study. A joint Executive Order was issued on October 5, 2010 by the Governors of Maine and New Hampshire to form a Bi-State Bridge Funding Task Force to address the financial challenges involving the Memorial and Sarah Mildred Long Bridge, as well as future work on the I-95 High Level Piscataqua River Bridge (see Appendix 57). The duties of the Task Force are:

- Identify mechanisms that would allow the two states to jointly identify and maximize funding for the replacement, rehabilitation, repair, maintenance, and operations of the three bridges;

- Identify methods to jointly structure financing for the replacement of Memorial Bridge, the replacement or rehabilitation of Sarah Mildred Long Bridge and the repair of the I-95 High Level Bridge;
- Propose such legislation that may be necessary in each state to facilitate the funding structure and other contractual authority for state agencies or authorities consistent with each state's laws; and
- Deliver a report to the Governors of the States of Maine and New Hampshire no later than December 15, 2010 with the proposals and recommended legislation required by the Order.
    - On December 15, 2010, the Task Force delivered a report with the following recommendations:
        - Construct the Memorial Bridge replacement beginning in 2011 using a combination of TIGER II Grant funds, FHWA funds, and MaineDOT and NHDOT Bridge funds;
        - Construct the recommended Sarah Mildred Long Bridge option beginning in 2016 using a combination of FHWA funds, NH Bureau of Turnpike funds, Maine Turnpike Authority funds, MaineDOT and NHDOT funds, and Department of Defense funds;
        - Create a sinking fund that would be contributed to equally by each state to be used for the continued Capital Repair and Rehabilitation (R&R) of the Sarah Mildred Long and I-95 High Level Bridges, using state and federal funding when necessary to address short falls;
        - No recommendation is being made by the Task Force on tolling, which if thought to be necessary would be considered by future Legislatures of the two States;
        - Continue to share Operation and Maintenance (O&M) costs for all three bridges equally between the two states. Combine bridge operator duties to significantly reduce operator costs; and
        - Revitalize the Interstate Bridge Authority (IBA) to oversee all three bridges and to serve as Funds' Administrator of Sinking Fund. This includes a re-establishment of the IBA, extending its charter to include the High Level Bridge, use the IBA to oversee and manage the Sarah Mildred Long and High Level bridges, and to act as an entity to oversee, manage and distribute monies from the sinking fund. IBA members will be selected from each state.

While the Task Force conducted its work, the Connections Study Report was being finalized. Additionally:

- NH DOT is taking the lead on the Memorial Bridge to:

  - Work with a consultant to conduct environmental documentation to satisfy National Environmental Policy Act, Section 106 (historic) and Section 4(f) (public lands) analyses and documentation.
  - Work with a consultant on a design-build approach to replace the Memorial Bridge.
  - Continue these activities with full public involvement, including Steering and Stakeholder Committees and Section 106 Consulting Parties, similar to what has been done on the Maine-New Hampshire Connections Study.

- MaineDOT is taking the lead on the Sarah Mildred Long Bridge to:
  - Work with a consultant to develop 30 percent design plans and detailed cost estimates for the rehabilitation option and mid-level Hybrid two-lane replacement bridge option immediately upstream. The Connections Report costs prepared by HDR are being used for the upstream low-level, two-lane bridge replacement option.
  - Conduct environmental documentation to satisfy National Environmental Policy Act, Section 106 (historic) and Section 4(f) (public lands) analyses and documentation.
  - Continue these activities with full public involvement, including Steering and Stakeholder Committees and Section 106 Consulting Parties, similar to what has been done on the Maine – New Hampshire Connections Study.

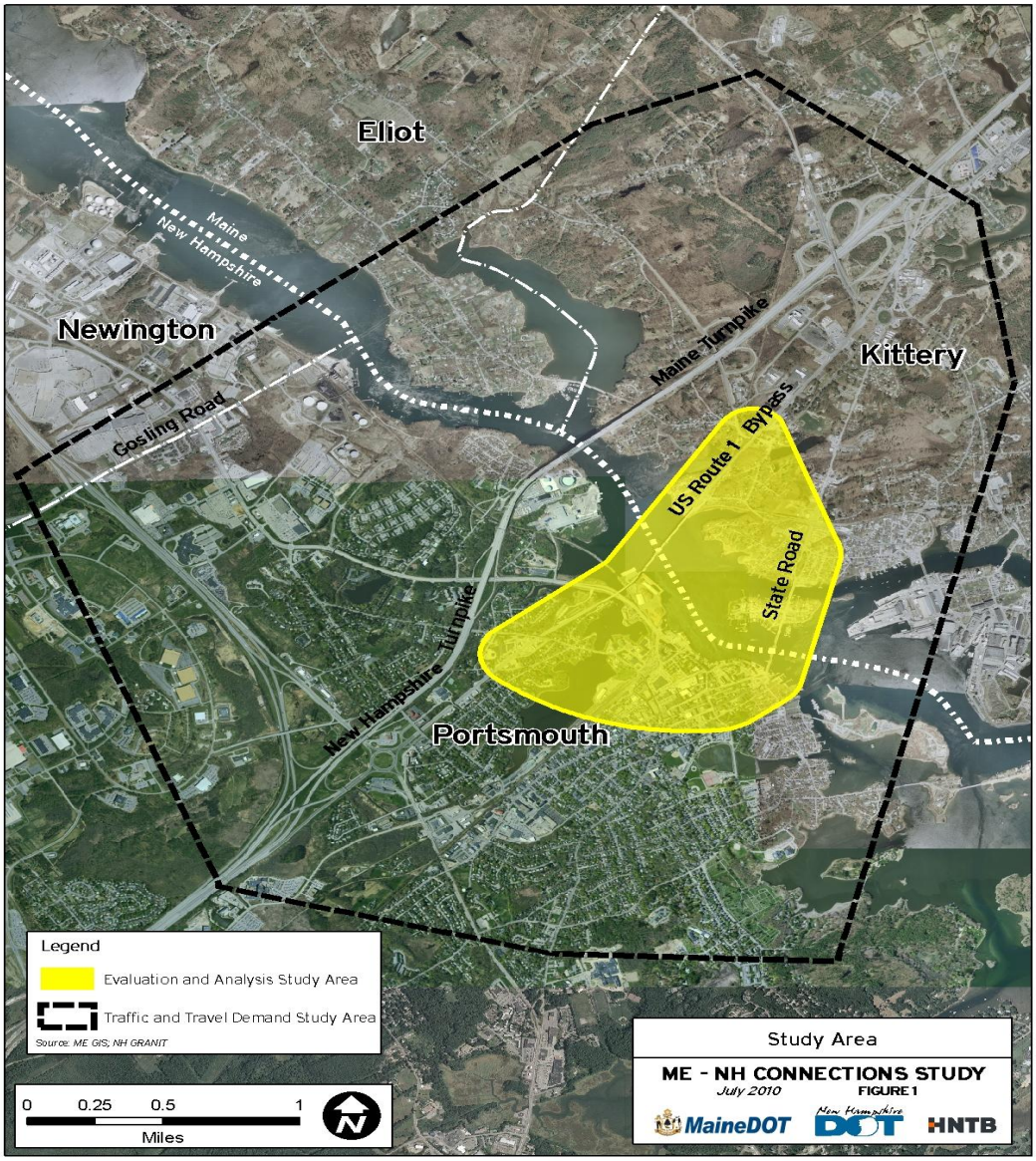
All of the activities noted above will occur concurrently so as to expedite delivery of the Memorial Bridge construction and determination of final recommended actions regarding the Sarah Mildred Long Bridge. The work is expected to begin immediately.

1. Introduction and Study Background

INTRODUCTION

The Maine-New Hampshire Connections Study focused on the identification and evaluation of potential transportation alternatives to meet local and regional crossing requirements through the Year 2035 affecting the three existing bridges (I-95 High Level Bridge, Sarah Mildred Long Bridge/U.S. Route 1 bypass, and the Memorial Bridge/U.S. Route 1) over the Piscataqua River. This evaluation included an assessment of modes, including rail, highway, transit, marine navigation, pedestrian and bicycle. Figure 1-1 provides an overview of the study area.

FIGURE 1-1: STUDY AREA MAP



The Study evaluated the engineering and environmental feasibility of the alternatives, including preliminary Section 106, Section 4(f) and the US Army Corps of Engineers Section 404b

assessment, in detail sufficient to identify a reasonable range of alternatives to be carried forward for completing the NEPA and Section 4(f) processes.

The major function of the three bridges serve different transportation roles with the I-95 High Level Bridge serving the region's Interstate river crossing needs, the Sarah Mildred Long Bridge serving the regional Maine and New Hampshire river crossing needs and the Memorial Bridge serving the local Kittery and Portsmouth river crossing needs. This study focused primarily on the needs for addressing the functional and structural deficiencies of the Memorial Bridge and the Sarah Mildred Long Bridge.

STUDY BACKGROUND

The Memorial and Sarah Mildred Long Bridges provide two of the three crossings over the Piscataqua River between Portsmouth, New Hampshire and Kittery, Maine. The effective operation of the two bridges, both of which are eligible for listing on the National Register of Historic Places (NR), provides a multi-modal transportation system that impacts trade and commerce, tourism, community life and the historic and aesthetic character of Kittery and Portsmouth. Both bridges are owned and maintained by a 50-50 joint responsibility agreement between the Maine and New Hampshire Departments of Transportation (DOTs). The bridges have been determined to be structurally deficient by both Maine and New Hampshire DOTs and their continued operation requires increasing maintenance costs of over one million dollars per year for each bridge. It has been determined that, without improvements, the Memorial Bridge would likely be closed within one to three years. Similarly, without improvements, the Sarah Mildred Long Bridge would likely be closed within seven to ten years. This near-term timeframe necessitated immediate actions by both Maine and New Hampshire DOTs described below.

In 2008, the two states went out to bid for a major rehabilitation of the Memorial Bridge. The final bid costs for this work were 30percent higher than anticipated. As a result, knowing that the Sarah Mildred Long Bridge would soon also need major work, the two states joined in a Memorandum of Agreement (MOA) in December 2008 to conduct a bi-state planning study to conduct detailed bridge inspections. The purpose of the study was to assess the long-term regional and community transportation needs and determine the best long-term transportation solution. The MOA included an agreement on the need for an updated inspection of both bridges, with MaineDOT taking the lead on the planning study and NH DOT taking the lead on the bridge inspections.

The Planning Study Request for Proposals was issued in January 2009 and the study was awarded to HNTB Corporation in February 2009. Work commenced in March. Maine and New Hampshire DOTs partnered fully in terms of study management, study direction, and decision-making. The Study Team, comprised of the two DOTs, HNTB and their sub consultants, managed and administered the study. The Maine and New Hampshire Divisions of the Federal Highway Administration provided procedural guidance and document review for the study.

In parallel and providing information to inform the findings of this Study Report, a Bridge Inspection and Cost Analysis (BICA) study was performed for both the Memorial and Sarah Mildred Long Bridges. In May and June of 2009, HDR Engineering, Inc. (HDR) and Hoyle Tanner and Associates, Inc. (Hoyle, Tanner) were contracted to perform an in-depth inspection of the bridges for the NH DOT and MaineDOT. The inspection results were used to perform a load rating (November and December, 2009) for the existing structure in its as-built and as-inspected condition, and planning level cost estimates for the rehabilitation of and replacement of the bridges for the BICA study. In addition, at the request of the NH DOT and MaineDOT, HDR performed an interim structural inspection, in May 2010 on the Memorial Bridge, on all primary truss members that rated at or below HS10 according to the Bridge Rating Report submitted in November 2009. The HS designation is an approximation of a vehicle weight/configuration used to simulate the greatest stresses caused by actual trucks on the bridge.

2.0: Public Outreach Process

The Maine-New Hampshire Connections Study's (Study) public outreach process was designed to clearly communicate the purpose of the Study, provide details on the analysis and ultimate screening of each proposed alternative and receive input from stakeholders and the general public.

The public outreach process was responsive and gave the general public and stakeholders an extensive opportunity to provide opinions and input. A study web site – www.mainenhconnections.org provided the public with updates on study progress, meeting dates, meeting minutes and materials, the purpose and need statement, information on how to get involved, committee members, study schedule and dates and an interactive question and answer (Q&A) section. The Study's goal was to provide the public with all relevant data and alternatives developed as part of this study in a clear and easy-to-understand manner.

2.1. STUDY COMMITTEES

Two committees, the Steering Committee and the Stakeholder Committee, provided feedback at regular intervals, significantly improving study process and direction. The Steering Committee, primarily responsible for directing the study, included representatives from Maine and New Hampshire DOTs, Maine and New Hampshire Historic Preservation Offices, the Town of Kittery, the City of Portsmouth, Pan Am Railways, and, as resources, the Rockingham County Planning Commission, the Southern Maine Regional Planning Commission and Maine and New Hampshire Divisions of the Federal Highway Administration. The Stakeholder Committee, responsible for helping the Steering Committee to interpret public feedback, included the Steering Committee and those representing business, navigation, community groups, multi-modal organizations, emergency services, individuals, conservation/sustainability groups and utilities, and included Section 106 Consulting Parties[3].

Steering Committee members are:

MaineDOT, Gerry Audibert and Russ Charette; NH DOT, Bob Landry and John Butler; Town of Kittery, Jon Carter, Town Manager; City of Portsmouth, Steve Parkinson, Department of Public Works; Pan Am Railway, Mike McDonough; Maine Historic Preservation, Kirk Mohney; NH Historic Preservation, Linda Wilson; Southern Maine Regional Planning, Tom Reinauer; Rockingham Planning Commission, Dave Walker; Federal Highway Administration - Maine, Mark Hasselmann; Federal Highway Administration - New Hampshire, Leigh Levine and Jamie Sikora.

In addition, to provide a broad-based spectrum of viewpoints and help to provide insight and guidance around public concerns, a diverse Stakeholder Committee was formed based on an

[3] Section 106 Consulting Parties are included under the National Historic Preservation Act. This act requires Federal agencies to take into account the effects of their actions on historic properties, whether publicly or privately owned

assessment of the needs of local and regional stakeholders. The Stakeholder Committee also includes Section 106 Consulting Parties.

Stakeholder Committee members are:

Section 106 Historic Consulting Parties:

Maine Preservation, Greg Paxton; NH Preservation Alliance, Jennifer Goodman; National Trust for Historic Preservation, Roberta Lane; Warner House Association., Ronan Donahoe; Albacore Park, Ken Herrick; Portsmouth Historical Society, Richard Candee; National Trust for Historic Preservation, Rebecca Williams.

Business:

Greater Portsmouth Chamber of Commerce, Doug Bates; Greater York Chamber of Commerce, Cathy Goodwin; Portsmouth Economic Development Committee, Nancy Carmer.

Navigation:

Portsmouth Pilots, Chris Holt; Kittery Port Authority, Milton Hall; Pease Development, Tracy Shattuck.

Community Groups:

Save Our Bridges, Ben Porter; Prescott Park Trustees, Phyllis Eldridge; City Neighborhood Steering Committee, Cristy Cardoso; City of Portsmouth Traffic and Safety Committee, Councilor Ken Smith; Portsmouth Democrats, Peter Somssich.

Multi-Modal:

Seacoast Area Bicycle Routes, Josh Pierce; East Coast Greenway, Cameron Wake; New Hampshire Seacoast Greenway, Steve Workman; York County Community Action, Connie Garber.

Emergency Services:

Kittery Police/Fire, Chief Ed Strong.

Municipalities:

York, Kinley Gregg; Eliot, Dan Blanchette.

Miscellaneous

Strawbery Banke Museum, Beth Wheland.

Individuals:

Rose Eppard, Portsmouth; Gail Drobnyk, Badgers Island.

Conservation/Sustainability:

Portsmouth Conservation Commission, Jim Horrigan.

Utilities:

Unitil, Peter Fister.

The following is a summary of all Public, Steering and Stakeholder Committee meetings, and Section106/Consulting Parties meetings and other meetings held for the Maine-New Hampshire Connections Study. This summary includes meeting date, agenda, and key input items. Detailed meeting minutes were prepared for all Public, Steering and Stakeholder Committee meetings, Section 106/Consulting Parties meetings, other process meetings, including action items, were documented in bullet format. These minutes are found in Appendix 49 (Public Meeting

Minutes), Appendix 50 (Steering and Stakeholder Committee Meeting Minutes), Appendix 51 (Other Meeting Minutes), and Appendix 52 (Section 106/Consulting Parties Meeting Minutes).

2.2. SUMMARY OF STEERING AND STAKEHOLDER COMMITTEE MEETINGS

05/22/09 | Meeting: Steering Committee Meeting

Meeting Agenda

- Welcome and Introductions
- Update on Study Data and Progress
- Committee Roles & Responsibilities
- Decision on Stakeholder Committee makeup
- Draft Purpose and Need Statement
- Brainstorming Session for Purpose and Need Statement
- Next Steps

Summary of Committee Input

- The Steering Committee made minor suggestions regarding adding members to the consultant's proposed list for the Stakeholder Committee and stated a wide range of needs as input for the draft Purpose and Need Statement.

06/25/09 | Meeting: Stakeholder Committee Meeting

Meeting Agenda

- Welcome
- Process/Next Steps
- Committee Membership
- Purpose and Need Statement Workshop

Summary of Committee Input

- Stakeholders reviewed a draft of the Purpose and Need Statement and added/reiterated need for items on long term environmental and fiscal sustainability, bicycle/pedestrian access, navigational improvements, economic viability, aesthetic and historic measures.

08/06/09 | Meeting: Steering Committee Meeting

Meeting Agenda

- Stimulus Grant Application Update
- Inspection and Study Update
- Purpose and Need Statement 2nd Draft
- Public Meeting Overview

Summary of Committee Input

- The committee reviewed and revised a new iteration of the Purpose and Need Statement, which had been changed based on FHWA comments, heard an update on the Transportation Investment Generating Economic Recovery (TIGER) Grant application and the still uncompleted inspection reports.

09/11/09 | Meeting: Stakeholder Committee Meeting

Meeting Agenda

- Welcome and Introductions
- Study Data Overview
- Fatal Flaw Analysis Discussion
- Brainstorm Alternatives (Solutions)
- Purpose and Need Statement Review
- Upcoming Meetings

Summary of Committee Input

- The committee discussed the contents of the TIGER Grant application package.
- The committee brainstormed alternatives, adding:
    - Tunnel
    - No bridges at all
    - Ferry (s)
    - Single high level bridge
- The committee accepted the revision of the draft Fatal Flaw Matrix.
- The committee accepted the final Purpose and Need Statement.

11/06/09 | Meeting: Steering Committee Meeting

Meeting Agenda

- Welcome
- Fatal Flaw Process
- Fatal Flaw Analysis to-date
- Evaluating the Alternatives
- Next Steps

Summary of Committee Input

- The committee viewed and agreed to accept the proposed list of alternatives for further consideration.
- High Level Sarah Mildred Long Bridge and all "new alternatives" were eliminated.
- Committee wanted to eliminate the new mid-level Sarah Mildred Long Bridge immediately and recommended eliminating both upstream and downstream Memorial Bridges due to historic impacts.

11/06/09 | Meeting: Stakeholder Committee Meeting

Meeting Agenda

- Welcome
- Fatal Flaw Process
- Fatal Flaw Analysis to-date
- Scoring the Alternatives
- Next Steps

Summary of Committee Input

- First Fatal Flaw Review: Committee viewed and agreed to accept proposed list of alternatives for further consideration.
- High Level Sarah Mildred Long Bridge and all "new alternatives" were eliminated.
- Committee wanted to eliminate new mid-level Sarah Mildred Long Bridge.

01/19/10 | Meeting: Steering Committee Meeting

Meeting Agenda

- Welcome
- Process/Next Steps
- TIGER Grant Application Update
- Results of Round 3 Fatal Flaw Analysis
- Alternatives Recommended to be carried forward
- Detailed Evaluation of Feasible Alternatives

Summary of Committee Input

- Reiteration of need for Business Impact Study and discussion of timing to implement – after Fatal Flaw Analysis completed.
- Fatal Flaw Analysis: New mid-level Sarah Mildred Long Bridge On-Alignment and mid-level Upstream Sarah Mildred Long Bridge eliminated.

01/19/10 | Meeting: Stakeholder Committee Meeting

Meeting Agenda

- Welcome
- Process/Next Steps
- TIGER Grant Application Update
- Results of Round 3 Fatal Flaw Analysis
- Alternatives Recommended to be carried forward
- Detailed Evaluation of Feasible Alternatives

Summary of Committee Input

- Continued Fatal Flaw Review: Committee discussed and agreed with adding a multi-use path to the Memorial Bridge Rehabilitation option.
- Reiteration of need for Business Impact Study and discussion of timing to implement – after Fatal Flaw Analysis completed.
- Fatal Flaw Analysis: New mid-level Sarah Mildred Long Bridge On-Alignment and mid-level Upstream Sarah Mildred Long Bridge eliminated.

03/26/10 | Meeting: Steering Committee Meeting

Meeting Agenda

- Final Fatal Flaw Report
- Review of Detailed Evaluation Progress to Date
- TIGER Grant Application –Round II
- Next Steps/Schedule

Summary of Committee Input

- Committee reviewed details of cross-sections for all remaining alternatives – no major changes.
- Report on Business Impact Survey – no concerns with process.

03/26/10 | Meeting: Stakeholder Committee Meeting

Meeting Agenda

- Final Fatal Flaw Report
- Review of Detailed Evaluation Progress to Date
- TIGER Grant Application –Round II
- Next Steps/Schedule

Summary of Committee Input

- Committee reviewed details of cross-sections for all remaining alternatives – no major changes.
- Report on Business Impact Survey – no concerns with process.

04/27/10 Meeting: Steering/Stakeholder Committee Meeting

Meeting Agenda

- Bridge Inspection Presentation
- Meeting Objectives
- Detailed Evaluation: Progress to Date
- Draft Evaluation Criteria
- Next Steps/Schedule
- Update: TIGER II Criteria

Summary of Committee Input

- Committees were very concerned about Memorial Bridge data but accepted conclusions of Inspection Report.
- Committees viewed Fatal Flaw Matrix and asked questions about weighting of criteria, how matrix was going to be used, discussion of meaning of regional economic impact versus local impact, accuracy of archeological data.
- Committee wanted to see criteria assessed separately for each bridge whenever possible.
- Committee strongly recommended that matrix with colors not be presented at this time at the public meeting because it appears to mean a decision has been made.

06/16/10 Meeting: Steering/Stakeholder Committee Meeting

Meeting Agenda

- Opening Discussion and Study Objectives
- Detailed Analysis of Alternatives
- Revisit Key Assumptions
- Recent Progress for Analysis of Alternatives
- Memorial Bridge Rehabilitation Alternative Update
- Mid-Level Sarah Mildred Long Hybrid Bridge Update
- Study Schedule

- Next Steps

Summary of Committee Input

- Committee members were concerned about the confusion following the May 6 public meeting and what the intent of Maine and New Hampshire was in terms of moving forward.
- Committee reiterated concern with Business Impact Analysis and asked questions regarding new assumptions on capacity, etc.
- Committee accepted that new Sarah Mildred Long Hybrid Bridge option proposed by MaineDOT has benefits.
- Committee did not believe that transit alternative proposed by MaineDOT would serve bicycle and pedestrian needs and wanted it removed from consideration.
- Committee expressed frustration that Maine seemed not to share their sense of urgency on Memorial Bridge and would not commit to the TIGER II application.
- Committee reiterated their lack of interest in pursuing the Memorial Bridge Bicycle/Pedestrian option.

11/16/10 | Meeting: Steering and Stakeholder Committee Meeting

Meeting Agenda

- Welcome
- Overview of Recent Events
- Review of Draft Final Report
- Next Steps for Memorial Bridge
- Next Steps for Sarah Mildred Long Bridge
- Next Steps for Connections Study

Summary of Committee Input

- Committees expressed concern that the TIGER II process was not included in the report.
- Committees expressed concern that the evaluation criteria for the two bridges were not separated for every criterion.
- Committees expressed continued interest for bicycle-pedestrian connectivity on the Sarah Mildred Long, especially during the Memorial Replacement period.
- Committees expressed continued interest in considering multi-modal options for all new Sarah Mildred Long Bridge options. It was noted that there are numerous design options that make this reality very feasible.
- Committees expressed concern over the scheduling of bridge construction as phasing is necessary for the efficient movement between communities during the construction period.
- Committees expressed the desire for continued contact as the process moves forward.

2.3. SUMMARY OF PUBLIC INFORMATIONAL MEETINGS

04/27/09 | Kickoff Public Meetings/Portsmouth High School/Kittery Trading Post

Meeting Agenda

- Study Purpose and Need Statement

- Federal Stimulus Grant Funding
- Study Schedule/Public Process
- Q&A on Process, Schedule and Stimulus
- What We Know Now
- Feedback – What More Should We Know?

Summary of Public Input

- Anger that the Memorial Bridge had not been repaired yet.
- Anger that the study was unneeded.
- Need for bicycle/pedestrian access on both bridges.
- East Coast Greenway over Memorial Bridge as important as US Route 1 traffic.
- Concern about need to apply for TIGER funding and Maine's lack of commitment.
- Concern about potential negative effects on PNSY.
- Concern about potential negative effects on the local economy if Memorial Bridge fails or is closed.
- Memorial Bridge connects commercial and historic districts of the two communities.

Total estimated attendees for both meetings: 150+/-

08/20/09 | Meeting: Public Informational Meeting/Portsmouth Public Library

Meeting Agenda

- Welcome
- Federal Stimulus Grant Update
- Bridge Inspections Update
- Study Update/Schedule Review
- Baseline Conditions and Analysis Overview
- Purpose and Need: Review and Discussion
- General Questions/Discussion

Summary of Public Input

- The public suggested revising the draft of the Purpose and Need Statement to include reference to rail, buses, evacuation and Section 106.
- A discussion of the history of public transit between the two communities included the comment that interstate transit was challenging due to federal interstate regulations.
- The public accepted the proposed process for the Fatal Flaw analysis.

Total estimated attendance: 70+/-

09/24/09 | Meeting: Public Informational Meeting/Kittery Trading Post

Meeting Agenda

- Welcome
- Update on Stimulus Applications/BICA
- Study Schedule Update
- Traffic Forecasts
- Fatal Flaw Analysis Discussion

- Brainstorm New Alternatives
- Next Steps

Summary of Public Input

- The public accepted the list of proposed alternatives.
- The public accepted the Purpose and Need Statement.

Total estimated attendance: 45+/-

12/16/09 | Meeting: Public Informational Meeting/Portsmouth High School

Meeting Agenda

- Welcome
- Memorial Bridge Update
- Stimulus Application Update
- Fatal Flaw Analysis
- Alternatives Considered but Eliminated
- Alternatives Carried Forward for further Study
- Next Steps

Summary of Public Input

- Public heard that Inspection Report on Memorial Bridge was worse than anticipated.
- Bicycle/Pedestrian Origin and Destination Survey released and accepted.
- Public accepted potential plans and timing for a Business Impact Analysis regarding effects of Memorial Bridge closure.
- Fatal Flaw Review/Second Round:
    - Mid-level Sarah Mildred Long Bridge on alignment eliminated.
    - Memorial Bridge total removal eliminated due to need for bicycle/pedestrian connection between communities.
    - Memorial Bridge Upstream and Downstream alternatives eliminated.
    - Public agrees with all proposals.
- Bicycle/Pedestrian option gets mixed review but audience does not suggest taking it from consideration.

Total estimated attendance: 110+/-

02/25/10 | Meeting: Public Informational Meeting/ Portsmouth High School

Meeting Agenda

- Welcome
- TIGER Grant Application Results (application was not selected)
- Round 3 Fatal Flaw Analysis Results
- Alternatives to be carried forward
- Next Steps: Detailed Evaluation
- Business Impact Assessment
- Next Steps/Upcoming Meetings

Summary of Public Input

- Fatal Flaw Review: Report accepted.
- Strong support for expanded bicycle/pedestrian access on Memorial Bridge Rehabilitation; informational Paper submitted by Steve Workman, New Hampshire Seacoast Greenway.
- Concern with effects on Sarah Mildred Long Bridge neighborhoods due to additional traffic if Memorial Bridge bicycle/pedestrian is the recommended option.
- Strong interest in plans/schedule for Business Impact Analysis.

Total estimated attendance: 110+/-

05/06/10 Meeting: Public Informational Meeting/Portsmouth City Hall

Meeting Agenda

- Welcome
- Presentation of Local and Regional Businesses Impact Analysis
- Presentation of Bridge Inspections
- Presentation of Evaluation Matrix

Summary of Public Input

- Public did not agree with or accept Charlie Colgan's and Evan Richert's conclusions that only local economic impacts would occur based on Business Impact Survey Report.
- Public did agree that some local businesses would lose significant business if Memorial Bridge is closed to vehicle traffic.
- Public was concerned about Memorial Bridge data in terms of replacement plans and current safety, but accepted conclusions of Inspection Report that bridge could not be rehabilitated.
- Public was very enthusiastic about NH DOT Commissioner Campbell's announcement that new NH Legislation authorized funding for the Memorial Bridge replacement option in order to apply for TIGER II funds.
- NH Seacoast Greenway and Eastern Trail representatives stated non-support of bicycle/pedestrian only Memorial Bridge option.

Total estimated attendance: 120+/-

06/23/10 Meeting: Public Informational Meeting/Portsmouth High School

Meeting Agenda:

- Study Update and Schedule
- Detailed Analysis of Recent Progress
- Update on Revisiting of Key Assumptions
- Alternatives Update: Memorial Bridge Rehabilitation and Sarah Mildred Long Mid-Level Hybrid Bridge
- List of Remaining Alternatives – Pros/Cons
- Next Steps

Summary of Public Input

- The public asked many questions regarding the underlying assumptions behind the study.

- The public indicated that they believed that any change in bridge configuration (including a Memorial Bicycle/Pedestrian Bridge or the Transit option) would not be business-friendly and is not supported, and that these two options should be eliminated.
- The public indicated that they believe that the Memorial Bridge – or lack thereof - would affect a much larger area than just Kittery, perhaps even all of York County.
- The public indicated that they believe the Sarah Mildred Long Hybrid Bridge option had benefits but they are concerned about the bicycle and pedestrian access and limiting potential passenger rail or more frequent rail usage.
- The public wondered why rail was really necessary at this location and why the Navy was not paying some of the added costs to provide it.
- Comments were made that a two-lane bridge plus another two-lane bridge provides future flexibility.
- Public show of hands showed no vote for bicycle/pedestrian; one vote for transit option, and virtually all support full two-lane Memorial Bridge replacement, "to see this area stay the way it is now".
- Another vote seemed to indicate support for Alternative 9: Full Memorial Bridge replacement coupled with Hybrid replacement at Sarah Mildred Long Bridge.
- Some concern heard regarding need for three bridges for evacuation and emergency response and potential closures.
- The public expressed concern that Maine is not committing to the TIGER II application.
- Overall, the public strongly supported keeping a vehicular crossing at Memorial Bridge and keeping the region as it is now.

Total estimated attendance: 120+/

11/16/10 | Meeting: Public Informational Meeting/Frank Jones Center

Meeting Agenda

- Welcome
- Overview of Recent Events
- Review of Draft Final Report
- Next Steps for Memorial Bridge
- Next Steps for Sarah Mildred Long Bridge
- Next Steps for Connections Study

Summary of Public Input

- The public expressed concern that there would be a need for a six-lane Sarah Mildred Long if the I-95 Bridge ever closed.
- The public expressed interest in providing bicycle-pedestrian connectivity on the Sarah Mildred Long Bridge.
- The public expressed interest in ensuring that all Memorial Bridge replacement options provide bicycle-pedestrian connectivity.
- The public expressed concern that the new administration in Maine could change the level of interest in supporting the replacement of both bridges.

2.4. SUMMARY OF PUBLIC MEETING COMMENTS

The study public involvement process was well attended, with a broad spectrum of individuals attending committee and public meetings. From the very first meetings, there has been a consistent sentiment that the two communities – Portsmouth and Kittery – are closely joined both economically and socially and any barrier, however small, to easy access between the two would not be welcomed by either community. This was clear from the input gathered for the Purpose and Need Statement as well as the documented comments made throughout the Study.

At the start of the Study there was perceived support for rehabilitating the existing Memorial Bridge, but when the inspection report indicated that rehabilitation was not feasible, this was accepted by the public with only minor evidence of concern.

The public in general was not supportive of a replacement bridge that would combine the two bridges, nor was it supportive of a higher level bridge. In general, this was because it was seen that these alternatives would create more difficulty in traveling between the two communities as well as create aesthetic and historic impacts.

The other overriding concern from the start was the need for full bicycle/pedestrian facilities across both bridges, but especially the Memorial Bridge. This led to the idea of replacing the Memorial Bridge with a bicycle/pedestrian-only bridge. While some initially welcomed this as a positive concept, in terms of public acceptance the idea rapidly fell victim to the growing concerns about the potential negative effect of reduced vehicle traffic to local businesses adjacent to the Memorial Bridge.

2.5. SUMMARY OF OTHER MEETINGS

04/20/09 Save Our Bridges Meeting

This informal meeting provided the Save Our Bridges committee (headed by Ben Porter and Richard Candee) with the opportunity to ask questions about the study objectives and timeframe, and also provided the Study Team with the opportunity to understand the concerns and objectives of the organization. An important outcome of the meeting was to ensure participation in the Study by key members of the organization.

Attendees: Carol Morris, Morris Communications; and Ben Porter, Richard Candee, Josh Pierce, Doug Bates, Tom Holbrook, Steve Fowle, all of Save Our Bridges.

04/02/09 Municipal Meeting: Portsmouth

This informal meeting was to provide city officials with an overview of the study objective and timeframe and allow them an early opportunity to ask questions and offer concerns and advice.

Attendees: Portsmouth City Manager John Bohenko; Portsmouth Public Works Director Steve Parkinson; and Carol Morris, Morris Communications.

04/02/09 Municipal Meeting: Kittery

This informal meeting was to provide the Kittery town manager with an overview of the study objective and timeframe and allow him an early opportunity to ask questions and offer concerns and advice.

Attendees: Kittery Town Manager Jonathan Carter and Carol Morris, Morris Communications.

05/04/09 Portsmouth Naval Shipyard Meeting

The purpose of this meeting was to provide an overview of the Study objectives and timeframe to PNSY officials, ask them to participate on the Steering Committee and define a process for obtaining PNSY-related information critical to the Study. The discussions include the Study purpose and goals, the upcoming Stimulus grant funding, the schedule and public process, the study team's assessments of PNSY needs, and an assessment by PNSY of future growth. Other information gathered from PNSY included:

1. The 2035 Infrastructure Plan was currently being developed.
2. An additional 1,000 jobs are possible in long term.
3. Three-shifts daily - 60% in first (7:00-3:30), 30% in next, 10% in night shift.
4. Approximately 200 commercial vehicle deliveries daily.
5. Both registered and private shuttle services transport personnel to the PNSY.
6. Concerns with Pan Am ownership of rail line and their long-term ability to service PNSY needs.
7. Note: PNSY had previously indicated that they would not accept the invitation to sit on the Steering Committee due to Navy policy.

Attendees: Deborah White, Danna Eddy and Rod Moore, all of PNSY; Gerry Audibert, MaineDOT; Bob Landry, NH DOT; Paul Godfrey, HNTB; and Carol Morris, Morris Communications.

06/16/09 Navigation Meeting

The purpose of this meeting was to review and discuss navigational needs and opportunities for the Piscataqua River as they relate to the Study. Items discussed were the upcoming United States Coast Guard (USCG) Waterways, Analysis and Management survey, the existing clearances of the two bridges and specific improvements requested (an extra 15' in vertical clearance for the Sarah Mildred Long Bridge, an extra 60' in horizontal clearance to match the Memorial Bridge, and reduce the skew on the Sarah Mildred Long Bridge), the size of the ships currently using the river (largest being the Panamax at 750' long, 108' wide, 135' air draft), and the process for procuring permits (USCG issues permit for bridge construction, U.S. Army Corps of Engineers (USACOE) evaluates environmental impacts). NH Port Authority provided an update on the Study's river user list.

Attendees: Paul Godfrey, HNTB; Bion Pike, Kittery Harbormaster; Milton Hall, Kittery Port Authority; Dick Holt, Jr., Portsmouth Pilots; Tracy Shattuck, NH Port Authority; Gerry Audibert, MaineDOT; Bob Landry, NH DOT; Terence Leahy, USCG; John Mauro, USCG; Gene Popien, NH DOT; John McDonald, USCG: and John Butler, NH DOT.

02/05/10 US Coast Guard Meeting

The purpose of this meeting was to bring the Coast Guard up to date with the progress of the Study and to determine their needs should a permit be required as a result of Study recommendations. Items discussed were the timeframe for receiving a Coast Guard permit, the size increase in the width of the lift section of the Sarah Mildred Long Bridge, the need for fenders, the height of a new bridge, the size of ships using the river, dredging needs and the Army Corps of Engineer's involvement, the feasibility of restricting river traffic during a bridge construction period, and a request for the Coast Guard to be a Cooperating Agency on the process.

Attendees: John McDonald, USCG; Dan Satterfield, USCG; Geno Marconi, NH Port Authority; Tracy Shattuck, NH Port Authority; Chris Holt, Portsmouth Pilots; Gerry Audibert, MaineDOT; Eric Shepherd, MaineDOT; Bob Landry, NH DOT; John Butler, NH DOT; Paul Godfrey, HNTB; and Carol Morris, Morris Communications.

06/03/10 New Hampshire State Historic Preservation Office Environmental Effects Meeting

The purpose of this meeting was to allow the New Hampshire State Historical Preservation Office (NH SHPO) the opportunity to advise NH DOT of the historical impacts of proposed alternatives for the Sarah Mildred Long Bridge and the Memorial Bridge. Items discussed were the results of the Determination of Eligibility (DOE) report, local property impacts, consultants' review of the Memorial Bridge, archaeological impact considerations, alternatives under consideration and whether each alternative had adverse impacts on the Memorial Bridge, Memorial Park, Scott Avenue Bridge or the Portsmouth Historical District.

Attendees: Bob Aubrey, John Butler, Mike Dugas, Jill Edelmann, Cathy Goodmen, Bob Landry, Don Lyford, Joyce McKay, Julius Nemeth, Kevin Nyhan, Christine Perron, Jason Tremblay, and Matt Urban, all from NH DOT; Jamie Sikora, NH FHWA; Laura Black, Edna Feighner, Peter Michaud, Beth Muzzey, and Linda Wilson, all from NH Division of Historical Resources; Joe Grilli, HNTB; James McMahon, Horizon Engineering; Vicki Chase and Brian Colburn, McFarland-Johnson; Russell Charette, MaineDOT; Rebecca Williams, National Trust for Historic Preservation**;** Jennifer Goodman, NH Preservation Alliance; Richard Candee, Portsmouth Historical Society; Carol Hooper and Lynne Monroe, Preservation Company; and Scott Lees, White Mountain Survey.

Note – The Maine SHPO was unable to attend due to scheduling conflicts.

06/24/10 New Hampshire State Historic Preservation Office Environmental Effects Meeting

The purpose of this meeting was to allow the NHSHPO the opportunity to advise NH DOT of the historical impacts of the proposed alternatives for the Sarah Mildred Long Bridge and the Memorial Bridge. Items discussed were a detailed explanation of alternatives remaining for consideration and whether the alternatives would have adverse effects to the bridge structure,

Albacore Park, Christian Shore Neighborhood District, Eastern Railroad or Portsmouth Historic District Landmarks.

Attendees**:** John Butler, Jill Edelmann, and Joyce McKay, all from NH DOT; Laura Black, Peter Michaud, Beth Muzzey, and Linda Wilson, all from NH Division of Historical Resources (NH DHR); Jamie Sikora, NH FHWA; Carol Hooper and Lynne Monroe, Preservation Company; Roberta Lane and Rebecca Williams, National Trust for Historic Preservation; Ken Herrick, Albacore Park; and Jennifer Goodman, NH Preservation Alliance.

Note – The Maine SHPO was unable to attend due to scheduling conflicts.

07/01/10 United States Coast Guard Meeting

The purpose of the meeting was to provide the USCG with an update on Study progress. Items discussed were the Study recommendations and the USCG preference, the concurrence that Memorial Bridge Rehabilitation is no longer a viable alternative, traffic growth assumptions, the revisitation of bridge openings to one lift per hour, the new Sarah Mildred Long Hybrid Bridge alternative, river dredging depths, the possibility of adjusting regulations to allow peak hour traffic to use Sarah Mildred Long Bridge without lifts in the event of Memorial Bridge closing for construction. John McDonald, from the USCG, said he would need a copy of the bridge summary logs for openings in order to evaluate feasibility of adjusting regulations. Also discussed were the pros and cons of the alternatives that remain on the table, study schedule, and the need for a USCG permit for any alternative on the Memorial Bridge or the Sarah Mildred Long Bridge.

Attendees: Steve Johnson, NH DOT; Gerry Audibert, MaineDOT; Gene Popien, NH DOT, Bob Landry, NH DOT; Chris Holt, Portsmouth Pilots; Tracy Shattuck, NH Port Authority; John McDonald, USCG; Paul Godfrey, HNTB; and Benjamin Ettelman, Morris Communications.

08/17/10 US Army Corp of Engineers Meeting

The purpose of the meeting was to provide a Connections Study update to the USACOE, review remaining alternatives that are still under consideration, as well as allow the opportunity for USACOE to provide comments and input regarding the remaining alternatives and the permitting process. Items discussed were the pending dismissal of the rehabilitation of the Memorial Bridge as a viable alternative, the review process for the draft report, NEPA considerations, the refined assumption for bridge lifts on the Sarah Mildred Long and Memorial Bridges during PM peak hour, the newly introduced Hybrid Sarah Mildred Long Bridge Alternative and possible permitting scenarios.

Attendees: Paul Godfrey, HNTB; Gerry Audibert, MaineDOT; Russ Charette, MaineDOT; Jay Clement, USACOE, Mark Hasselmann, Maine FHWA, Bob Landry, NH DOT; John Butler, NH DOT; Richard Roach, USACOE; Chris Williams, NH Department of Environmental Services; Ted Deers, NH DES; and Ben Ettelman, Morris Communications.

08/19/10 Meeting with Pan Am Railways

The purpose of this meeting was to provide a Connections Study update to Pan Am Railways, review remaining alternatives still under consideration, and allow opportunity for Pan Am Railways to provide comments and input regarding the remaining alternatives. With the exception of the Hybrid alternative, all of the remaining alternatives would maintain similar rail operations and procedures to current practices. The Hybrid Alternative was discussed in greater detail because it could potentially change operation and maintenance responsibilities and procedures. Pan Am Railways expressed potential concerns regarding the Hybrid Alternative regarding their responsibility for a fixed vs. moveable track, and the need for them to perform a visual inspection by walking all portions of the rail prior to rail movement, which could impact the length of time the vehicle portion of the bridge would be closed during rail movements. Other meeting discussions included the potential for future rail shipments other than to PNSY (none known or anticipated at this time) and the need for an additional rail track (none foreseen). Regarding bridge rehabilitation, Pan Am Railways indicated there might be coordination and service issues for deliveries to PNSY, given the bridge could be closed for up to two years during construction. A follow up letter was sent to Pan Am Railways requesting additional information regarding these concerns and opinion on alternatives after the meeting.

Attendees: Mike McDonough, Pan Am Railways; Gerry Audibert, MaineDOT; Russ Charette, MaineDOT; Bob Landry, NH DOT; John Butler, NH DOT; Paul Godfrey, HNTB; and Carol Morris, Morris Communications.

12/09/10 United States Coast Guard Meeting

The Purpose of this meeting was to provide a study, make sure everyone is aware of the process in place, what tasks need to get done in what order and to clarify environmental requirements. The Portsmouth Pilots outlined their concerns that a Sarah Mildred Long replacement bridge would not improve the significant safety issues encountered due to the narrowness of the horizontal bridge opening. They noted that ships are continually built to be larger due to environmental and economic concerns, and maintaining the existing bridge horizontal clearance would over time reduce the number of ships physically able to deliver goods to this region. The USCG noted that they have been involved in other bridge projects in order to make sure future ship size is factored in before the application for a permit is made. If USCG believes there is a navigational hazard, they can deny a permit. It was noted that the Governors' Task Force is still looking at funding for all Sarah Mildred Long Bridge options and the process is not completed. Three options (rehabilitation of the existing bridge, replacement with a low-level two-lane bridge immediately upstream, and replacement with a mid-level two-lane hybrid bridge immediately upstream) – except No-Build – are still on the table. It was noted that the next steps include completion of the NEPA process and Section 106 for each bridge. It was also noted that the historic aspect of the Sarah Mildred Long Bridge may become more important since the Memorial Bridge will be replaced. A discussion took place regarding the channel widening at the Sarah Mildred Long Bridge, and it was noted that it is still under consideration. A discussion took place regarding the permit application for the Memorial Bridge, and the USCG asked when they would get that application. It was agreed to get the design to the USCG soon so the

permitting processes (wetlands, etc.) could move forward concurrently. NH DOT said that the Memorial Bridge design build contract was scheduled for award in the fall.

Attendees: John Butler, NH DOT; Bob Juliano, NH DOT; Bob Landry, NH DOT; Chris Holt, Portsmouth Pilots; Dick Holt, Jr., Portsmouth Pilots; P.J. Johnson, Portsmouth Pilots; Vicki Chasse, McFarland Johnson; Jed Merrow, McFarland Johnson; Peter Reilly, HDR; Gary Kassoff, USCG; Chris Bisigwano, USCG; John McDonald, USCG; Paul Godfrey, HNTB; and Carol Morris, Morris Communications.

On January 6, 2011, the USCG submitted comments on the "Draft Final Report, Maine-New Hampshire Connections Study, dated November 9, 2010" regarding the needs of navigation.

The USCG commented that the navigation needs, particularly at the Sarah Mildred Long Bridge, dictate that replacement/rehabilitation designs incorporate navigational clearance improvements. The navigational clearance designs should favor greater horizontal clearance as well as an increase in the vertical clearance in the closed position as compared to those clearances which maintain the existing navigational opening.

Regarding the Memorial Bridge, the USCG recommended that commencement of construction of the Memorial Bridge precede that of the Sarah Mildred Long Bridge due to the structural issues at the Memorial Bridge.

2.6. SUMMARY OF SECTION 106 CONSULTATION MEETINGS

As part of the investigations conducted in accordance with Section 106 of the National Historic Preservation Act, parties with a demonstrated interest in historic resources that may be affected by the alternatives considered in the Study were identified and invited to participate in the evaluation process. The purpose of the consultation was to consider historic resources early in the feasibility evaluations of alternatives. It is recognized that further Section 106 Consultation would be required subsequent to the conclusion of the Study, when NEPA documentation and design studies are advanced.

Consulting/interested parties were invited to participate on the Study Stakeholder Committee. In addition, both State Historic Preservation Offices (SHPO) were invited to participate on the Study Steering Committee. Committee meeting agenda, meeting notes, and meeting materials were sent to the consulting/interested parties, as invited participants on these committees, whether or not they attended meetings.

The following organizations were identified and invited to participate as consulting/interested parties:

- Albacore Museum and Park*
- Aroostook Band of Micmacs
- City of Portsmouth**
- COWASS North America, Inc., The Abenaki Nation of Vermont, Inc.
- Friends of the South End
- Historic New England

- Houlton Band of Maliseet Indians
- Kittery Historical and Naval Museum
- Kittery Historical Society
- Maine Historic Preservation Commission (Maine SHPO)**
- Maine Preservation*
- National Trust for Historic Preservation*
- New Hampshire Division of Historical Resources (New Hampshire SHPO)**
- New Hampshire Preservation Alliance*
- Passamaquoddy Tribe of Indians
- Portsmouth Advocates
- Portsmouth Athenaeum
- Portsmouth Historic District Commission
- Portsmouth Historical Society*
- Portsmouth Naval Shipyard (PNSY)
- Prescott Park Trustees**
- Strawbery Banke Museum**
- Town of Kittery**
- Warner House Association*

** Organizations that accepted invitation to become Consulting Parties*
*** Organizations that sat on Steering or Stakeholder Committee*

In addition to participation in the Steering Committee and Stakeholder Committee meetings, additional consultation meetings were conducted for this stakeholder group. Minutes of these meetings are included in Appendix 52 (Section 106/Consulting Parties Meeting Minutes). The dates of these meetings and the topics discussed are noted below:

- **04/21/10 Consultation Meeting on Albacore Park Issues and Concerns.** Topics discussed: 1) Bridge inspection results; 2) eligibility and need for further investigations; 3) potential effects of alternatives on historic resources; and, 4) schedule and process.

  Attendees: Bob Landry, NH DOT; John Butler, NH DOT; and Ken Herrick, Albacore Park.

- **06/03/10 NH DOT, Bureau of Environment Effects Meeting.** The primary purpose of this meeting was to conduct a preliminary historic impact evaluation for the No-Build and Build Alternatives which remained after completion of the Connection Study's Fatal Flaw screening analysis. The potential direct and indirect impacts to historic resources resulting from the alternatives were identified and/or considered. In some cases, the potential direct or indirect effects of alternatives on historic resources could not be determined and/or confirmed without further design details being developed. Topics discussed: 1) Effects of the alternatives on the Memorial Bridge, the Sarah Mildred Long Bridge, and other historic resources in New Hampshire; and, 2) process.

Attendees: Bob Aubrey, John Butler, Mike Dugas, Jill Edelmann, Cathy Goodmen, Bob Landry, Don Lyford, Joyce McKay, Julius Nemeth, Kevin Nyhan, Christine Perron, Jason Tremblay, and Matt Urban, all from NH DOT; Jamie Sikora: NH FHWA; Laura Black, Edna Feighner, Peter Michaud, Beth Muzzey, and Linda Wilson, all from NH DHR; Joe Grilli, HNTB; James McMahon, Horizon Engineering; Vicki Chase and Brian Colburn, McFarland-Johnson; Russell Charette, MaineDOT; Rebecca Williams, National Trust for Historic Preservation**;** Jennifer Goodman, NH Preservation Alliance; Richard Candee, Portsmouth Historical Society; Carol Hooper and Lynne Monroe, Preservation Company; and Scott Lees, White Mountain Survey.

- **06/24/10 NH DOT, Bureau of Environment Effects Meeting.** The primary purpose of this meeting was to continue conducting a preliminary historic impact evaluation for the No-Build and Build Alternatives which remained after completion of the Connection Study's Fatal Flaw screening analysis. The potential direct and indirect impacts to historic resources resulting from the alternatives were identified and/or considered. In some cases, the potential direct or indirect effects of alternatives on historic resources could not be determined and/or confirmed without further design details being developed. Topics discussed: 1) Continued discussion from the June 3rd meeting on the effects of alternatives on the Memorial Bridge, the Sarah Mildred Long Bridge, and other historic resources in New Hampshire; 2) process; and, 3) need for further effects meetings when design is advanced.

  Attendees: John Butler, Jill Edelmann, and Joyce McKay, all from NH DOT; Laura Black, Peter Michaud, Beth Muzzey, and Linda Wilson, all from NH DHR; Jamie Sikora, NH FHWA; Carol Hooper and Lynne Monroe, Preservation Company; Roberta Lane and Rebecca Williams, National Trust for Historic Preservation; Ken Herrick, Albacore Park; and Jennifer Goodman, NH Preservation Alliance.

2.7. MAINE PROGRAMMATIC AGREEMENT WITH STATE AND FEDERAL AGENCIES

In 2004, the Federal Highway Administration, Federal Transit Administration (FTA), Maine State Historic Preservation Officer and the Advisory Council on Historic Preservation (ACHP) developed and signed a programmatic agreement outlining the process by which the responsibility for ensuring cultural resource and 36 CFR Part 800 activities would be undertaken by MaineDOT, with annual assessment by FHWA, the FTA, SHPO and ACHP.

A copy of Maine's Programmatic Agreement with State and Federal Agencies can be found in Appendix 56.

2.8. MAINE AND NEW HAMPSHIRE GUBERNATORIAL TASK FORCE

On October 5th, 2010, Maine Governor John Baldacci and New Hampshire Governor John Lynch co-signed an executive order authorizing the creation of a task force charged with aggressively formulating plans that would allow the states of Maine and New Hampshire to develop funding for the bridge projects, identifying joint financing options and proposing any necessary

legislation to accommodate bridge construction. Among the two Governors' assurances is a commitment maintaining all three bridge crossings including a full vehicular replacement of the Memorial Bridge.

A copy of the Governor's executive order can be found in Appendix 57.

A copy of the *"Bi-State Bridge Funding Task Force – Final Report, dated December 15, 2010"* can be found in Appendix 60.

3.0: Study Purpose and Need

The Study Purpose and Need Statement was developed in collaboration between MaineDOT, NH DOT, FHWA, Steering and Stakeholder Committee members, Consulting Parties, other interested parties, and the general public.

The following three paragraphs provide definitions of "Study Purpose", Study Need", and "Study Goals".

The Study Purpose was framed around a positive outcome. It was focused on the condition of the transportation system. The purpose statement was broad enough to ensure multi-modal solutions were not dismissed prematurely.

The Study Need established evidence that a transportation problem exists, or would exist if issues are not addressed; was factual and results based; and supported the assertions made in the purpose statement.

Study Goals included other broader elements such as maintaining access to downtowns, maintaining or improving economic growth and stability, and conserving the aesthetic and environmental quality of the river and its setting. Goals sought to balance environmental and transportation values.

The following is the Final Study Purpose and Need Statement for the Maine-New Hampshire Connections Study[4] as agreed to by all participants:

The Memorial and Sarah Mildred Long Bridges provide two of three crossings of the Piscataqua River. The effective operation of the two bridges, which are eligible for the National Register of Historic Places, impacts a multi-modal transportation system that serves multiple land- and water-based transportation modes as well as trade and commerce, tourism, community life and the historic and aesthetic character of Kittery and Portsmouth. The bridges have been determined to be structurally deficient by both New Hampshire and Maine Departments of Transportation. The continued operation of the existing bridges requires increasing annual maintenance costs.

[4] Study Purpose and Need Statement finalized September 17, 2009

STATEMENT OF PURPOSE:

The purpose of the Maine-New Hampshire Connections Study is to identify and evaluate feasible long-term (2035) transportation strategies that facilitate the safe, secure and effective multi-modal movement of people and goods across and upon the Piscataqua River between Kittery, Maine and Portsmouth, New Hampshire and which support the region's economic, cultural, historic, archeological and natural resources objectives and its community quality of life.

STATEMENT OF NEED: (Statement of Transportation Deficiencies)
The Need for the Study is based on present and future transportation deficiencies, specifically:

1. *Structural deficiencies exist that threaten accessibility and mobility to the region and require load postings on the Memorial Bridge and the Sarah Mildred Long Bridge,*
2. *Decreased reliability of the lift spans and increasing maintenance needs of the Memorial and Sarah Mildred Long Bridges are causing unnecessary delays to marine and land transportation, including response times of emergency vehicles,*
3. *Inadequate or outdated design features of these two bridges potentially adversely affect marine and land transportation safety,*
4. *Multi-modal (pedestrian, bicycle, rail, maritime traffic, vehicular) opportunity is limited by inadequate or outdated facilities.*

GOALS:
In order to achieve the stated Purpose and Need, the Study would strive to achieve the following goals:

a. *Improve local and regional economic growth and stability, tourism and recreational opportunities.*
b. *Maintain or improve access to Portsmouth and Kittery downtowns and Portsmouth Naval Shipyard.*
c. *Improve local connections to regional transportation modes, for example the Portsmouth International Airport at Pease.*
d. *Minimize long-term costs for the regional transportation system.*
e. *Improve bicycle and pedestrian access across the Piscataqua River.*
f. *Reduce operational and maintenance costs (currently $1.1+ M per year per bridge).*
g. *Avoid or minimize detrimental impacts to the historic significance and integrity of the Kittery-Portsmouth area.*
h. *Conserve the aesthetic setting of the Piscataqua River.*
i. *Conserve the environmental quality of the Piscataqua River.*
j. *Avoid or minimize detrimental impacts to residential neighborhoods in Kittery, Portsmouth and neighboring areas.*
k. *Reduce or maintain emissions of pollutants, including greenhouse gases.*

l. Comply with applicable federal and state regulations, for example Section 106 of the National Historic Preservation Act[5].

m. Maintain or improve emergency evacuation efficiency across the Piscataqua River.

n. Do not preclude future transportation opportunities, for example, providing for passenger rail service or bus service across the Piscataqua River.

The needs and goals identified above are labeled alphabetically and numerically for reference to the Alternatives Evaluation Matrix (Figure 8-18) found in Chapter 8 of the Report.

[5] Compliance with applicable federal and state regulations are not goals, but requirements of the NEPA, Section 106 and Section 4(f) processes. However, the language has not been modified to preserve the final Purpose and Need statement as approved.

4.0: Study Process and Summary of Fatal Flaw Analysis

4.1. STUDY PROCESS

The following provides an overview of the process established and implemented for the Maine-New Hampshire Connections Study. This planning study identifies, assesses and determines the feasibility of a broad range of transportation alternatives. This study provides a link between the planning phase of project development and the NEPA process. Further evaluation under NEPA of a selective number of alternatives under Section 404 of the Clean Water Act, Section 106 of the National Historic Preservation Act, and Section 4(f) of the U.S. DOT Act, will advance the preliminary assessments conducted under this study. The State of Maine's Sensible Transportation Policy Act (STPA) also guides this study process.

NEPA requires all Federal agencies to conduct their planning and decision making process to; (1) Consider appropriate environmental factors when making decisions and not basing decisions solely on technical and economic factors; (2) Involve the affected and interested public early in its environmental-analysis process; (3) Seek less environmental damaging ways to document identified transportation needs; and (4) Document in plain language for the decision maker and the public this environmental-analysis process.

Section 404 of the Clean Water Act establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Wetlands subject to Section 404 are defined as "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit obtainable from the U.S. Army Corps of Engineers, before dredged material may be discharged into waters of the United States.

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to consider the effects of projects, carried out by them or subject to their assistance or approval, on historic properties and provide the Advisory Council on Historic Preservation an opportunity to comment on these projects prior to a final decision on them. Projects range from construction or rehabilitation to demolition. Properties listed on or eligible for listing on the National Register of Historic Places are considered historic, subject to the provisions of Section 106. The National Register is a listing of historic properties maintained by the National Park Service. It includes buildings; structures; objects; districts; and sites of national, state, or local importance. Section 106 allows the past to be considered when looking to the future.

Section 4(f) of the Department of Transportation Act of 1966 stipulates that FHWA and other Department of Transportation agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites

unless there is no feasible and prudent alternative use of the land, and the action includes all possible planning to minimize harm to the property resulting from the use.

Section 106 of the National Historic Preservation Act and Section 4(f) were enacted by Congress on the same day in 1966 and have some overlap when historic properties are involved. A key difference is Section 106 is essentially a consultative procedural requirement, while Section 4(f) precludes project approval if the specific findings cannot be made.

STPA (23 MRSA §73) requires MaineDOT, Maine Turnpike Authority, Metropolitan Planning Organizations, and Regional Planning Councils (Regional Planning Commissions, Councils of Government, and Economic Development Districts) to incorporate the following policy objectives:

1. *TRANSPORTATION POLICY. It is the policy of the State that transportation planning decisions, capital investment decisions and project decisions must;*
   - *A. Minimize the harmful effects of transportation on public health and on air and water quality, land use and other natural resources;*
   - *B. Require that the full range of reasonable transportation alternatives be evaluated for all significant highway construction or reconstruction projects and give preference to transportation system management options, demand management strategies, improvements to the existing system, and other transportation modes before increasing highway capacity through road building activities;*
   - *C. Ensure the repair and necessary improvement of roads and bridges throughout the State to provide a safe, efficient and adequate transportation network;*
   - *D. Reduce the State's reliance on foreign oil and promote reliance on energy-efficient forms of transportation;*
   - *E. Meet the diverse transportation needs of the people of the State, including rural and urban populations and the unique mobility needs of the elderly and disabled;*
   - *F. Be consistent with the purposes, goals and policies of the Comprehensive Planning and Land Use Regulation Act; and*
   - *G. Incorporate a public participation process in which local governmental bodies and the public have timely notice and opportunity to identify and comment on concerns related to transportation planning decisions, capital investments decisions and project decisions. The department and the Maine Turnpike Authority shall take the comments and concerns of local citizens into account and shall be responsive to them.*

The Study was conducted in three steps: 1) Identification of Alternatives, 2) Fatal Flaw Analysis, and 3) Detailed Evaluation of Alternatives. Public Outreach was utilized throughout the process. These steps are summarized below:

1. ***Identification of Alternatives***. The Study Team developed an initial list of alternatives presented to the committees and the public for input. In total, 63 alternatives were identified through this process, including a No-Build Alternative. Alternatives included rehabilitation of both bridges as well as a range of low, mid and high-level replacement

options, both on and off the current bridge alignments. Alternatives also included such suggestions as a tunnel or a ferry service that would replace both bridges.

2. ***Fatal Flaw Analysis***. Using the jointly developed Study Purpose and Need statement as a guide, all alternatives identified above were qualitatively and quantitatively analyzed at a fatal flaw level to justifiably dismiss those conceptual alternatives that demonstrably:
    - Did not satisfy Study Purpose and Need;
    - Had significant environmental impacts;
    - Was not permittable;
    - Was not financially feasible;
    - Was not physically feasible; and/or
    - Was clearly inferior in comparison to other alternatives.

    Some alternatives dismissed during the Fatal Flaw Analysis may require additional evaluation during future NEPA documentation to comply with other federal requirements such as Section 404 of the Clean Water Act or Section 4(f) of the Department of Transportation Act of 1966, although a Preliminary Section 4(f) Least Harm analysis was completed during the Fatal Flaw Analysis.
3. ***Detailed Evaluation of Alternatives.*** All conceptual alternatives that passed the Fatal Flaw criteria were brought forward to be evaluated in greater detail. In this detailed evaluation, alternatives were analyzed with due consideration of the Study Area constraints and opportunities, transportation deficiencies, and applicable design guidelines and standards. Those alternatives that best met the Study's Purpose and Need and evaluation criteria developed from the Purpose and Need Statement are identified as Preferred Alternative(s) in this Study Report.

A continuous thread throughout the entire Study has been an extensive and ongoing Public Outreach process. The Connection Study Public Outreach process was designed to present an unbiased development of alternatives with no pre-determined outcomes, transparent decision-making and the maximum opportunity for feedback on all of the Study's data compilation, analysis, and conclusions in order to facilitate extensive discussion and documentation among the varied stakeholders. A list of Steering and Stakeholder Committee members can be found in Chapter 2. Identification of Alternatives (Step 1) and Fatal Flaw Analysis (Step 2) are further described in detail below as part of Chapter 4. The Detailed Evaluation of Alternatives (Step 3) is described in Chapter 8.

4.2. IDENTIFICATION OF FATAL FLAW ALTERNATIVES

This section describes the alternatives that were developed and evaluated for the Connections Study during the Fatal Flaw process. The term "alternative" was used in two ways:

1) To describe new Piscataqua River crossings between Kittery and Portsmouth that would not include the use of the existing two bridges other than to maintain rail use; or
2) To describe combinations of a Memorial Bridge and a Sarah Mildred Long Bridge option.

The term "option" was used to describe different improvement scenarios that were evaluated for each individual existing bridge, i.e. the Sarah Mildred Long Bridge and the Memorial Bridge. Alternatives considered included 1) the No-Build Alternative; 2) combinations of options with varying improvements to the Memorial Bridge and Sarah Mildred Long Bridge simultaneously; and, 3) new alternatives with new Piscataqua River crossings. All alternatives assumed that a rail line connection across the Piscataqua River, currently provided on the Sarah Mildred Long Bridge, would remain.

a. No Build Alternative

The No Build alternative assumed that no new construction would occur, and that the present level of maintenance of the two existing bridges and their approaches within the study area would continue. Given this, the No Build alternative assumed that by the Study's design year of 2035 the existing Memorial Bridge would not be available for use due to age and structural issues. It has been estimated that without improvements, the Memorial Bridge would likely have to be closed within 1 to 3 years. The Memorial Bridge was recently closed to vehicular traffic to make necessary structural repairs, and upon its reopening had been posted at a three-ton weight limit, effectively prohibiting all vehicles except automobiles and pickup trucks. The No-Build Alternative also assumes that the Sarah Mildred Long Bridge would remain open, but over time would require additional weight limit restrictions. It is currently posted at a 20-ton weight limit.

b. Memorial Bridge Options

Eight options were considered for addressing the Memorial Bridge (MB) needs. They included:

1. Option MB1 - Rehabilitation of the existing superstructure on existing alignment;
2. Option MB2 - Replacement of the superstructure on existing alignment with similar navigational clearances;
3. Option MB2A - Replacement of the lift bridge on new alignment either upstream or downstream with similar navigational clearances;
4. Option MB3 - Replacement of the lift bridge on existing alignment with a new mid-level bridge;
5. Option MB3A - Replacement of the lift bridge on new alignment either upstream or downstream with a new mid-level bridge;
6. Option MB4 - Replacement of the lift bridge on existing alignment with a new, fixed high-level bridge;
7. Option MB5 - Complete bridge removal; and
8. Option MB6 - Bridge replacement on existing alignment for bicycle/pedestrian use only.

c. Sarah Mildred Long Bridge Options

Seven options were considered for addressing the Sarah Mildred Long (SL) Bridge needs. They included:

1. Option SL1 - Rehabilitation of the existing structure on existing alignment;
2. Option SL2 - Replacement of the existing lift bridge on existing alignment with increased horizontal navigational clearances;

3. Option SL2A - Replacement of the lift bridge on new alignment upstream with increased horizontal navigational clearances;
4. Option SL3 - Replacement of the lift bridge on existing alignment with a new mid-level bridge;
5. Option SL3A - Replacement of the lift bridge on new alignment upstream with a new mid-level bridge;
6. Option SL4 - Replacement of the lift bridge on existing alignment with a new, fixed high-level bridge; and
7. Option SL5 - Close existing bridge to vehicular traffic, but keep rail portion of bridge.

All options assumed that rail service would remain – either on the existing Sarah Mildred Long Bridge or on a replacement Sarah Mildred Long Bridge. Downstream bridge replacement options were considered, but eliminated due to the proximity of the NH Port Authority dock facility and the ship turning basin within the river.

d. Combination Memorial Bridge/Sarah Mildred Long Bridge Alternatives

The eight Memorial Bridge options identified in Section "b" above were combined with the seven Sarah Mildred Long Bridge options identified in Section "c" above. These combinations created 56 individual alternatives to be considered and analyzed. In addition to these 56 combinations, two additional options were created. These two options would replace the existing Sarah Mildred Long Bridge with a new four-lane bridge (1 on existing alignment, 1 on an upstream alignment) with existing vertical clearances. These 58 alternatives are listed in Table 1 below.

e. New Alternatives

Four new alternatives that eliminated both the Memorial Bridge and Sarah Mildred Long Bridge and replaced them with a new infrastructure crossing (low/mid level bridge, high-level bridge, tunnel, and high speed ferry service) at a new location were also developed and analyzed for providing vehicular connections between the City of Portsmouth and the Town of Kittery. These four alternatives are also listed Table 4-1.

Table 4-1: Listing of the 63 Fatal Flaw Analysis Alternatives

Alternative Number	Alternative Description	Alternative Identification
1	Memorial Bridge closed and removed. Sarah Mildred Long Bridge remains open but with greater weight restriction.	No Build
2	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new high-level bridge.	NA1
3	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new low-level or mid-level bridge.	NA1A
4	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new tunnel under the river.	NA2
5	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and providing a high speed ferry service.	NA3
6	Rehabilitate both bridges on existing alignment with existing clearances.	MB1+SL1
7	Rehabilitate the Memorial Bridge on existing alignment and replace the Sarah Mildred Long Bridge superstructure on existing alignment. Both bridges would maintain existing clearances.	MB1+SL2
8	Rehabilitate the Memorial Bridge on existing alignment and replace the Sarah Mildred Long Bridge on new upstream alignment. Both bridges would maintain existing clearances.	MB1+SL2A
9	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB1+SL3
10	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB1+SL3A
11	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB1+SL4
12	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB1+SL5
13	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB2+SL1
14	Replace the Memorial Bridge and the Sarah Mildred Long Bridge superstructures on existing alignments with similar clearances.	MB2+SL2
15	Replace the Memorial Bridge superstructure on existing alignment and replace the Sarah Mildred Long Bridge on new upstream alignment. Both bridges would maintain similar clearances.	MB2+SL2A

16	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB2+SL3
17	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB2+SL3A
18	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB2+SL4
19	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB2+SL5
20	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB2A+SL1
21	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge superstructure on existing alignments with similar clearances.	MB2A+SL2
22	Replace the Memorial Bridge on new alignment either upstream or downstream and replace the Sarah Mildred Long Bridge on new upstream alignment. Both bridges would maintain similar clearances.	MB2A+SL2A
23	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB2A+SL3
24	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB2A+SL3A
25	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB2A+SL4
26	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB2A+SL5
27	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB3+SL1
28	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances.	MB3+SL2
29	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB3+SL2A

30	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB3+SL3
31	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB3+SL3A
32	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB3+SL4
33	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB3+SL5
34	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB3A+SL1
35	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignments with similar clearances.	MB3A+SL2
36	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB3A+SL2A
37	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB3A+SL3
38	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB3A+SL3A
39	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB3A+SL4
40	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB3A+SL5
41	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB4+SL1
42	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances.	MB4+SL2

43	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB4+SL2A
44	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB4+SL3
45	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB4+SL3A
46	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB4+SL4
47	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB4+SL5
48	Close Memorial Bridge to all traffic and remove. Rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB5+SL1
49	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (two-lanes).	MB5+SL2
50	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (four-lanes).	MB5+SL2
51	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge on new upstream alignment (four-lanes) with similar clearances.	MB5+SL2A
52	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (4-lanes) on existing alignment.	MB5+SL3
53	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (foour-lanes) on new upstream alignment.	MB5+SL3A
54	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a high-level fixed span bridge (four-lanes) on new alignment.	MB5+SL4
55	Close the Memorial Bridge to all traffic and remove. Close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB5+SL5
56	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB6+SL1
57	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (two-lanes).	MB6+SL2

58	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (four-lanes).	MB6+SL2
59	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge on new upstream alignment (four-lanes) with similar clearances.	MB6+SL2A
60	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on existing alignment.	MB6+SL3
61	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on new upstream alignment.	MB6+SL3A
62	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a high-level fixed span bridge (four-lanes) on new alignment.	MB6+SL4
63	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances and the close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB6+SL5

4.3. FATAL FLAW ANALYSIS PROCESS

This section provides an overview of the fatal flaw analysis process. This includes information regarding approach, methodology, and objectives of the fatal flaw analysis, as well as the evaluation criteria identified through joint collaboration with the Steering Committee, Stakeholder Committee and general public.

a. Approach, Methodology, and Objectives

The fatal flaw analysis was a qualitative and quantitative level analysis that resulted in a limited evaluation and screening process of the study alternatives and options. The limited evaluation and screening was undertaken in a progressive approach by evaluating the identified alternatives and options against small groups of evaluation criteria (see Section b below). These small groups of evaluation criteria were selected with the purpose of identifying those alternatives that were able to move forward to the next round or be eliminated from further consideration with proper documentation. This methodology for the fatal flaw analysis was reviewed and approved by MaineDOT and NH DOT.

The fatal flaw analysis was used to eliminate from the large number of alternatives those that demonstrably:

- Did not satisfy Study Purpose and Need;
- Had significant environmental impacts;

- Was not permittable;
- Was not financially feasible;
- Was not physically feasible; and
- Was clearly inferior in comparison to other alternatives.

The objective of the fatal flaw analysis was to screen all of the study alternatives to determine which alternatives would be dismissed from further consideration and which alternatives would be advanced into the final round of analysis. This final round of analysis would utilize the same evaluation criteria, but in a more detailed, quantitative versus qualitative assessment.

b. Evaluation Criteria

The evaluation criteria summarized below were developed in joint collaboration with the Steering Committee, the Stakeholder Committee, and the general public. These criteria were based upon the Study Purpose and Need (See Chapter 3).

The 15 evaluation criteria listed below were used to evaluate each of the study's 63 alternatives in the Fatal Flaw Report[6].

1. **Study Area Mobility and Accessibility:** Did the alternative provide adequate* Study Area mobility and accessibility as defined by the Study's Purpose and Need?
2. **Satisfy Structural Needs**: Did the alternative provide adequate* structural and functional life of Memorial and Sarah Mildred Long Bridges to 2060 or beyond?
3. **Lift Span Reliability:** Did the alternative provide adequate[7] lift span reliability to 2060 or beyond?
4. **Bridge Design Features/Vehicular Traffic:** Did the alternative provide adequate* bridge design features for vehicular (car and truck) traffic (lane width, shoulder width, etc)?
5. **Bridge Design Features/Marine Traffic:** Did the alternative provide adequate* bridge design features for marine traffic (clearance, bridge skew, etc.)?
6. **Bridge Design Features/Other Modes:** Did the alternative provide adequate* bridge design features for other modes (bicycle lanes, crosswalks, sidewalks, etc.)?
7. **Accessibility to Portsmouth, Kittery and Portsmouth Naval Shipyard (PNSY):** Did the alternative maintain or improve access to Portsmouth and Kittery downtowns and the PNSY?
8. **Rail Access to Portsmouth, Kittery and PNSY:** Did the alternative maintain the rail line though the City of Portsmouth across the Piscataqua River through the Town of Kittery and to the PNSY?
9. **Life Cycle Costs:** Estimated 100-year life cycle cost (in Present Value $) for each alternative were developed and were compared based on the range of costs for each alternative. No alternatives were eliminated in the Fatal Flaw Analysis based on cost.

[6] See Appendix 43

[7] *Adequacy related to the alternatives' compliance with federal and state design criteria.*

10. **Property/Neighborhood Impacts:** Estimated level of individual properties/ neighborhoods impacts for each alternative were developed and were compared based on range of impacts for each alternative.
11. **Natural Resource Impacts:** Estimated natural resource impacts for each alternative (in acres) were developed and were compared based on the range of impacts for each alternative.
12. **Physical Resource Impacts:** Estimated physical resource impacts for each alternative (in acres) were developed and were compared based on the range of impacts for each alternative. Physical resources include community and municipal facilities.
13. **Historic Resource Impacts:** Estimated level of historic properties/areas impacts by each alternative were developed and were compared based on the range of impacts for each alternative.
14. **Permittable:** Was the alternative considered permittable?
15. **Vehicle Miles Traveled (VMT)/Vehicle Hours Traveled (VHT)/Emissions:** Measure of VMT and VHT for each alternative as it related to vehicle emissions.

4.4. FATAL FLAW ANALYSIS RESULTS

The fatal flaw analysis went through three levels of screening for dismissing options/alternatives from further consideration.

ROUND 1 SCREENING: The goal of the Round 1 screening was to dismiss the options/alternatives that had the greatest impacts to the human environment as compared to other alternatives or did not meet study area mobility needs.

The Round 1 screening focused on the following six screening criteria:

1. Ability to satisfy the study purpose and need;
2. Ability to satisfy the regions mobility and accessibility needs from a traffic standpoint;
3. Historic resource impacts;[8]
4. Property and neighborhood impacts;
5. Physical resource impacts[9]; and
6. Natural resource impacts.

Thirty-four alternatives were dismissed from further consideration in the Round 1 screening analysis. These alternatives are listed below in Table 4-2.

Table 4-2: Listing of the 34 Alternatives Eliminated in Round 1

Alternative Number	Alternative Description	Alternative Identification
2	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new high-level bridge.	NA1

[8] Appendix #17 - Preliminary Impact Analysis. Summarizes physical and historic impacts conducted for each Bridge Option as part of the Fatal Flaw Analysis.

[9] Appendix #17 - Preliminary Impact Analysis. Summarizes physical and historic impacts conducted for each Bridge Option as part of the Fatal Flaw Analysis.

3	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new low-level or mid-level bridge.	NA1A
4	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and construction of a new tunnel under the river.	NA2
5	The elimination of all vehicular traffic from the Memorial and Sarah Mildred Long Bridges and providing a high speed ferry service.	NA3
12	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB1+SL5
19	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB2+SL5
26	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB2A+SL5
27	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB3+SL1
28	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances.	MB3+SL2
29	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB3+SL2A
30	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB3+SL3
31	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB3+SL3A
32	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB3+SL4
33	Replace the Memorial Bridge on existing alignment with a mid-level movable bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB3+SL5
34	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB3A+SL1

35	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignments with similar clearances.	MB3A+SL2
36	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB3A+SL2A
37	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB3A+SL3
38	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB3A+SL3A
39	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB3A+SL4
40	Replace the Memorial Bridge on new alignment either upstream or downstream with a mid-level movable bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB3A+SL5
41	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB4+SL1
42	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances.	MB4+SL2
43	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge on new upstream alignment with similar clearances.	MB4+SL2A
44	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB4+SL3
45	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB4+SL3A
46	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB4+SL4
47	Replace the Memorial Bridge on existing alignment with a high-level fixed span bridge and close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB4+SL5

48	Close Memorial Bridge to all traffic and remove. Rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB5+SL1
49	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (two-lanes).	MB5+SL2
55	Close the Memorial Bridge to all traffic and remove. Close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB5+SL5
56	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB6+SL1
57	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (two-lanes).	MB6+SL2
63	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances and the close Sarah Mildred Long Bridge to all traffic and remove deck. Rail portion of the Sarah Mildred Long Bridge would remain.	MB6+SL5

ROUND 2 SCREENING: The goal of the Round 2 screening was to dismiss the options/alternatives that had the greater impacts when compared to similar (like) options/alternatives.

The Round 2 screening focused on the following three screening criteria:

1. General ability to satisfy the study purpose and need;
2. Comparison to similar alternatives; and
3. Accessibility needs from a bicycle and pedestrian standpoint.

Fourteen alternatives were dismissed from further consideration in the Round 2 screening analysis. These alternatives are listed below in Table 4-3.

Table 4-3: Listing of the 14 Alternatives Eliminated in Round 2

Alternative Number	Alternative Description	Alternative Identification
11	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB1+SL4
18	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB2+SL4
20	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and rehabilitate the Sarah Mildred Long Bridge with existing clearances.	MB2A+SL1

21	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge superstructure on existing alignments with similar clearances.	MB2A+SL2
22	Replace the Memorial Bridge on new alignment either upstream or downstream and replace the Sarah Mildred Long Bridge on new upstream alignment. Both bridges would maintain similar clearances.	MB2A+SL2A
23	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB2A+SL3
24	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB2A+SL3A
25	Replace the Memorial Bridge on new alignment either upstream or downstream with similar clearances and replace the Sarah Mildred Long Bridge with a high-level fixed span bridge on new alignment.	MB2A+SL4
50	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge superstructure on existing alignment with similar clearances (four-lanes).	MB5+SL2
51	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge on new upstream alignment (four-lanes) with similar clearances.	MB5+SL2A
52	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on existing alignment.	MB5+SL3
53	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on new upstream alignment.	MB5+SL3A
54	Close Memorial Bridge to all traffic and remove. Replace the Sarah Mildred Long Bridge with a high-level fixed span bridge (four-lanes) on new alignment.	MB5+SL4
62	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a high-level fixed span bridge (four-lanes) on new alignment.	MB6+SL4

ROUND 3 SCREENING: The goal of the Round 3 screening was to dismiss the options/alternatives that had the greater impacts when compared to similar (like) options/alternatives.

The Round 3 screening focused on the following three screening criteria:

1. General ability to satisfy the study purpose and need;
2. Construction impacts of a mid level Sarah Mildred Long Bridge; and
3. Impact assessment to the Port of New Hampshire and nearby areas.

Six alternatives were dismissed from further consideration in the Round 3 screening analysis. These alternatives are listed below in Table 4-4.

Table 4-4: Listing of the 6 Alternatives Eliminated in Round 3

Alternative Number	Alternative Description	Alternative Identification
9	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB1+SL3
10	Rehabilitate the Memorial Bridge on existing alignment with existing clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB1+SL3A
16	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on existing alignment.	MB2+SL3
17	Replace the Memorial Bridge superstructure on existing alignment with similar clearances and replace the Sarah Mildred Long Bridge with a mid-level movable bridge on new upstream alignment.	MB2+SL3A
60	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on existing alignment.	MB6+SL3
61	Replace Memorial Bridge on existing alignment with a pedestrian and bicycle lift only bridge with similar clearances. Replace the Sarah Mildred Long Bridge with a mid-level movable bridge (four-lanes) on new upstream alignment.	MB6+SL3A

4.5. SUMMARY OF FATAL FLAW ANALYSIS

The Final Fatal Flaw Report[10] considered eight different Memorial Bridge Options with three of those options being carried forward for detailed evaluation, and considered seven different Sarah Mildred Long Bridge Options with three of those options being carried forward for detailed evaluation.

The Memorial Bridge Options being carried forward from the fatal flaw analysis included:

- **Option MB1**: Rehabilitate the existing bridge on existing alignment, including replacing the lift span, with existing clearances and reuse of the existing abutments and piers.
- **Option MB2**: Replace the superstructure of the existing bridge, including the lift span, with similar navigational clearances. Replace the existing abutments and reuse the existing piers.
- **Option MB6**: Similar to Option MB2 above, except that the replacement bridge would only accommodate bicycle and pedestrian traffic.

The Sarah Mildred Long Bridge Options being carried forward from the Fatal Flaw Analysis included:

[10] See Appendix 43

- **Option SL1**: Rehabilitate the existing bridge on existing alignment consists of complete demolition and replacement of the abutment, approach spans, piers and foundations and the rehabilitation of the fixed span trusses, towers, the lift span truss, and the associated foundations and rehabilitation of the rail component.
- **Option SL2**: Replace the existing bridge on existing alignment with a new two-lane or four-lane bridge, including the lift span and substructure, with improved horizontal navigational clearances; and, replace the rail component.
- **Options SL2A**: Replace the existing bridge with a new two-lane or four-lane bridge, including the lift span and rail line, on a new alignment immediately upstream with improved horizontal navigational clearances to improve marine vessel safety.

Options SL2 and SL2A each have two-lane and four-lane options that can be combined with two of the three MB options, resulting in 12 distinct alternatives, not including the No-Build Alternative.

Of the 63 alternatives evaluated in the Final Fatal Flaw Report[11], the following alternatives were recommended to be carried forward for detailed evaluation:

- **Alternative 1:** No Build Alternative (Memorial Bridge Closed, Sarah Mildred Long Bridge remains open with reduced posting).
- **Alternative 6:** Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Rehabilitated (MB1 + SL1).
- **Alternative 7:** Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment, two-lane (MB1 + SL2).
- **Alternative 7:** Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment, four-lane (MB1 + SL2).
- **Alternative 8:** Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment, two-lane (MB1 and SL2A).
- **Alternative 8:** Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment, four-lane (MB1 and SL2A).
- **Alternative 13:** Memorial Bridge Replacement, Sarah Mildred Long Bridge Rehabilitated (MB2 + SL1).
- **Alternative 14:** Memorial Bridge Replacement, Sarah Mildred Long Bridge Replaced on existing alignment, two-lane (MB2 + SL2).
- **Alternative 14:** Memorial Bridge Replacement, Sarah Mildred Long Bridge Replaced on existing alignment, four-lane (MB2 + SL2).
- **Alternative 15:** Memorial Bridge Replacement, Sarah Mildred Long Bridge Replaced on upstream alignment, two-lane (MB2 + SL2A).
- **Alternative 15:** Memorial Bridge Replacement, Sarah Mildred Long Bridge Replaced on upstream alignment, four-lane (MB2 + SL2A).
- **Alternative 58:** Memorial Bicycle/Pedestrian Bridge Replacement, Sarah Mildred Long Bridge Replaced on existing alignment, four-lane (MB6 + SL2).

[11] See Appendix 43

- **Alternative 59:** Memorial Bicycle/Pedestrian Bridge Replacement, Sarah Mildred Long Bridge Replaced on upstream alignment, four-lane (MB6 + SL2A).

At the conclusion of the Fatal Flaw Report, the alternatives (above) being carried forward for detailed evaluation were relabeled as follows:

- ***The No-Build Alternative*** = Memorial Bridge Closed, Sarah Mildred Long Bridge remains open with reduced posting (*Was Alternative 1*).
- ***Alternative 1*** = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Rehabilitated *(Was Alternative 6).*
- ***Alternative 2a*** = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment (two-lane) *(Was Alternative 7).*
- ***Alternative 2b*** = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane) *(Was Alternative 7.*
- ***Alternative 3a*** = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment (two-lane) (*Was Alternative 8).*
- ***Alternative 3b*** = Memorial Bridge Rehabilitated, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane) (*Was Alternative 8).*
- ***Alternative 4*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Rehabilitated *(Was Alternative 13).*
- ***Alternative 5a*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (two-lane) (*Was Alternative 14).*
- ***Alternative 5b*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane) (*Was Alternative 14).*
- ***Alternative 6a*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (two-lane) *(Was Alternative 15).*
- ***Alternative 6b*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane) *(Was Alternative 15).*
- ***Alternative 7*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane) *(Was Alternative 58).*
- ***Alternative 8*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane) (*Was Alternative 59).*

The No Build Alternative normally assumes that no new construction would occur, and that the present level of maintenance of the existing transportation system within the study area would continue. However, this No Build Alternative assumes that the existing Memorial Bridge would not be available for use due to structural issues. It has been estimated that without improvements, the Memorial Bridge would likely have to be closed within one to three years. The Memorial Bridge was closed to vehicular traffic in October of 2009 for approximately six weeks to make necessary structural repairs, and upon its reopening has been posted at a three-ton weight limit, effectively prohibiting all vehicles except automobiles and pickup trucks. The No-

Build Alternative also assumes that the Sarah Mildred Long Bridge would remain open, but would be posted weight limit restrictions. It is currently posted at a 20-ton weight limit.

In this report, the Memorial Bridge rehabilitation and replacement options would also include replacing both bridge abutments under both scenarios. The piers would not need replacement under either scenario.

Also in this report, the Sarah Mildred Long Bridge rehabilitation would consist of complete demolition and replacement of the abutment, approach spans, piers and foundations and the rehabilitation of the fixed span trusses, towers, the lift span truss, and the associated foundations and rehabilitation of the rail component. The only Sarah Mildred Long Bridge spans that would be rehabilitated under Alternatives 1 and 4 above would be the four existing fixed truss spans and the lift span.

4.6. SUPPLEMENTAL ALTERNATIVES (POST FATAL FLAW REPORT)

Subsequent to the completion of the Final Fatal Flaw Report, three additional alternatives were proposed by MaineDOT and were developed and evaluated in the same manner as the previous 63 alternatives that had been screened in the Final Fatal Flaw Report. These three additional alternatives were comprised of an additional Memorial Bridge Option, identified as MB7 and two additional Sarah Mildred Long Bridge Options, identified as SL2B (6 percent grade hybrid) and SL2C (5 percent grade hybrid).

These new options are described as follows:

- **Option MB7 (Transit Alternative):** Memorial Bridge would be closed and removed. The bridge between Kittery and Badgers Island would remain open. Bicycle and pedestrian river crossings on the Memorial Bridge would be replaced with a free bus transit system utilizing the Sarah Mildred Long Bridge that would operate seven days per week, 365 days per year from 5:00 AM to 11:00 PM.
- **Option SL2B and SL2C (Hybrid):** A new Sarah Mildred Long Hybrid Bridge would be constructed on new alignment immediately upstream with a two-lane mid level (86 foot± vertical clearance for SL2B in the closed position and 74 foot± vertical clearance for SL2C in the closed vehicle position) moveable span to reduce the number of openings, provide greater horizontal lift span opening to improve marine vessel passage (increase from 200 feet to approximately 270 feet), and increase bridge vehicle capacity. The existing Sarah Mildred Long Bridge would be closed and removed following construction of the new bridge. The new bridge would also provide for a new rail crossing. This option is being referred to as a hybrid lift span option in that the single moveable lift span deck would accommodate both vehicular and rail traffic, one mode at a time. This unique vertical lift span would be lowered from its mid-level vehicle traffic position to the low-level rail position to accommodate the rail traffic and raised to provide passage for tall marine vessels. The difference between SL2B and SL2C is based on meeting pedestrian accessibility requirements by using a lower percent approach grade (5 percent for SL2C vs. 6 percent for SL2B).

The new Memorial Bridge option and the two new Sarah Mildred Long Hybrid Bridge options created the three additional river crossing alternatives to be advanced for detailed analysis. The three additional alternatives are described as follows:

- ***Alternative 9*** = Memorial Bridge Replaced on existing alignment. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 6 percent road grade would be constructed on a new alignment immediately upstream with an 86-foot± vertical clearance moveable span (in the closed vehicle position) to reduce the number of lift openings and provide greater horizontal lift span opening (approximately 270 feet versus 200 feet) to improve marine vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB2 with Sarah Mildred Long Bridge Option SL2B.)
- ***Alternative 10*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 6 percent road grade would be constructed on a new alignment immediately upstream with an 86-foot± vertical clearance moveable span (in the closed vehicle position) to reduce the number of lift openings and provide greater horizontal lift span opening (approximately 270 feet versus 200 feet) to improve marine vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB6 with Sarah Mildred Long Bridge Option SL2B.)
- ***Alternative 11*** = Memorial Bridge would be closed and removed, with the bridge between Kittery and Badgers Island remaining open. A free bus transit system would operate seven days per week, 365 days per year from 5:00 AM to 11:00 PM for providing bicycle/pedestrian river crossing connections that were provided by the Memorial Bridge. A new two-lane "hybrid" mid-level Sarah Mildred Long Bridge with 5 percent road grade, adequate shoulders for bicyclists and a sidewalk for pedestrians would be constructed on a new alignment immediately upstream with a 74-foot± vertical clearance moveable span (in the closed vehicle position) to reduce the number of lift openings and provide greater horizontal lift span opening (approximately 270 feet versus 200 feet) to improve marine vessel passage. The new bridge would also provide for a new rail crossing. (Memorial Bridge Option MB7 with Sarah Mildred Long Bridge Option SL2C.)

Also subsequent to the completion of the Final Fatal Flaw Report, a detailed inspection report of the Memorial Bridge (See Appendix 48) provided the basis for NH DOT and MaineDOT determination that rehabilitation of the Memorial Bridge is not reasonable and viable due to its poor structural condition. This is discussed in further detail in Chapter 5. Based on this report, MaineDOT and NH DOT are recommending that all alternatives that include the rehabilitation of the Memorial Bridge be dismissed from further analysis, subject to review and approval of all documentation. This recommendation removes the five alternatives (Alternatives 1, 2a, 2b, 3a, and 3b) that include the Memorial Bridge rehabilitation option from detailed evaluation as a part of this report.

This resulted in the following alternatives being carried forward for further evaluation in this report:

- ***The No-Build Alternative*** = Memorial Bridge Closed, Sarah Mildred Long Bridge remains open with reduced posting.
- ***Alternative 4*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Rehabilitated.
- ***Alternative 5a*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (two-lane).
- ***Alternative 5b*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane).
- ***Alternative 6a*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (two-lane).
- ***Alternative 6b*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane).
- ***Alternative 7*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on existing alignment (four-lane).
- ***Alternative 8*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment (four-lane).
- ***Alternative 9*** = Memorial Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment with two-lane hybrid bridge with 6 percent road grade.
- ***Alternative 10*** = Memorial Bicycle/Pedestrian Bridge Replaced on existing alignment, Sarah Mildred Long Bridge Replaced on upstream alignment with two-lane hybrid bridge with 6 percent road grade.
- ***Alternative 11*** = Memorial Bridge would be closed and removed and replaced with a free bus transit system operating seven days per week, 365 days per year from 5:00 AM to 11:00 PM for providing bicycle/pedestrian river crossing connections that were provided by the Memorial Bridge. Sarah Mildred Long Bridge Replaced on upstream alignment with two-lane hybrid bridge with 5 percent road grade, adequate shoulders for bicyclists and a sidewalk for pedestrians.

5.0: Bridge Inspection Summary

5.1. MEMORIAL BRIDGE

The following conditions overview of the Memorial Bridge was based on the in-depth and interim structural inspections and load rating performed by HDR. This section addressed only the three truss spans of the Memorial Bridge that span over the Piscataqua River; the Kittery Approach spans are not included. The purpose of this overview was to summarize reasons why the Memorial Bridge Rehabilitation was dismissed from further consideration based on the results of the 2009 Bridge Inspection Report and 2010 Bridge Condition Summary Report. Appendix 46 contains the full Memorial Bridge Condition Summary Memorandum. Appendix 48 contains a web link to the full Memorial Bridge Inspection Report.

INTRODUCTION

In May and June of 2009, HDR Engineering, Inc. (HDR) and Hoyle Tanner and Associates, Inc. (Hoyle, Tanner) performed an in-depth inspection of the Memorial Bridge for the NH DOT and MaineDOT. The inspection results were used to perform a load rating (November, 2009) for the existing structure in its as-built and as-inspected condition, and planning level cost estimates for rehabilitation of the Memorial Bridge as part of the Bridge Inspection and Cost Analysis (BICA) study. Subsequently, at the request of the NH DOT and MaineDOT, HDR performed an interim structural inspection, in May 2010, on all primary truss members that rated at or below HS10 according to the Bridge Rating Report submitted in November 2009. The HS designation is an approximation of a vehicle weight/configuration used to simulate the greatest stresses caused by actual trucks on the bridge.

BRIDGE DESCRIPTION

The Memorial Bridge carries U.S. Route 1 over the Piscataqua River between Portsmouth, New Hampshire and Kittery, Maine. The structure is located in a tidal area where the water elevation typically has an eight to twelve foot variation between high and low tide. The span-drive vertical lift bridge was built in 1922 and consists of three truss spans and ten approach spans. The truss spans are two Pratt-type, camelback, steel fixed through-trusses and a Pratt-type, straight back, steel center lift through-truss. The total length of the three truss spans is 900 feet. The approach spans, referred to as the Kittery Approach, are comprised of ten multi-stringer and floor beam approach spans on the north side of the structure; but are not included as part of this condition summary. The Scott Avenue Bridge spans in Portsmouth, NH are also not included as part of this condition summary.

The lift span has an open steel grating deck and all other spans have a reinforced concrete deck. The roadway decks are supported by steel purlins. The sidewalk decks are comprised of timber planks supported by steel stringers. The truss spans, including the vertical lift towers, are supported by reinforced concrete piers with granite facades.

IN-DEPTH INSPECTION (June 2009)

Inspection Methods

Several inspection access methods were utilized to perform the in-depth inspection of the Memorial Bridge.

The truss span bottom chords, bottom gusset plates and the floor system (comprised of the bottom side of the deck as well as the floorbeams, stringers, bottom lateral bracing, stringer bracing, purlins and all their connections) were inspected utilizing a bucket boat. The bucket boat is a custom designed and constructed craft consisting of a 30 foot by 15 foot boat with pontoons and a 60 foot hydraulic bucket. The truss span diagonals, verticals, top chords and towers were inspected by industrial rope access. Structure climbing and the use of the vertical lift truss were used to access the top of the towers. The truss span piers were inspected utilizing a bucket boat, as well as underwater diving.

Bridge Condition

Table 5-1 on the following page summarizes the Memorial Bridge conditions as part of the June 2009 Inspection.

Bridge Structure Summary

The in-depth inspection performed by HDR and Hoyle, Tanner in May and June of 2009 recommended that the bridge posting be lowered to 10 tons due to the further deterioration found in the structural members since the previous inspection and load rating performed in 2003. At the time of the inspection, the Memorial Bridge was posted for 15 tons. After the gusset plate load rating was finalized, the load rating analysis determined that emergency repair of one gusset plate was required. The bridge was closed for the emergency repair of the gusset plate in October-November 2009; and then a three-ton load restriction was posted for the entire bridge when it was reopened.

TABLE 5-1
MEMORIAL BRIDGE - 2009 CONDITIONS SUMMARY TABLE

(June 2009 Inspection)					
Inspected Elements	**Condition Rating**				
	Serious	**Poor**	**Fair**	**Satisfactory**	**Good**
Overall Deck (including concrete and open steel structural deck)		✔			
Wearing Surface			✔		
Deck Joints			✔		
Sidewalks			✔		
Bridge Rail		✔			
Drainage			✔		
Overall Superstructure	✔				
Purlins			✔		
Stringers	✔				
Floorbeams	✔				
Truss Members		✔			
Towers		✔			
Tower Gusset Plates requiring attention	✔				
Bearings		✔			
Connections and Plates	✔				
Bracing	✔				
Overall Substructure			✔		

INTERIM STRUCTURAL INSPECTION (May 2010)

Inspection Methods

At the request of the NH DOT and the MaineDOT, HDR performed an interim structural inspection, in May 2010, on all primary truss members that rated at or below HS10 according to the Bridge Rating Report submitted in November 2009.

It was found that five floor beams and twenty gusset plates rated at or below HS10. Therefore, the May 2010 Interim Structural Inspection focused on these critical elements:

- 5 floor beams in Span 2 (lift span)
- 8 gusset plates in Span 1 (Portsmouth side of lift span)
- 6 gusset plates in Span 2 (lift span)
- 6 gusset plates in Span 3 (Kittery side of lift span)

Therefore, the scope of the interim inspection was limited to the five floor beams and twenty gusset plates listed above. The May 2010 inspection results were compared to those found during the 2009 inspection to ascertain the extent that deterioration had progressed. During the interim structural inspection, HDR found that deterioration on several members had continued to progress, and new areas of deterioration were found. Rope access methods were utilized to gain access to the underside of the roadway deck, allowing inspectors better access to the top of the roadway stringers. This gained access, not afforded by the original bucket boat methods, allowed inspectors to discover three new corrosion holes on the floor beam webs, above the roadway stringer connections.

Bridge Condition

Table 5-2 summarizes the Memorial Bridge conditions as part of the May 2010 Inspection.

TABLE 5-2
MEMORIAL BRIDGE - 2010 CONDITIONS SUMMARY TABLE

(May 2010 Interim Inspection)					
Inspected Elements (limited to those members identified above that had rated previously below HS10)	**Condition Rating**				
	Serious	**Poor**	**Fair**	**Satisfactory**	**Good**
Overall Superstructure	✔				
Floorbeams and	✔				
Connections and Plates (Gusset Plates)		✔			

MEMORIAL BRIDGE INSPECTION RECOMMENDATIONS

In the one-year period since the baseline in-depth inspection (June 2009), deterioration has continued to measurably advance on multiple members, and would continue to do so. Since the progress of deterioration in the structural members varies from member to member, depending on member locations and their physical conditions; HDR recommends that the scope of each future interim inspection be expanded to cover more members. HDR recommends that the Memorial Bridge continues to be inspected in six month intervals; and, ***given the evidence of increased deterioration of floor beams, HDR recommends that all members that were found to have a load rating below HS15 be inspected in the next interim inspection.***

A check was performed on the load rating of the members, based on the condition documented from the interim inspection (May 2010). Despite the advancement in section loss on the members inspected, ***the structure's current posting of three tons is still sufficient***. While several gusset plates have seen advancement in section loss, the increased deterioration does not occur in areas of the plates which govern their current capacities.

MEMORIAL BRIDGE: GENERAL COMMENTS

Based on the inspection report and the load rating analysis, there are a number of areas of concern that cannot be adequately remedied with the rehabilitation of the bridge in its current "Serious" state. These items are as follows:

- The deterioration of the truss bottom chords, gusset plates and associated roadway deck structure are attributable to the original design details and location of the truss panel points with respect to the roadway and the pedestrian walkway. The truss chord panel points are located in areas that are subject to frequent application of deicing agents which have had a direct impact on the poor condition of the joints. In addition, the areas which are comprised of complex "built–up" sections are extremely difficult to access for routine maintenance, cleaning and painting. Even with rigorous and frequent maintenance, it is likely that these areas would still experience accelerated deterioration as compared to the rest of the structure.
- In addition to the detailing issues as described above, the rehabilitated structure with the built-up members maintains the "miles" of seams between plates and angles, and approximately 240,000 rivets that would provide avenues for similar deterioration patterns. Because of these details, it is difficult to clean the steel 100 percent due to access constraints; which then provides the potential "seed" for continued deterioration. By maintaining the same details, and not updating/improving the connections, the bridge would experience a similar pattern of deterioration.
- The overall "Serious" rating of the bridge introduces a higher level of uncertainty for the contractor when bidding on the project. Considering the current "Serious" condition of many of the structural members, and the documented continued advancement of deterioration, the true extent of deterioration is difficult to ascertain. The contractor would only know the true level of deterioration once the debris, paint and any temporary repairs are removed. This uncertainty could increase the contractors bid as well as

increasing the risk for potentially costly change orders during the course of the rehabilitation contract.

- The bottom chords represent a potential fatal flaw issue for rehabilitation. Given the deterioration noted at the bottom chord truss panel points, virtually all of the bottom chords are future candidates for replacement. In order to replace a bottom chord, the truss would need to be temporarily supported to bring the chord to a "no load" condition and removal of the stress from the chord being replaced. Providing temporary support to put even a single bottom chord into a "no load" condition involves installation of an extensive temporary structure. This process is time consuming and expensive. There are a total of 20 bottom chords per truss or 40 bottom chords (fixed truss spans) that would have to be considered for replacement. The schedule and related cost would likely be prohibitive.
- This approach is also problematic from a structural perspective. Even with putting the bottom chord into a "no load" condition for replacement of the chord, there would be a certain degree of unknown stress redistribution into the structure when the new, unloaded, member is loaded by removal of the temporary supports. This could result in redistributed stress patterns that are not fully known, once the bridge is again "loaded". This redistribution of stresses is compounded by the potential need to replace up to 20 bottom truss chord members per approach truss and is therefore not recommended.

Under any rehabilitation scenario, the Memorial Bridge would require substantially more maintenance and subsequent partial and full rehabilitations over the same life cycle period as a similar "new" replacement structure. A "new" replacement structure would have superior serviceability and operational reliability; and finally, a new replacement structure would be less expensive to construct and maintain over the design lifetime of the structure.

Bridges are routinely rehabilitated to increase their useful life; however, given the "Serious" condition rating that was based on the observed extent of deterioration of the structure and the structure details, inaccessible built up sections, and major structural elements and joints in areas subject to frequent application of deicing agents, the existing Memorial Bridge is not a viable candidate for rehabilitation.

At the request of the State DOT's, FHWA provided their perspective on the viability of the Memorial Bridge Rehabilitation option. FHWA indicated that based upon the results of the 2009 Bridge Inspection data and subsequent Consultant and State DOT bridge engineering expert recommendations, they concurred that the major rehabilitation of the Memorial Bridge did not appear to be a practical alternative which warranted further detailed consideration. The Study information indicates that the rehabilitation alternative would provide a much reduced service life at significantly higher operational and maintenance costs and therefore, not in the public interest to warrant further consideration. The FHWA further indicated that although the Memorial Bridge Rehabilitation option is not recommended for further detailed consideration, the rehabilitation must be considered as part of the NEPA and associated Section 106/Section 4(f) analysis process associated with the bridge. The Connections Study information will

provide the necessary documentation and rationale as to why any such Section 106 or Section 4(f) avoidance and/or minimization alternatives considered were determined impractical to implement.

Based on the above data and bridge condition overview and associated documents, the Memorial Bridge Rehabilitation option was dismissed from further consideration.

5.2. SARAH MILDRED LONG BRIDGE

INTRODUCTION

In May and June of 2009, HDR and Hoyle, Tanner performed an in-depth inspection of the Sarah Mildred Long Bridge for the NH DOT and MaineDOT. The inspection results were used to perform a load rating (December, 2009) for the existing structure in its as-built and as-inspected condition, as part of the Bridge Inspection and Cost Analysis (BICA) study.

The approach spans consist of a fifteen-span girder structure on the New Hampshire approach (Spans 1-15), and the seven-span girder structure on the Maine approach (Spans 21 – 27). Based upon the results of the in-depth inspection and subsequent load rating analysis, it is understood that the approach spans control the overall load rating for the bridge, and it is therefore assumed that the abutments and approach spans would be replaced under all alternatives. The rehabilitation option for the Sarah Mildred Long Bridge consists of replacing the abutments and all approach piers and spans and rehabilitating the five existing truss spans.

BRIDGE DESCRIPTION

The Sarah Mildred Long Bridge carries the U.S. Route 1 Bypass over the Piscataqua River between Portsmouth, New Hampshire and Kittery, Maine. The Sarah Mildred Long Bridge also carries the Pan-Am Railways line over the Piscataqua River and connects to the Portsmouth Naval Shipyard. The structure is located in a tidal area where water elevation typically has an eight to twelve foot variation between high and low tide. The tower-driven vertical lift bridge was built in 1940. The five main truss spans carry both highway and rail traffic and consist of four fixed spans and one movable lift span; comprised of riveted steel, straight-back, warren-type truss spans. The roadway approach spans are comprised of built-up riveted deck girders and floor beams, as well as rolled I-shaped and C-shaped stringers. The railroad approach spans consist of three deck girder spans on the south approach, as well as two fixed deck girder spans and a retractable deck girder span on the north approach. The roadway and access walk decks are composed of reinforced concrete. The truss spans are supported by reinforced concrete piers with granite facades. The approach spans are supported by reinforced concrete piers and abutments, and steel pier bents.

IN-DEPTH INSPECTION (June 2009)

Inspection Methods

Several inspection access methods were utilized to perform the in-depth inspection of the Sarah Mildred Long Bridge. The fascia side of the trusses, the fascia side gusset plates, the overhang and floor beam support brackets and the bottom deck (railroad) floor system were inspected

utilizing a bucket boat. The bucket boat is a custom designed and constructed craft consisting of a 30 foot by 15 foot boat with pontoons and a 60 foot bucket.

The interior face of the trusses and the underside of the roadway deck were inspected utilizing a UB-30 hi-rail vehicle operating from the railroad deck. The towers were inspected by industrial rope access. Structure climbing and the vertical lift truss span were used to access the top of the towers. The truss span piers were inspected utilizing a bucket boat, as well as underwater diving.

Bridge Condition

The inspection found the overall condition of the superstructure to be "Serious", the overall condition of the substructure to be "Serious" and the overall condition of the deck to be "Poor", as documented in the inspection report. Per National Bridge Inspection Standard (NBIS) guidelines, one overall condition rating is assigned to the entire structure, as was done in the Inspection Report. For purposes of this study, condition rating assessments are provided for the Truss Spans and Approach Spans separately, in order to provide a more accurate description of

TABLE 5-3
SARAH MILDRED LONG BRIDGE APPROACH SPANS
2009 CONDITION SUMMARY TABLE

(June 2009 Inspection)					
Approach Spans **Inspected Elements**	**Condition Rating**				
	Serious	**Poor**	**Fair**	**Satisfactory**	**Good**
Deck		✔			
Wearing Surface		✔			
Deck Joints			✔		
Sidewalks		✔			
Bridge Rail	✔				
Drainage		✔			
Superstructure	✔				
Highway Stringers	✔				
Highway Girders				✔	
Railroad Girders			✔		
Highway Floorbeams	✔				
Bearings			✔		
Connections and Plates			✔		
Substructure	✔				

the structure condition for the approach spans and for the truss spans. In addition, since the approach spans superstructure, abutments and piers are to be replaced under all options, subsequent discussion after the following summary tables focuses on addressing the truss spans.

Table 5-3 summarizes the Sarah Mildred Long Bridge Approach Spans Conditions and Table 5-4 summarizes the Sarah Mildred Long Truss Spans Conditions as found during the 2009 June inspection.

TABLE 5-4
SARAH MILDRED LONG BRIDGE TRUSS SPANS
2009 CONDITION SUMMARY TABLE

(June 2009 Inspection)					
Truss Spans **Inspected Elements**	**Condition Rating**				
	Serious	**Poor**	**Fair**	**Satisfactory**	**Good**
Deck		✔			
Wearing Surface		✔			
Deck Joints			✔		
Sidewalks		✔			
Bridge Rail	✔				
Drainage		✔			
Superstructure			✔		
Stringers			✔		
Floorbeams			✔		
Truss Members			✔		
Bearings			✔		
Connections and Plates			✔		
Substructure			✔		

GENERAL CONDITION COMMENTS

Superstructure

The concept plan for the rehabilitation of the Sarah Mildred Long Bridge consists of complete demolition and replacement of the abutments, approach spans, piers and foundations, superstructure and the rehabilitation of the fixed span trusses, towers, the lift span truss, and the associated foundations.

The overall superstructure condition rating of the structure was "Serious", as indicated in the condition report, is governed by the approach spans (See Appendix 48). The general condition

of the truss spans and towers is "Fair". The lift span electrical and mechanical systems were recently updated and are in good working order.

The In-Depth Inspection, Conditions Report, and its appendices (see Appendix 48 for the website to access the full Sarah Mildred Long Bridge Inspection Report) fully documents areas with deterioration and defects. Appendix B of Appendix 48, with photos, isolated areas on the trusses where deterioration is more severe, such as Photo II-32 (Truss Span 5, Vertical Member). These areas are not indicative of the overall superstructure condition, unless specifically noted as a typical condition. The tables in Appendix C of Appendix 48 thoroughly document the condition of each truss member.

More typically, deterioration of truss members consists of either surface rust or laminar corrosion limited to areas near the interface with batten or gusset plates, which has caused prying of the plates in many instances. The areas of laminar corrosion are generally localized to small portions of the member. As part of the rating analysis, HDR applied documented section losses from the inspection when rating the superstructure members.

The design of the Sarah Mildred Long Bridge has the roadway on top of the fixed and movable trusses and the corrosive deicing agents are confined within the roadway and removed and isolated from the structure below at the scupper drain locations. The design of the roadway joints on the trusses included the use of a drainage trough under the joint that routed contaminated materials that may have seeped through joints away from the structural support steel. This good detailing practice contributed to the observed "Fair" condition of the roadway beams and stringers.

The approach structures, on the other hand, employ a deck joint design that does not include the trough as part of the deck joint. As a result, contaminated runoff from the roadbed that seeped through the joint was a major factor in the observed severe deterioration of the support steel as well as the concrete piers below. This resulted in an overall rating of "Serious" for the approach structures on either side of the truss superstructure.

The rehabilitation option assumes the abutments and all approach spans, piers, foundations and superstructure are to be demolished and replaced. This removal and replacement work represents 60% of the structure by length. The approach structures would be replaced using construction materials and methods currently in use by both NH DOT and MaineDOT.

Substructure

The overall substructure condition rating was "Satisfactory". Concrete cores were taken from the tower piers below the low water line and evaluated using petrographic analysis. The petrographic analysis of the cores was used as a basis for estimating remaining life using numerical simulations and showed that without significant rehabilitation, concrete outside of the tidal zone would have an expected useful life over 50 years. Visual inspection of the cores found no corrosion of the steel reinforcement. The assessment also reported that, while elevated chloride levels were detected as much as 10 inches from the face of concrete, the lack of free

oxygen within the concrete has prevented this condition from corroding the steel reinforcement for the concrete located below the splash line.

Concrete within the tidal zone is exposed to a more corrosive environment as well as freeze/thaw cycles and requires rehabilitation. Visual inspection indicated that the condition of the concrete and steel reinforcement in this area likely could be rehabilitated with standard construction practices to provide an expected life of at least 50 years.

A lump sum cost allocation has been made in the Life Cycle Cost Analysis to account for a major bridge rehabilitation at year 50 (See Appendix 30 for Life Cycle Cost Analysis information).

Based on the inspection of the piers performed in July 2009, Piers 15 through 20, those that support the Truss Spans, could potentially be rehabilitated. Deterioration found on the piers above the water line, such as cracking, erosion and spalls could also likely be repaired by traditional rehabilitation techniques. No critical problems, such as settlement, were found at these piers.

For more information regarding the condition of the piers, refer to the full *In-Depth Inspection and Condition Report for the Sarah Mildred Long Bridge*, Volumes 1 and 2 of 2. See Appendix 48 for website to access the full report.

LOAD RATING SUMMARY

It is assumed that the approach spans superstructure, as well as the approach spans piers, abutments and foundations of the Sarah Mildred Long Bridge would be replaced and the truss spans would be rehabilitated. Therefore, this load rating summary is specific to the truss spans only.

A load rating of a bridge structure pertains to the analysis of a structure in order to compute the maximum allowable loads that can be carried across a bridge safely over time.

The members of the truss spans were rated for both the American Association of State Highway and Transportation Officials (AASHTO) highway HS loading and the American Railway Engineering and Maintenance-of-Way Association (AREMA) Cooper E80 loading. The HS Loading is a scalable load, with HS20 used as the statutory limit for purposes of summarizing the load rating, as prescribed by AASHTO for the load rating of structures. Currently, the NH DOT and MaineDOT require that new structures be designed for HS25 loading. Information regarding members which do not meet requirements for HS25 loading is provided in the next section.

The HS20 loading designation refers to a hypothetical design vehicle for a truck loading, with a specific gross vehicle weight (pounds) and axle spacing, as outlined in AASHTO. An HS25 loading accounts for higher loading conditions, which represents a 25 percent increase in loading over the standard HS20 truck and a greater gross weight.

The Cooper E80 loading is recommended for design and analysis by AREMA. In addition, stringers supporting the railroad floor system at the towers were checked for capacity of the M130 military train loading at the request of the NH DOT and MaineDOT. The M130 railcar is a specialized transport railcar with a total maximum weight of 205 tons. One theoretical locomotive of the Cooper E80 loading weighs 284 tons. Since the Cooper E80 axle loads are higher, and the Cooper E80 axle spacing is closer than that of the M130 loading, the Cooper E80 loading will govern any analysis for train loads.

The Cooper E80 loading designation refers to a recommended train load (locomotive) in pounds per axle and uniform trailing load (remaining train cars), as outlined in AREMA. The Cooper E80 Loading also considers the design train to be traveling at 60 miles per hour (mph). This high speed accounts for high impact loading. If a structure does not rate for E80 at the recommended speed, the Cooper E80 rating may still be attained through the reduction of the recommended design speed by use of specific formulas from the AREMA Guidelines. Finally, an M130 train loading is a specific combination of axle spacings and loadings that pertain to the trains currently using the Sarah Mildred Long Bridge today.

The Sarah Mildred Long Bridge was designed for H20 highway loading and Cooper E72 Railway loading standards.

The following rating summary provides a response for specific requested rating categories/summaries for the truss spans:

Highway Load Rating:

- Members with load ratings below HS20
- Members with load ratings above HS20 but below HS25

Railroad Load Rating:

- Truss members with load ratings below E80
- Tower stringer and floor beam (governing location) load ratings for an M130 train.

Highway Load Rating

The highway load rating was performed with an assumption that the lower railroad deck is loaded simultaneously with an AREMA Cooper E80 train at full speed (60 mph), with full impact (standard recommended practice according to AREMA). The AASHTO Load Factored Method was used for the rating.

1) **Members with Load Ratings below HS20:**
    - All truss members and gusset plates have as-built (member structural properties in the new, as-built, condition) and as-inspected (member structural properties accounting for the deterioration outlined from the inspection) load ratings above HS20, except one (out of 90) vertical truss member, which has an as-inspected rating of HS15.0, on the west truss of Span 2. However, with the E-80 Cooper train speed reduced to 10 mph, the current speed at which trains travel on the bridge, the vertical truss member rated above HS20 for the as-inspected condition.

This member would require reinforcement to bring its capacity over HS20 with trains traveling at full speed.

2) **Members with Load Ratings above HS20 but below HS25:**
   - As-Built Condition: The truss members and gusset plates that have as-built load ratings above HS20 but below HS25 are:
     - Four (out of 80) Top Chord Truss Members
     - Twelve (out of 180) Truss Gusset Plates
     - All Roadway Stringers
     - All Roadway Floorbeams
   - As-Inspected Condition: The truss members and gusset plates that have as-inspected load ratings above HS20 but below HS25 are:
     - Four (out of 80) Top Chord Truss Members
     - Twelve (out of 180) Truss Gusset Plates
     - All Roadway Stringers
     - All Roadway Floorbeams

The remaining truss members and gusset plates have as-built and as-inspected load ratings ***above HS25.***

Railroad Load Rating

The railroad load rating was performed to truss members with an assumption that the AREMA Cooper E80 loading was at full speed (60 mph) on the lower deck and the upper roadway deck is loaded simultaneously with HS20 loading, the statutory loading required by AASHTO for load rating of bridges. The AREMA Allowable Stress Method was used for the rating.

1) **Truss Members with Ratings below E80:**
   - As-Built Condition: The truss members that have as-built load ratings below E80 are:
     - Four (out of 80) Top Chord Truss Members
   - As-Inspected Condition: The truss members that have as-inspected load ratings below E80 are:
     - Four (out of 80) Top Chord Truss Members
     - Three (out of 80) Diagonal Truss Members

Under current practices the train speed is 10 mph. At this speed reduction, all members except two Top Chord members in Span 2 (one on East Truss, one on West Truss) and two Top Chord members in Span 4 (one on East Truss, one on West Truss) have ratings above E80.

The Top Chord member on Span 2, East and West Trusses, and Top Chord member on Span 4, East and West Trusses, do not rate because of the way in which they were originally modeled in LARSA (the structural computer software used during the analysis). During the first round of the analysis, the towers were not included as part of the structural model and the end joint of these top chords were modeled as pinned connections, because of their

connection to the tower. However, there are no signs of overstress on these members. Further analysis modeling the actual stiffness of the towers may yield that the as-inspected ratings for these members, with the reduced speed of 10 mph, would be above E80. If this is not found to be the case, these members would require reinforcement.

The four Top Chord truss members and three Diagonal truss members that do not meet statutory loading requirements will require rehabilitation to accommodate faster than 10 mph train speeds, if required in the future.

2) **Tower Stringer and Floorbeam Load Ratings for Cooper E80 and M130 trains:**
The railroad stringers and floorbeams at the two towers were rated for both the AREMA Cooper E80 and an M130 train for as-inspected conditions. The load ratings, controlled by a stringer in the South Tower, are as follows:
    - Cooper E80 Loading – E56.8
    - M130 Loading – Rating Factor = 0.62 (225.2 kip out of a 410 kip vehicle)
    - A speed reduction to 15mph is required for the stringer to rate for E80.
    - A speed reduction to 25mph is required for the stringer to rate for M130.

    If faster train speeds are required in the future, then the railroad stringers and floorbeams at the two towers would require reinforcement.

It should be noted that there are also speed constraints caused by the geometry of the track on the north and south sides of the bridge structure; as well as the Class designation of the track, according to the U.S. Department of Transportation (USDOT), Federal Railroad Administration (FRA) – Office of Safety, Code of Federal Regulations. To the north, there is a 7.5-degree horizontal curve, and to the south there is a 6.0-degree horizontal curve; and this rail line is designated as a Class 2 track. According to the Code of Federal Regulations, Track Safety Standards Part 213; the maximum allowable operating speed for freight trains, Class 2 track, is 25 mph. Class 2 passenger trains can travel at 30 mph. However, with the governing approach horizontal curve of 7.5-degree, the maximum allowable curving speed is 24 mph (Elevation of outer rail = 0 inches).

Load Rating Analysis Assumptions

The above ratings are based on combined highway and railroad loadings on the bridge structure, which is standard load rating procedure. The current practice is to close the bridge to highway traffic when there is a train movement over the bridge due to the restrictions surrounding the type of cargo that the train transports. Therefore, it is reasonable to project that the above load ratings would increase if only one loading condition (either highway or railroad loadings) was applied at a time.

The current load rating analysis includes the State of New Hampshire and State of Maine Maximum Certified Vehicle Weights for single unit vehicles and combination vehicles. The maximum weight for the combination vehicles category is 99,000 pounds (lbs). NH DOT has developed a Legal Load Equivalents table for Ordinary Legal Loads and Certified Vehicles

(Single Unit and Combination Units); all equivalents are in HS tons. The HS tons are converted based on the longitudinal effective span lengths of each member and the load rating is included in the Bridge Capacity Summary, Form 4, of the Load Rating Report prepared by HDR.

For truss members with longitudinal effective span lengths of 224-feet, the required capacity for supporting the 99,000 lb combination vehicle is HS20.5. As outlined in this section, only one truss member would rate below HS20.5; but rates under current practices of reducing the train speed to 10 mph. Given the current prohibition to simultaneous movements of both vehicles and trains, the bridge can accommodate the 99,000 lb vehicle.

As a result of the in-depth inspection and the subsequent load rating analysis, the truss spans of the Sarah Mildred Long Bridge can carry an HS20 loading and the State of New Hampshire and State of Maine Maximum Certified Vehicle 99,000 lbs combination vehicle loading under current train speeds. This analysis was based on combined highway and railroad loadings on the bridge structure, which is standard load rating procedure. Some members, as previously listed, will require rehabilitation to support HS20 and HS25 truck loading if trains are to travel at full speed in the future.

Impacts to Railroad and Marine Operations during Rehabilitation of the Sarah Mildred Long Bridge

A significant portion of the Sarah Mildred Long Bridge rehabilitation work is related to the demolition and reconstruction of the approach spans which are highway focused and largely independent of railroad and marine operations. The rail operations are generally confined to the truss spans of the structure. Thus, the demolition and reconstruction of the approach spans is not dictating that the rail portion of the structure be closed for the full two to three year construction period. Marine traffic can be accommodated by keeping the lift span in a raised position, until critical electrical and mechanical activities need to get underway. Highway access would not be possible during the rehabilitation.

The rehabilitation of the Sarah Mildred Long Bridge would require multiple independent construction activities including demolition, excavation, concrete foundation, pier and deck construction, steel repair and replacement, approach roadway construction, electrical mechanical upgrades and painting. Depending on contractor methods and schedules, some of these activities might possibly be isolated to specific areas of the structure and would not all occur at one time or at the same location, the work would have to be well-coordinated between PNSY, Pan Am Railways, the contractor, NH DOT and MaineDOT and sequenced accordingly. The need to sequence these activities provides opportunities to maintain full time marine access and intermittent rail traffic to and from the PNSY.

Since the trains run infrequently over the truss structure, many phases of the rehabilitation of the truss spans, deck replacement, repair and replacement of structural steel, electrical and mechanical upgrades, cleaning and painting of the trusses, etc, could be sequenced in a manner that supports periodic train traffic. There would be periods of time where the bridge would not be available to rail traffic, but careful staging of construction and communication with PNSY can

minimize interruption. Please note that the majority of railroad movable bridge rehabilitation projects routinely completed around the country are performed under live traffic or with very short duration closure windows available to the contractors for critical construction activities. It is therefore a common practice to sequence rehabilitation of movable structures to maintain some minimum level of desired functionality.

CONCLUSION

Based on the bridge inspections and load ratings performed during 2009 and 2010, the overall condition rating of the superstructure is "Serious" and the overall condition rating of the substructure is also "Serious". The overall condition rating includes both the approach spans and truss spans. Under rehabilitation the approach spans would be replaced and only the truss spans would remain, which have a superstructure and substructure condition rating of "Fair". Refer to the Life Cycle Cost Analysis (Appendix 30) for costs associated with rehabilitation of the structure.

The load rating analysis accounted for the current deteriorated condition of the bridge structure. Future section loss and related deterioration can be mitigated with application and maintenance of paint and sealer. Proper and frequent maintenance of the coating system is vital to minimize further deterioration of the structure. The Life Cycle Cost Analysis identifies a cost to be incurred every 5 years which accounts for this maintenance (See Appendix 30 for the Life Cycle Cost Analysis).

Members listed in this section that do not rate for HS25 design criteria, would require reinforcement under rehabilitation. Since the deck would be replaced under the rehabilitation option, access to these members would be straight forward for purposes of rehabilitation or reconstruction. Portions of the substructure located within the tidal zone would also require partial depth rehabilitation of the concrete.

Finally, because the overall (approach spans and truss spans) condition rating of the Sarah Mildred Long Bridge is "Serious", as documented in the Bridge Inspection Report in accordance with National Bridge Inspection Standards guidelines for condition rating structures, MaineDOT and the NH DOT have also requested that the FHWA consider whether rehabilitation is a reasonable and viable alternative.

6.0. Evaluation and Analysis Tasks

This chapter provides an overview of the evaluation and analysis tasks conducted for each alternative carried forward from the Fatal Flaw Analysis. These tasks produced data and information used to identify the benefits and impacts of the No-Build Alternative and each proposed Build Alternative. The following provides a brief description of each task. Relevant graphics, technical memoranda, and technical reports associated with these tasks are referenced and summarized at the end of each task description.

6.1. ENGINEERING ANALYSIS

This section documents the assumptions and design criteria used to develop horizontal and vertical alignments for each of the build alternatives. The design criteria included identification of appropriate design guidelines, regulations, and criteria relative to horizontal geometry, vertical geometry, number of travel lanes, lane width, shoulder width, marine vessel clearances, and bicycle and pedestrian facilities (i.e. sidewalks and shoulders). Conceptual plans, profiles, and cross sections were developed as part of this task and were utilized to perform other relevant evaluation and analysis tasks. A key assumption in the engineering analysis was that any new bridge or bridges constructed would be required to last 100 years given proper maintenance and should provide the bridge structure the ability to accommodate the expected traffic and marine vessel growth in the region over the next 25 years.

Publications referenced in developing these criteria are AASHTO‘s ―A Policy on Geometric Design of Highways and Streets”, Maine DOT‘s ―Highway Design Guide”, and New Hampshire DOT‘s ―Highway Design Manual”. The following summarizes the criteria used for the Maine-New Hampshire Connections Study.

Design Options

Horizontal and vertical alignments developed were used to create option ―footprints” used to quantify resource impacts and provide a basis for developing planning level cost estimates. Downstream alignments for Sarah Mildred Long Bridge Options were not investigated since accommodating the rail for the downstream alignment created more ROW impacts than the upstream alignment, as well as impacting the USCG identified 1000‘ turning basin immediately downstream of the Sarah Mildred Long Bridge.

Topographic Information

Aerial photos and Geographic Information System (GIS) data were used to develop horizontal and vertical alignments. The City of Portsmouth, NH provided GIS data including contours at one interval. For Kittery, ME, the Maine Office of GIS provided GIS files which included 20 foot contours.

Roadway Classification

Both NH DOT and MaineDOT classify the U.S. Route 1 Bypass as a Principle Arterial. U.S. Route 1 is a Principle Arterial in Maine and a Minor Arterial in New Hampshire. Neither was

identified as being part of the National Highway System (NHS). Route 103 in Kittery, Maine from the Portsmouth Naval Shipyard to U.S. Route 1 and U.S. Route 1 from Route 103 to the Kittery Rotary are on the Strategic Highway Network (StraHNet).

Speed

The Design Speed was assumed to be 35 mph for all alternatives.

Vertical Grade

The maximum vertical grade for highway alignments was assumed to be 6 percent. Maximum grade for pedestrians was 5 percent. Maximum vertical grade for rail alignments was assumed to be 1 percent.

Moveable Bridge Type

Three moveable bridge types were considered for the low and mid level bridges: lift, bascule, and swing. Because of the large horizontal clearances to be maintained, the lift bridge was assumed to be the most efficient using a through truss to maximize vertical clearances over the river.

Roadway and Rail Clearances

The roadway and rail clearances assumed for the bridge alternatives are noted below:

Roadway	16‘-6” (over arterial)
	15‘-6” (over collector & local road)
Rail	22‘-6”

Bicycle/Pedestrian Widths

The bicycle/pedestrian widths assumed for the new bridge alternatives are noted below:
(The rehabilitated bridge options may not be able to provide the minimum bicycle/pedestrian widths noted below.)

Bicycle	5‘-0” roadway shoulder minimum width (with guardrail or vertical curb)
Pedestrian	5‘-0” wide sidewalk (minimum width)

Marine Vessel Clearances

The existing vertical and horizontal clearances for the bridges over the Piscataqua River were noted in Appendix 3. Maximum vertical and horizontal marine vessel clearances used in designing the replaced bridge alternatives are noted below:

Memorial Bridge:	Horizontal – 260 feet (same as existing)
	Vertical – 150 feet (same as existing)
Sarah Mildred Long Bridge:	Horizontal – 270 feet[12]
	Vertical – 135 feet (same as existing)

[12] Horizontal width based upon current Panamax vessel dimensions (750’ length, 108’ beam, 135’ air draft) with harbor pilot vessel on either side and current 30 +/-degree bridge skew to river channel.

Additional information regarding Engineering Analysis and associated findings can be found in the following documents included with this Study Report:

- ***Appendix #3 – Navigational Needs of the Piscataqua River***
- ***Appendix#53 – Engineering Design Criteria Memorandum***

6.2. MARINE NAVIGATION EVALUATION

This section summarizes the findings of the marine navigation evaluation performed for the Study, which included an identification of the existing horizontal and vertical clearances of the three bridges, and summary and evaluation of bridge lift data.

6.2.1 Existing Clearances and Frequency of Lifts

Table 6-1 provides the clearances for the three lower Piscataqua River bridges as identified on the National Oceanic and Atmospheric Administration (NOAA) Chart 13283, 20th Edition. The vertical clearance is the distance between mean high water and the underside of the bridge. The Memorial and Sarah Mildred Long Bridges have lift spans that provide additional vertical clearance when opened. The Sarah Mildred Long Bridge also provides a retractable span for the lower rail level that is not in the main ship channel but in shallower water close to the Kittery shore. The I-95 High Level Bridge is fixed providing a 135 foot vertical clearance.

Table 6-1
Bridge Horizontal and Vertical Clearances

Bridge		Horizontal	Vertical	
			Open	Closed
Memorial Bridge		260 feet	150 feet	19 feet
Sarah Mildred Long Bridge	Lift	200 feet	135 feet	10 feet
	Retractable Span	70 feet	36 feet	10 feet
I-95 High Level Bridge		440 feet	135 feet fixed	

Source: NOAA Chart 13283

Generally, the lift spans in the main channel are opened upon the vessel‘s signal except for recreational and small commercial vessels which during certain time periods (May 15th – October 31st) must wait for a lift that occurs twice an hour or pass under with a vessel that is not required to wait.

6.2.2 Analysis of Bridge Lift Records

The New Hampshire Department of Transportation (NH DOT) has provided a copy of the log books for the lift spans of Sarah Mildred Long and Memorial Bridges. HNTB entered a portion of the 2008 records into a database to analyze data such as number of lifts by month, height of lifts, number of passing under vessels, and time span for the bridge lift.

Table 6-2 provides a breakdown of lifts for each bridge by month for 2008 based upon the log books for the Sarah Mildred Long and Memorial Bridges as provided by NH DOT. Lifts in

which a vessel did not pass underneath but had a purpose such as testing, maintenance, and training have been separated. Note that the total number of lifts for the Memorial Bridge is approximately 900 greater than for the Sarah Mildred Long Bridge. This is due to commercial vessels originating or stopping at either the Port of Portsmouth or day excursion vessels operating from docks in the City of Portsmouth located between these two bridges. In 2008, the retractable rail span was open all winter (typically closed) and this helped reduce the number of lifts and accounted for some of the 900 lift difference between the Memorial and Sarah Mildred Long Bridges.

Table 6-2
Number of Lifts for 2008

Month	Sarah Mildred Long Bridge		Memorial Bridge	
	Lift for Vessel to Pass Under	Lift for Testing, Maintenance, Training, etc.	Lift for Vessel to Pass Under	Lift for Testing, Maintenance, Training, etc.
January	239	3	271	7
February	189	15	216	16
March	182	51	189	15
April	231	29	179	46
May	258	29	297	9
June	232	79	451	23
July	274	52	525	5
August	248	46	488	3
September	226	70	427	3
October	196	82	357	3
November	137	17	246	4
December	225	68	234	9
Subtotal	**2637**	**541**	**3880**	**143**
Total	**3178**		**4023**	

Figures 6-1 and 6-2 provide a summary of the lift height for both bridges. The lifts for testing, maintenance, and training have been excluded. These charts show the number of lifts for ranges of lift heights along with a cumulative total of the number of lifts. More than a third of the lifts for the Sarah Mildred Long Bridge are between 46 feet and 50 feet high. For the Memorial Bridge, more than a third of the lifts are between 36 feet and 40 feet high. This difference in range of heights can be attributed to the Memorial Bridge having a ~~–c~~losed" clearance nine feet higher than the Sarah Mildred Long Bridge.

Figure 6-1: Height of Lifts

Sarah Mildred Long Bridge

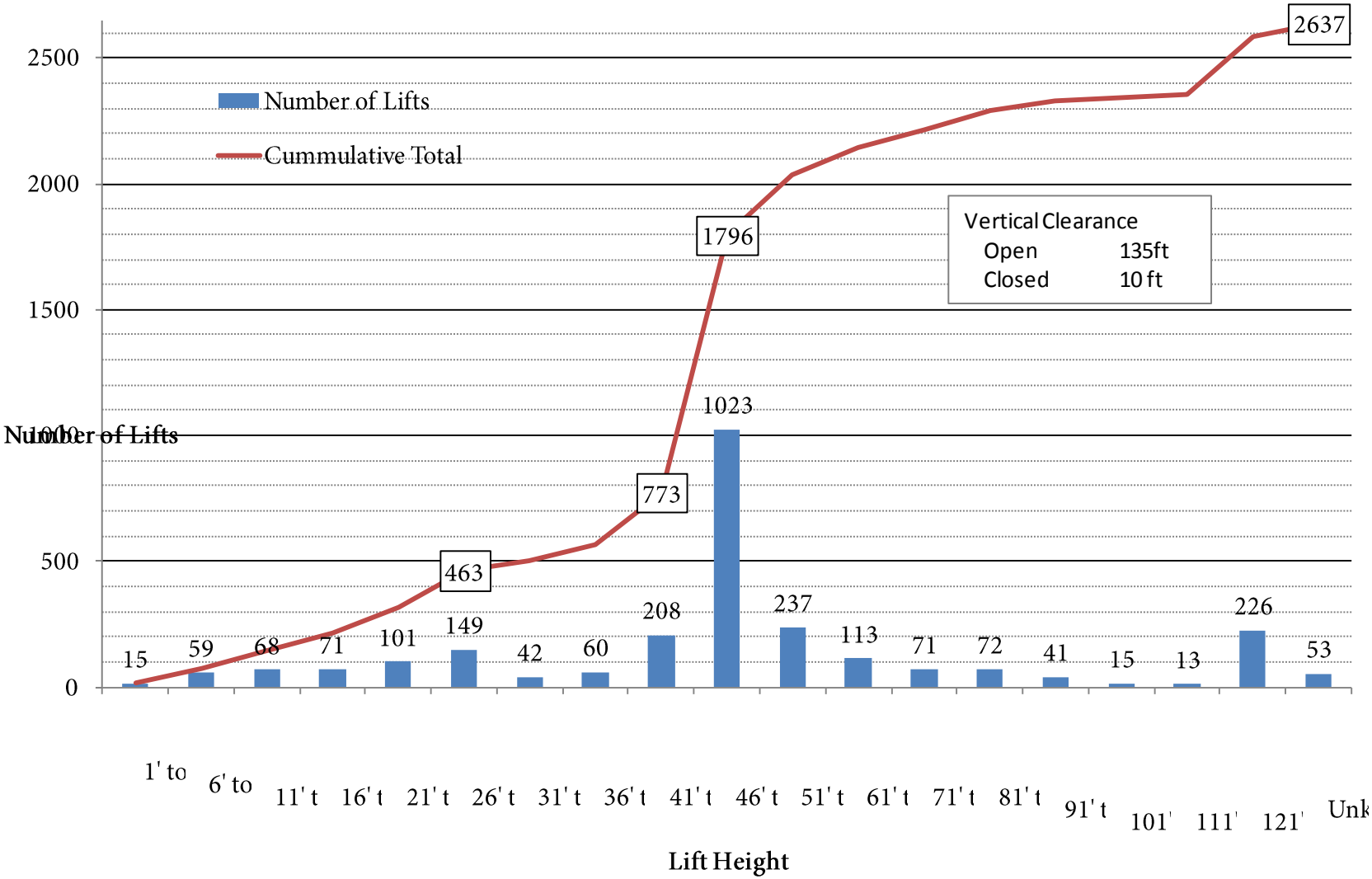
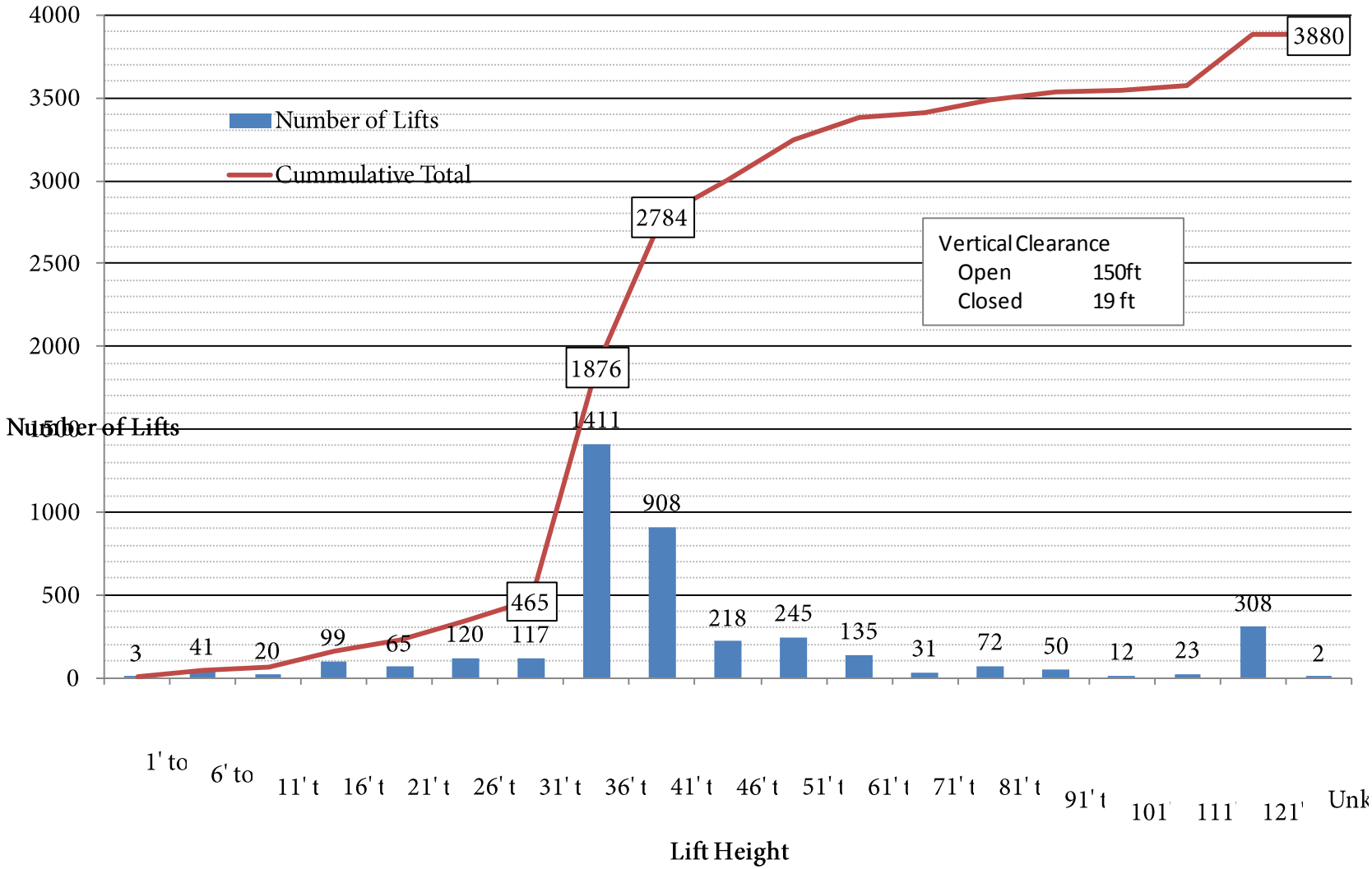


Figure 6-2: Height of Lifts
Memorial Bridge



The lift logs of the bridges provided the "Time Span Open" and "Time Span Closed" and the bridges take one to two minutes for the bridge to lift up or down depending on the height of the bridge lift. To calculate the length of the roadway closure, three minutes were added to the difference of "Time Span Open" and "Time Span Closed". The average closure time for the roadways on the Sarah Mildred Long and Memorial Bridges are 9.5 and 8.9 minutes respectively. Most (79 percent for Sarah Mildred Long Bridge and 85 percent for Memorial Bridge) of the lifts closed the road for seven to ten minutes.

Additionally, bridge lift data was evaluated during traffic peak hour (3:45 to 4:45 PM) for the month of July 2008 for the Sarah Mildred Long and Memorial Bridges. This data was relevant to determine how much vehicular bridge capacity is affected during peak traffic times.

Additional information regarding the Marine Vessel Evaluation and associated findings can be found in the following documents included with this Study Report:

- **Appendix #3 – Navigational Needs of the Piscataqua River**
- **Appendix #45 – Bridge Capacity Analysis Summary Report**

6.3. CRASH EVALUATION

The section identifies locations within the Study Area where a higher number of crashes were reported. The data analyzed was provided by the Maine Department of Transportation: Traffic Engineering, Crash Records Section and the New Hampshire Department of Transportation. The three year crash analysis period was January 2005 to December 2007.

MaineDOT and NH DOT record all reported crashes in which there is property damage in excess of $1000 or in which there has been personal injury. Crash reports received by MaineDOT are assigned to a corresponding node or element established as part of MaineDOT's crash records system. The NH DOT organized data by recording crash locations as an intersection or a roadway link with exact location denoted by distance and direction from the nearest intersection.

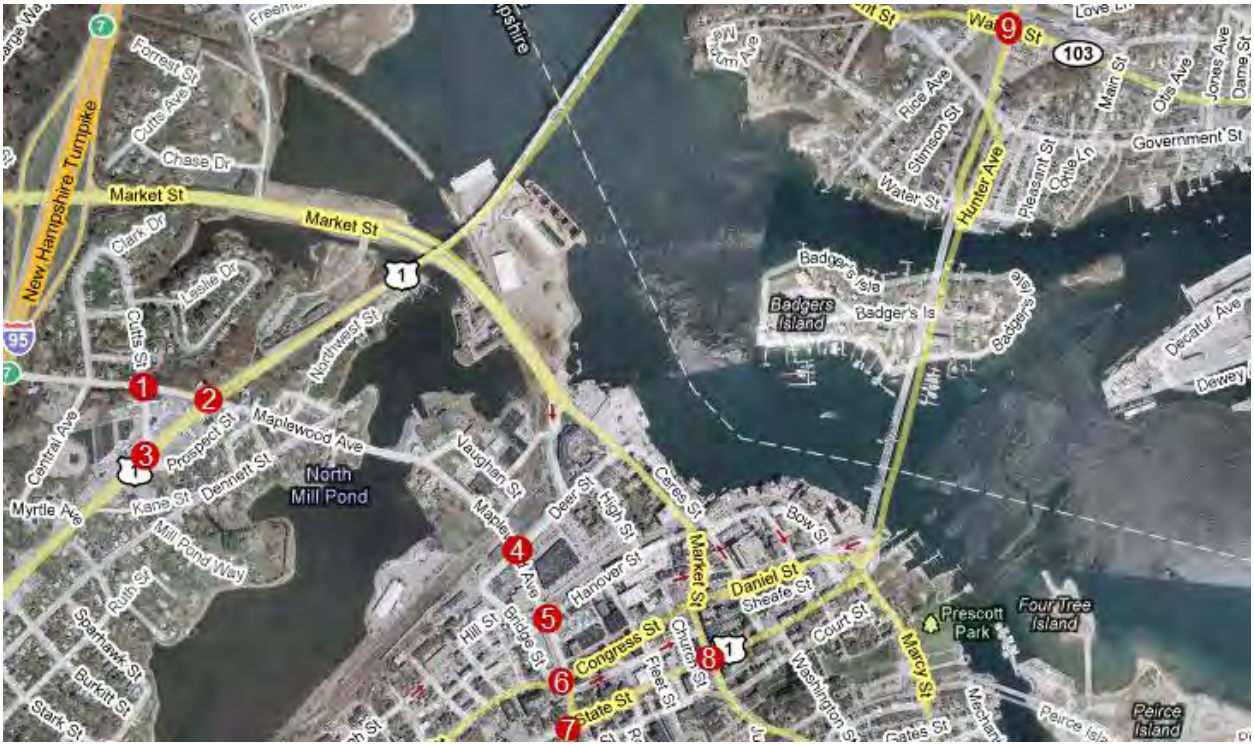
In Maine, if a particular node or element meets certain criteria, then the MaineDOT classifies particular nodes or elements as a high-crash location (HCL). These criteria are:

- The link or node must have eight or more reported crashes over a three year period, and,
- The link or node must have a "critical rate factor" (CRF) over 1.00. (The critical rate factor relates the crash rate at a particular link or node to the statewide crash rate average for a similar type of facility).

Since CRF values are not calculated for locations in New Hampshire, comparable high crash locations (HCLs) between the two states could not be identified. As such, locations of high safety concern were based upon intersection or roadway sections with eight or more reported crashes over the three year crash analysis period identified.

Using these parameters, one (1) location in Kittery and eight (8) locations in Portsmouth were identified as locations for high safety concern. All nine locations are illustrated in Figure 6-3.

Figure 6-3
Locations of High Safety Concern



Remedial action was recommended for each location and summarized in ***Appendix #2 – Crash Data Compilation and Summary*** found in this Study Report.

6.4. ORIGIN AND DESTINATION ANALYSIS

This section summarizes the methodology and results of the origin and destination (O&D) surveys conducted for the study.

6.4.1: Vehicle Origin and Destination Survey

A vehicle O&D survey was conducted on the Memorial Bridge and the Sarah Mildred Long Bridge. The survey was performed on Tuesday, May 19, 2009, between the hours of 3:00 pm and 6:00 pm. Based on historic data provided by MaineDOT and NH DOT, this is the busiest period during the weekday for both bridges. Both northbound and southbound traffic was interviewed.

The purpose of the survey was threefold:

1. To understand key characteristics of the users of the two bridges;
2. To compare and contrast the types of trips served by each bridge; and,
3. To provide baseline data to be incorporated into the travel demand model developed for the study.

Approximately 380 surveys were required to be recorded at each bridge in order to achieve statistical validity[9]. A total of 640 vehicles were surveyed on the Memorial Bridge, while another 652 were surveyed on the Sarah Mildred Long Bridge. Table 6-3 provides a detailed summary of the survey sample.

Table 6-3
Interview Sample Summary

Bridge	*Surveyed Vehicles*	*Total Vehicles*	*% Vehicles Surveyed*
Memorial - NB	327	1,119	29.2%
Memorial - SB	313	1,073	29.2%
Sarah Mildred Long - NB	324	1,562	20.7%
Sarah Mildred Long - SB	328	1,747	18.8%
Combined	**1,292**	**5,501**	**23.5%**

Survey data was entered and summarized into two categories — one summarizing the characteristics of the *vehicles* using each bridge, and the other summarizing the characteristics of the *trips* over each bridge. Results of the vehicle O&D survey for key characteristics are shown below.

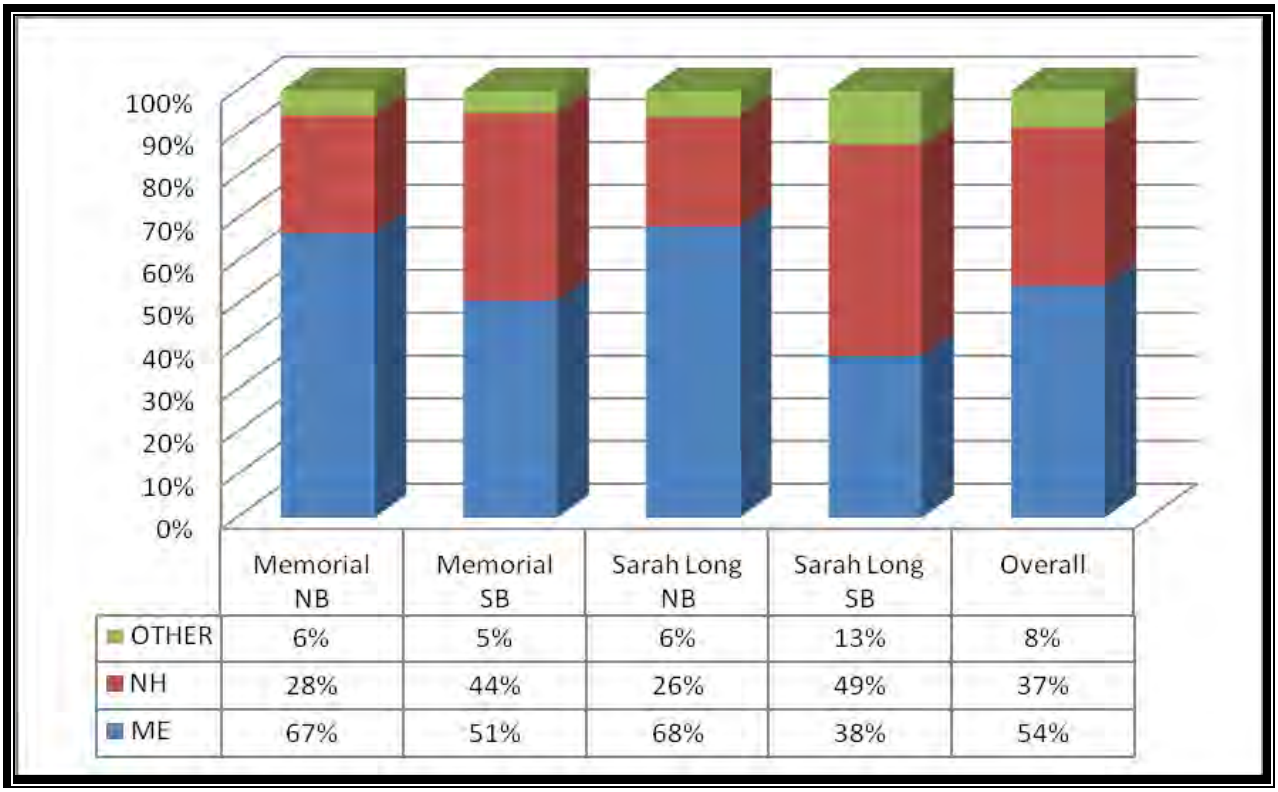
State of registration. Surveyors observed the license plate and noted the state in which the vehicle was registered. The state of registration was assigned to one of the following three categories:

- Maine,
- New Hampshire, and
- Other (For all vehicles registered outside of Maine and New Hampshire).

Figure 6-4 provides a summary of the responses.

[9] Approximately 380 surveys were needed to achieve a confidence level of 95 percent, with a confidence interval of ±5 percent.

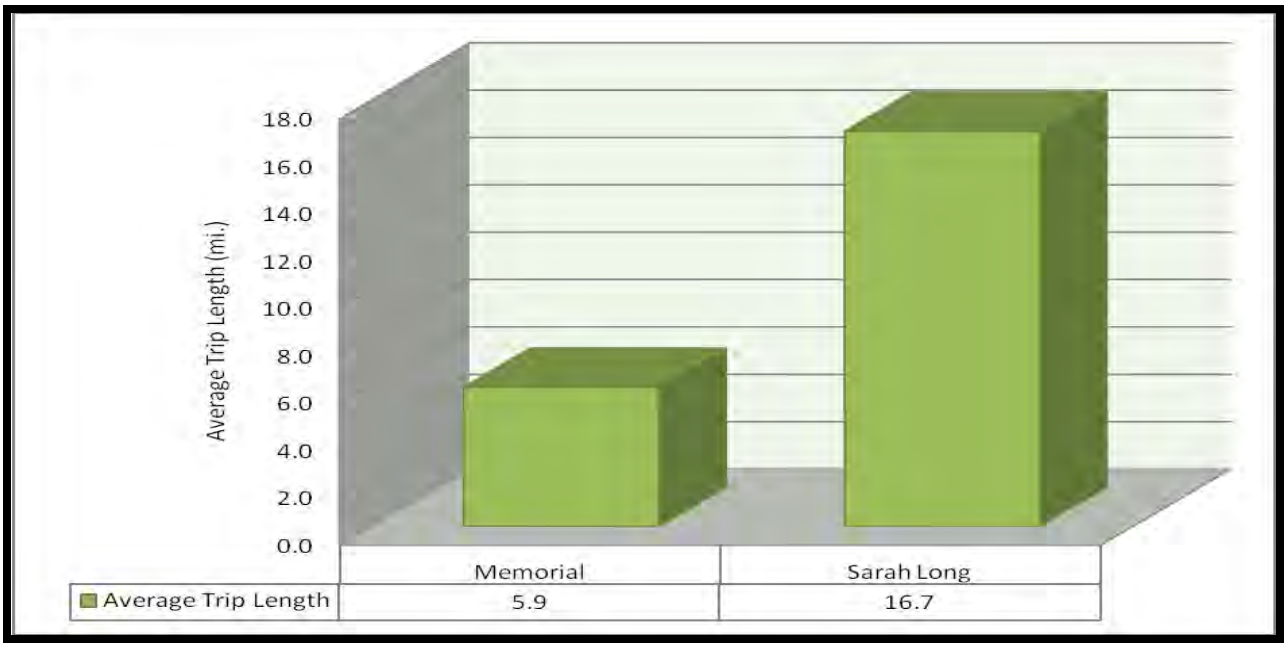
Figure 6-4: State of Registration Summary



	Memorial NB	Memorial SB	Sarah Long NB	Sarah Long SB	Overall
OTHER	6%	5%	6%	13%	8%
NH	28%	44%	26%	49%	37%
ME	67%	51%	68%	38%	54%

Trip Lengths. Trip lengths, from origin to destination, were calculated for each survey. The average trip length based on this data and the number of sampled surveys was then calculated. The results are shown in Figure 6-5.

Figure 6-5: Average Trip Length, by Bridge



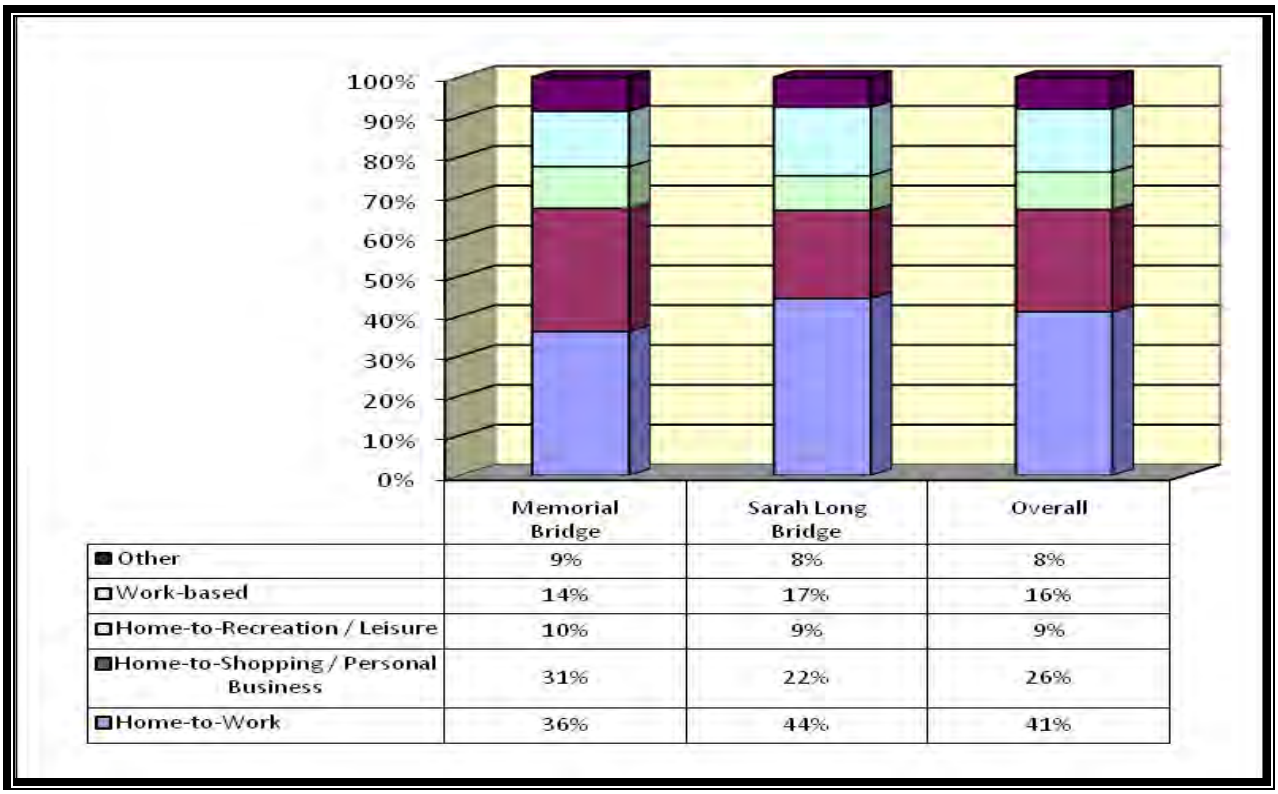
	Memorial	Sarah Long
Average Trip Length	5.9	16.7

Trip Purpose. Each driver that participated in the survey was asked for the start point of the trip (the *origin*) and the end point of the trip (the *destination*). The driver was further asked to identify the ―location type" of the origin and destination. Seven options were provided for the ―location type" category: (1) home, (2) work, (3) store/shopping, (4) personal business, (5) recreation, (6) leisure, and (7) other. The location types for each trip's origin and destination were then paired to generate a ―trip purpose". All trip purposes were subsequently placed into one of the following 5 categories:

- **Home-to-Work**. These are trips between home and work, in either direction.
- **Home-to-Shopping/Personal Business**. These are trips between a driver's home and a place identified as either ―shopping" or ―personal business".
- **Home-to-Leisure/Recreation.** These are trips between home and a place identified as either ―leisure" or ―recreation".
- **Work-based.** These are all trips (other than ―home-to-work" trips) that have ―work" as either the origin or destination.
- **Other.** These encompass all types of trips not included in one of the 4 categories noted above. Examples would include ―shopping-to-recreation" or ―home-to-other".

Figure 6-6 provides an overview of the trip purpose data provided by the survey respondents.

Figure 6-6
Trip Purpose by Bridge



	Memorial Bridge	Sarah Long Bridge	Overall
Other	9%	8%	8%
Work-based	14%	17%	16%
Home-to-Recreation / Leisure	10%	9%	9%
Home-to-Shopping / Personal Business	31%	22%	26%
Home-to-Work	36%	44%	41%

All vehicle O&D data was used to help calibrate the travel demand model, which is described in greater detail in Section 6.5. Additional information regarding the vehicle Origin and Destination Analysis and associated findings can be found in the following document included with this Study Report:

- **Appendix #41 – Connections Origin-Destination Survey, Summary Report**

6.4.2: Bicycle and Pedestrian Origin and Destination Survey

A bicycle and pedestrian origin and destination (O&D) survey was conducted in July 2009 on the Memorial Bridge only. Similar to the vehicle O&D survey, the purpose of the survey was to gain a better understanding of the key characteristics of the bicycle and pedestrian users of the bridge and to support the calibration of the travel demand model.

The O&D survey was conducted on two days—Thursday, 16 July 2009, and Saturday, 18 July 2009. These days were chosen in order to observe any fluctuation in pedestrian and cyclist patterns between weekdays and weekends. Each survey was conducted from 11am to 2pm and from 3pm to 6pm. Interviewers requested pedestrians and cyclists to stop by word of mouth, as well as by holding signs that stated ‗Bicycle Survey, Please Stop'.

The survey was designed to gather the following seven pieces of information:

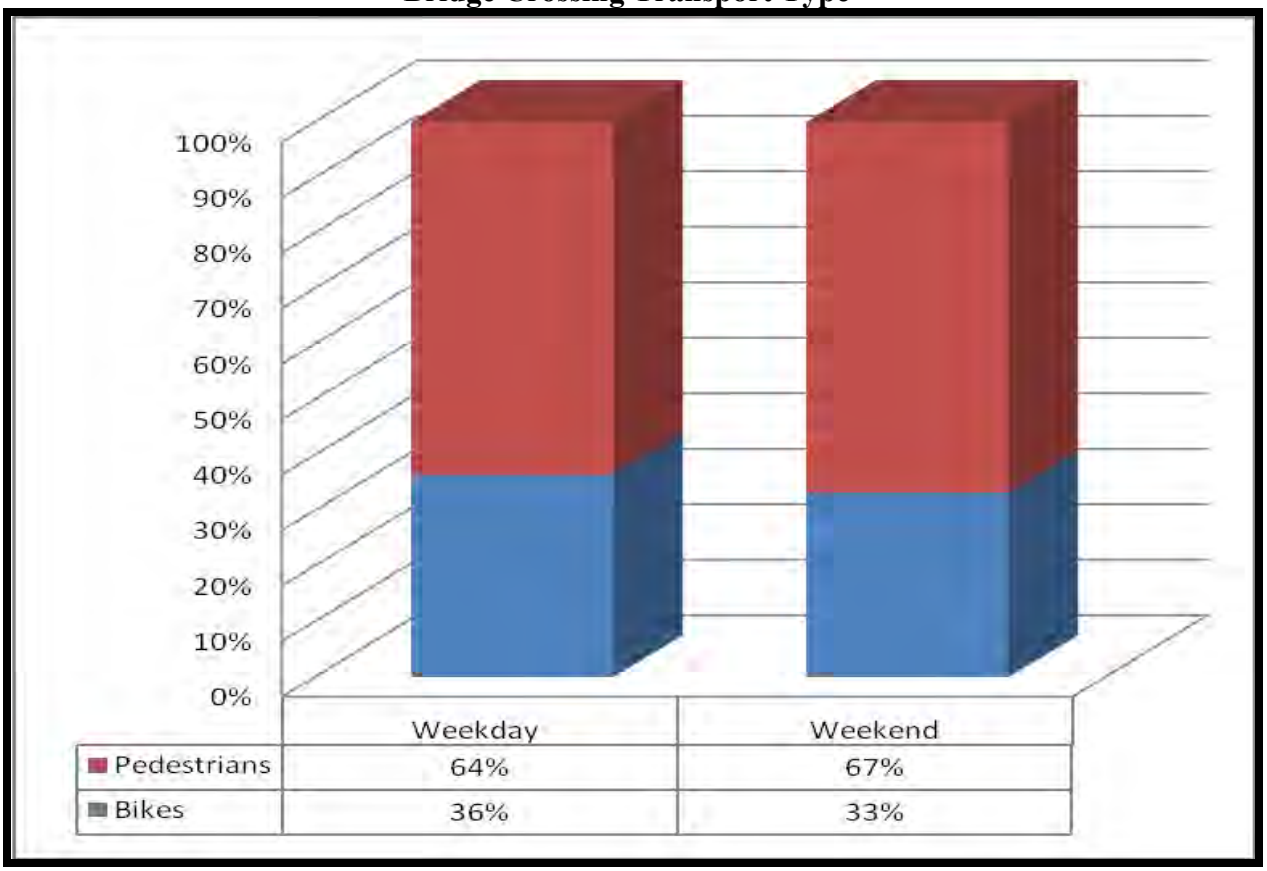
1. Direction of travel (NB vs. SB)
2. Transport type (pedestrian vs. bicycle)
3. State of permanent residence
4. Frequency of travel (both in terms of **days per week** and **months per year**)
5. Trip origin (location at which the current trip started)
6. Trip destination (location at which the current trip ends)
7. Trip purpose

Overall, a total of 242 bicyclists and pedestrians were interviewed—117 during the weekday survey, and 125 during the weekend survey. This represents a statistically valid sample size, yielding a confidence level of 95 percent with a confidence interval of ±6 percent.

Survey data was entered and summarized into two categories—one summarizing the characteristics of the *users* on the bridge, and the other summarizing the characteristics of the *trips* over the bridge. Results of the bicycle and pedestrian O&D survey for key characteristics are shown below.

Transportation Type. As the surveyors approached participants, their method of transport was classified as either ―pedestrian" or ―bicycle". Figure 6-7 summarizes the results of these classifications.

Figure 6-7
Bridge Crossing Transport Type

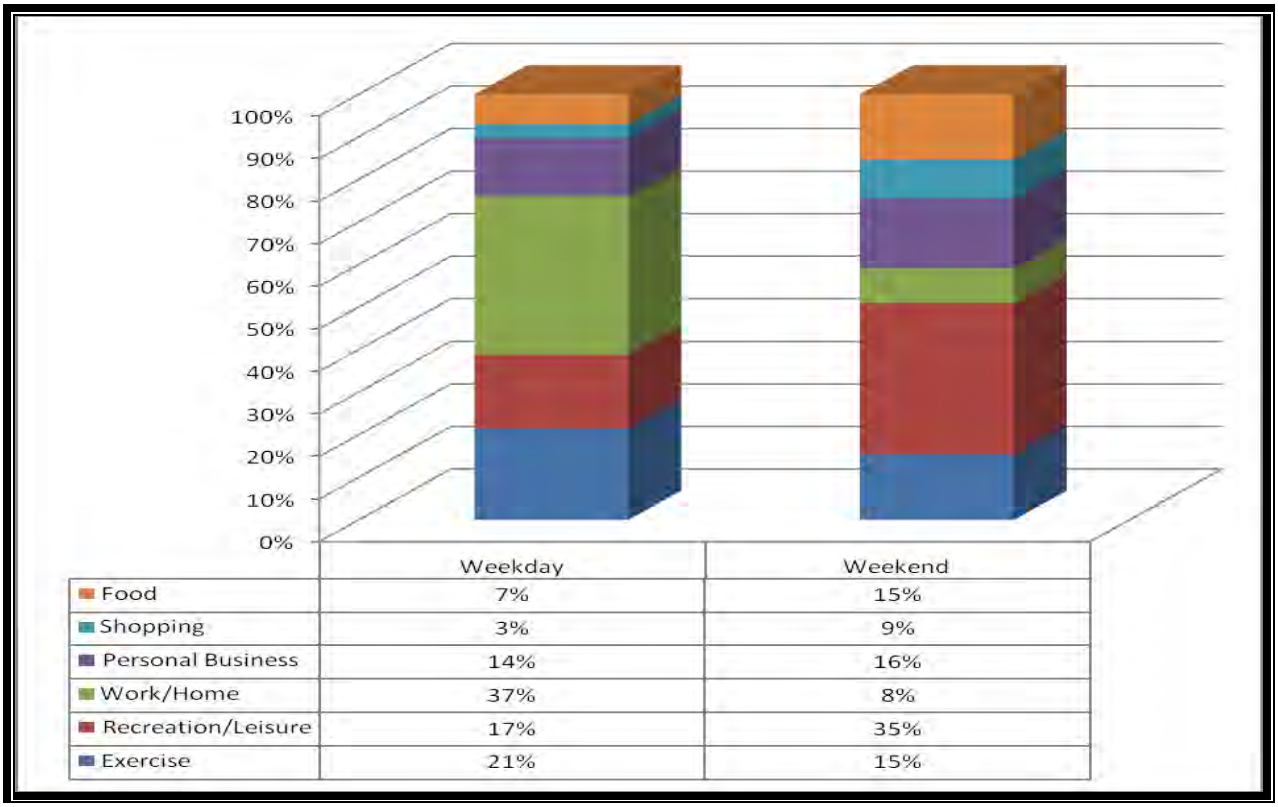


Trip Purpose. The identification of *trip purpose* is an important component of any origin–destination study. For the purpose of this pedestrian and bicycle origin-destination survey, participants were asked to categorize their trip purpose into one of the following six categories:

- **Exercise** – Pedestrians or cyclists utilizing the bridge for the purpose of exercise.
- **Recreation/Leisure** – Persons utilizing the bridge for the purpose of recreation or leisure, such as sightseeing.
- **Work/Home** – Persons crossing the bridge in order to go from home to work or from work to home.
- **Personal Business** – Persons conducting personal business such as visiting the bank or travelling to a doctor‘s appointment by crossing the bridge.
- **Shopping** – Pedestrians or cyclists crossing the bridge in order to shop at a grocery store or mall.
- **Food** – Persons utilizing the river crossing for the purpose of visiting a restaurant.

The results are summarized in Figure 6-8.

Figure 6-8
Trip Type Summary, Weekday vs. Weekend



	Weekday	Weekend
Food	7%	15%
Shopping	3%	9%
Personal Business	14%	16%
Work/Home	37%	8%
Recreation/Leisure	17%	35%
Exercise	21%	15%

This O&D data was used to help calibrate the travel demand model for bicycle and pedestrian trips converted to vehicle trips. Additional information regarding the bicycle and pedestrian Origin and Destination Analysis and associated findings can be found in the following document included with this Study Report:

- **Appendix #42 – Connections Pedestrian and Bicycle Origin and Destination Survey, Summary Report**

6.5. TRAFFIC ANALYSIS

The methodologies and procedures used to perform the traffic analysis for the study are summarized in this section as well as the results of the evaluations. Traffic operations analyses are a multi-stepped process beginning with defining the Study Area and identifying the locations for detailed evaluation. The Study Area, determined during scope development, was generally limited to Interstate 95 (I-95), U.S. Route 1 and U.S. Route 1 Bypass in the Town of Kittery, Maine and the City of Portsmouth, New Hampshire. Figure 6-9 shows the Study Area limits for the detailed traffic operations analysis and identified the Study Area locations examined in depth.

Figure 6–9
Traffic Study Area

2009 Existing Traffic Volumes

The second step was developing the traffic volume networks. Traffic data (intersection turning movement counts and automatic traffic recorder data) was gathered in the spring of 2009 at numerous locations within the Study Area. The data was then balanced and seasonally adjusted to develop traffic volume networks for the Study Area. Existing 2009 traffic volume networks for the system-wide peak hour (weekday 3:45- 4:45PM) as well as the individual weekday morning and evening peak hours were established.

2035 Traffic Forecasts

A travel demand model was developed for the Study Area for the purpose of preparing vehicle traffic forecasts for the study. The model makes use of three existing models that cover portions of the model area (the Seacoast Regional Travel Demand Model, the New Hampshire Statewide Model, and the Maine Statewide Model). The model is based in TransCAD Transportation GIS Software. Traffic forecasts are for a summer weekday PM peak hour in the year 2035.

Traffic volumes and travel pattern information from several sources were used to calibrate the model to current conditions:

- Summer 2009 weekday PM peak hour volumes on the three bridges and at 23 intersections from counts conducted for the Maine-New Hampshire Connections Study and from other recent counts.
- Year 2009 origins and destinations of vehicle, pedestrian, and bicycle trips made on the Sarah Mildred Long and Memorial Bridges, based on intercept surveys conducted as part of the Maine-New Hampshire Connections Study (see Section 6.4).
- Town of residence information for current employees of PNSY.
- Year 2000 Census journey-to-work information.

Tables 6-4 and 6-5 identify current and future job, population and housing growth for Kittery and Portsmouth.

Table 6-4
Population, Households & Employment Trends in Kittery, Maine 2000-2035

	2000		2007		2008	2035		
	Population	Household	Population	Household	Employment	Population	Household	Employment
Kittery Portion of Study Area	**1,603**	**810**	**1,689**	**849**	**808**	**2,022**	**1,067**	**1,118**
Town of Kittery Total	**9,543**	**4,078**	**9,987**	**4,274**	**8,349**	**11,951**	**5,371**	**11,005**

Table 6-5
Population, Household & Employment Trends in Portsmouth, NH 2000-2035

	2000		2007			2035		
	Population	Households	Population	House-holds	Employ-ment	Population	Households	Employment
Portsmouth Portion of Study Area	**5,214**	**2,903**	**5,391**	**2,929**	**10,447**	**5,671**	**3,181**	**13,800**
City of Portsmouth Total	**20,784**	**9,875**	**21,497**	**9,960**	**32,414**	**23,041**	**11,138**	**42,819**

These population, household and employment forecasts were the basis for determining future travel demand within the Study Area. Based on these forecasts, traffic growth for each bridge in the Study Area was anticipated to increase as noted below:

- I-95 High Level Bridge: 0.9 percent per year
- Sarah Mildred Long Bridge: 0.7 percent per year
- Memorial Bridge: 0.8 percent per year

Four system-wide peak hour networks for 2035 were developed from travel demand models with the 2035 No Build condition assumed travel via the existing I-95 High Level Bridge and the existing (2-lane) Sarah Mildred Long Bridge with the Memorial Bridge being closed. The first

2035 Build condition (referred to herein as Alternative Build 1) allowed traffic to move as it does currently on all three bridges. The second 2035 Build condition (referred to as Alternative Build 2) allowed traffic on the existing I-95 High Level Bridge and on an expanded Sarah Mildred Long Bridge (2 lanes in each direction); this alternative assumed the Memorial Bridge is closed. The third 2035 Build condition (referred to as Alternative Build 3) allowed traffic on the existing I-95 High Level Bridge, on an expanded Sarah Mildred Long Bridge with 4 lanes, and on the Memorial Bridge with 2 lanes.

Existing (2009) and future No-Build (2035) bridge traffic volumes are summarized on Figures 6 through 10.

Capacity Analysis

In the final steps, the intersection locations were evaluated. The evaluation criteria used in the intersection analyses was based on methodology provided in the 2000 Highway Capacity Manual[10] (HCM). Level of service (LOS) is a term used to denote the different operating conditions that occur on a given roadway facility under various traffic volume demands. LOS, defined in the HCM, are given letter designations ranging from LOS A (best) to LOS F (worst). For signalized intersections, the LOS designation was for the overall conditions at the intersection. Unsignalized intersection analyses, however, assumed that through traffic on the mainline was not affected by side street traffic and thus the LOS designations are for the turning movements, not the overall operations.

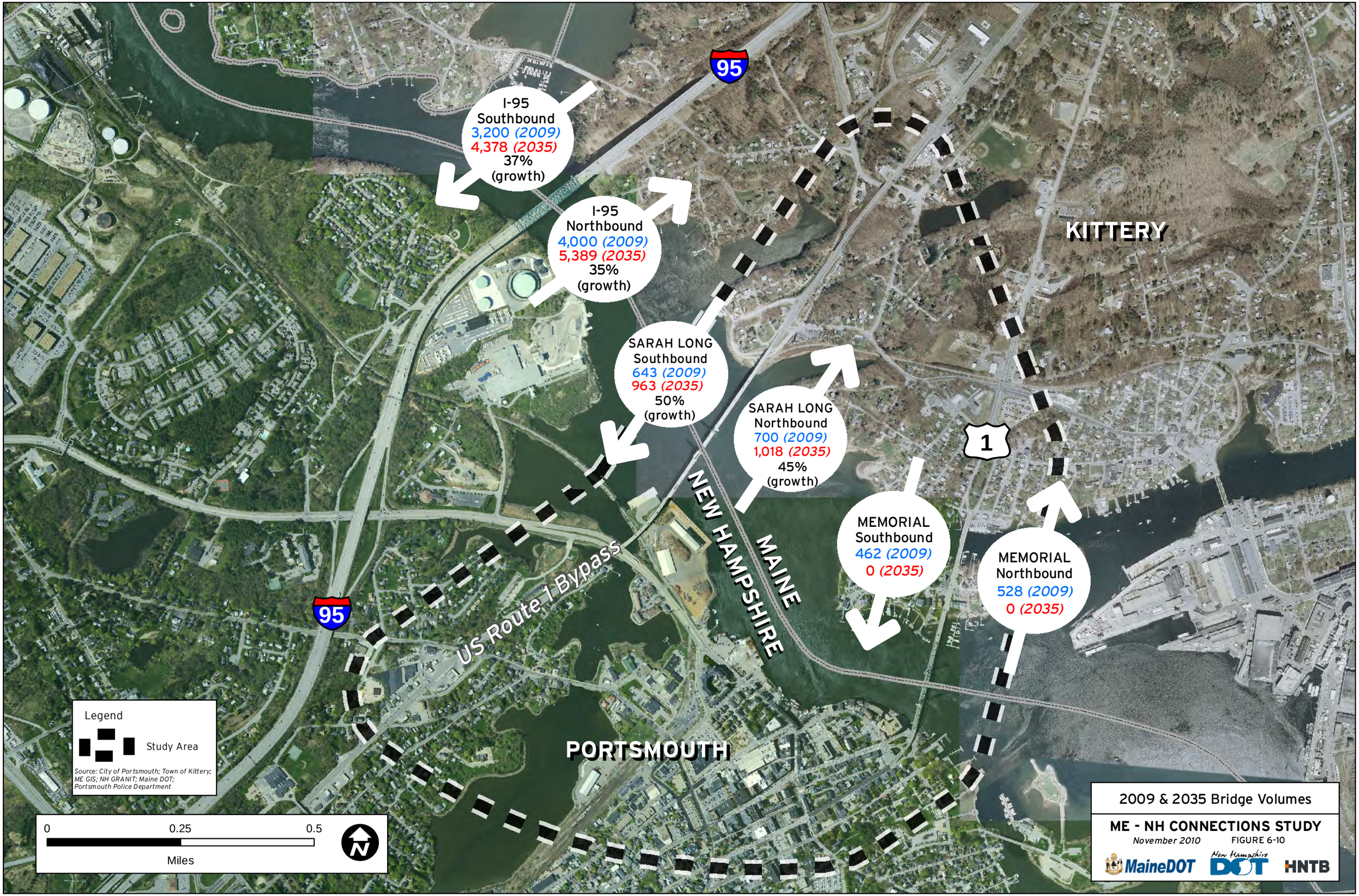
A volume to capacity (v/c) ratio was the primary tool used to analyze each of the three Study Area bridges. However, supplemental LOS analyses based on HCM criteria were also conducted for the I-95 High Level Bridge future operations. The methodologies and assumptions used to calculate the capacity for each of the three bridges can be found in the Piscataqua River Bridge Capacity Analyses Report (June 2010).

Signalized Intersection Capacity Analysis

The results of the signalized intersection capacity analyses are summarized in Table 6-6.

Existing Results: Under the 2009 weekday morning, weekday evening and system peak existing conditions some of the signalized intersections operate at LOS D or better. The maximum delay and v/c ratio experienced at any of the intersections was 40 seconds of delay per vehicle with a v/c ratio of 0.75 at the intersection of U.S. Route 1 at Maplewood Avenue in Portsmouth during the weekday evening peak period. It should be noted that the four traffic signals along Maplewood Avenue/Middle Street in Portsmouth operate within an existing coordinated signal system and the analyses at these intersections were performed using the existing (implemented in 2004) coordinated signal timings.

[10] Highway Capacity Manual, Transportation Research Board, Washington, D.C., 2000.


95
I-95
Southbound
3,200 (2009)
4,378 (2035)
37%
(growth)
I-95
Northbound
4,000 (2009)
5,389 (2035)
35%
(growth)
SARAH LONG
Southbound
643 (2009)
963 (2035)
50%
(growth)
SARAH LONG
Northbound
700 (2009)
1,018 (2035)
45%
(growth)
MEMORIAL
Southbound
462 (2009)
0 (2035)
MEMORIAL
Northbound
528 (2009)
0 (2035)
KITTERY
NEW HAMPSHIRE
MAINE
1
95
US Route 1 Bypass
PORTSMOUTH
Legend
Study Area
Source: City of Portsmouth; Town of Kittery; ME GIS; NH GRANIT; Maine DOT; Portsmouth Police Department
0
0.25
0.5
Miles
N
2009 & 2035 Bridge Volumes
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-10
MaineDOT
New Hampshire DOT
HNTB

No-Build Results: The 2035 No-Build condition was the benchmark from which the Build alternatives will be compared. Three signalized intersections were included in the 2035 analyses that were not included in the 2009 existing baseline conditions. Two of these are the Albacore Connector intersections with Market Street and U.S. Route 1 Bypass. The Albacore Connector was assumed to be a formalized connection between Market Street and the U.S. Route 1 Bypass and signalized at both ends by 2035. For analysis purposes, the existing signalized geometric condition was assumed to remain unchanged for the Market Street intersection. The new signalized intersection at the U.S. Route 1 Bypass was assumed to include the construction of a separate left-turn lane on the bypass under the 2035 No Build condition; the other approaches were assumed to consist of a single lane approach.

The third new signalized intersection included in the 2035 analysis is the intersection of Market Street and Russell Street. This unsignalized intersection currently meets peak hour signal volume warrants. Under the 2035 No Build condition, several hundred more vehicles are expected to divert to this location with the Memorial Bridge closed, further meeting signal warrant criteria. The intersection was assumed to be signalized with the existing geometric conditions. For analysis purposes, the intersection was assumed to be signalized for all 2035 No Build and Build alternatives.

As shown in Table 6-6, under the 2035 No Build conditions, most of the signalized intersections operate at LOS D or better. The exception was the intersection of the U.S. Route 1 Bypass at the Albacore Connector in Portsmouth, which was expected to operate at LOS F. It should be noted that while the intersections of Maplewood Avenue at Deer Street and Maplewood Avenue at U.S. Route 1 (Congress Street) in Portsmouth are operating at LOS D, they also operate at or near capacity with v/c ratios of 1.00 and 0.98 respectively.

Build Results: In response to the 2035 No-Build analysis results, it was determined that all of the Build alternatives would need to include signal improvements at the intersection of U.S. Route 1 Bypass at the Albacore Connector in Portsmouth and the junction of the U.S. Route 1 Bypass with Oak Terrace/Bridge Street in Kittery. The Build analyses at the intersection of U.S. Route 1 Bypass with the Albacore Connector included the construction of turn lanes on all intersection approaches. In Kittery, improvements assumed at the junction of the U.S. Route 1 Bypass with Oak Terrace/Bridge Street include signalizing the Oak Terrace and Bridge Street approaches to U.S. Route 1 Bypass, limiting access on Old Post Road to right-in/right-out access and signalizing the intersection of Cook Street/Bridge Street/Government Street to accommodate the rerouted Old Post Road traffic.

In addition to the physical improvements at the above locations, it was noted that signal timings and coordination have been optimized for the 2035 volumes. Signal operation improvements were also assumed at the intersection of U.S. Route 1 at Walker Street in Kittery where an existing signal deficiency is assumed to be fixed. The signal controller at Walker Street under

existing conditions also controls the operations at Government Street; these intersections are assumed to have their own traffic controllers in 2035 with appropriate signal timings.

Under the three Build alternatives, the signalized intersections operate at LOS D or better. No intersections were expected to operate at or near capacity under the Build 1 and Build 3 alternatives where the maximum projected v/c ratio is 0.92 under both alternatives. The Build 2 alternative shows the intersections of Maplewood Avenue at Deer Street and U.S. Route 1(Congress Street) at Maplewood Avenue in Portsmouth operating at LOS D with v/c ratios near capacity (0.98).

With the implementation of the proposed improvements discussed above for the U.S. Route 1 Bypass/Bridge Street area in Kittery, the signalized intersections of U.S. Route 1 Bypass with Oak Terrace and Bridge Street would operate at LOS C or better for the Build alternatives. Likewise, the proposed signalized intersection of Bridge Street/Government Street with Cook Street would operate at LOS C or better.

The results of the signalized intersection capacity analyses for the existing, no-build and build alternatives are summarized in Table 6-6.

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Table 6.6
Signalized Intersection Capacity Analyses Summary

Location	2009 AM Existing 2-MB, 2-SML			2009 PM Existing 2-MB, 2-SML			2009 Existing 2-MB, 2-SML			2035 No Build 0-MB, 2-SML			2035 Build 1 2-MB, 2-SML			2035 Build 2 0-MB, 4-SML			2035 Build 3 2-MB, 4-SML		
	v/c*	Delay+	LOS^	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS	v/c*	Delay+	LOS^	v/c	Delay	LOS
U.S. Route 1 at Government Street	0.29	21	C	0.36	16	B	0.37	16	B	0.27	17	B	0.42	17	B	0.28	28	C	0.41	17	B
U.S. Route 1 at Walker Street	0.35	20	C	0.7	25	C	0.78	28	C	0.67	28	C	0.81	32	C	0.75	23	C	0.79	31	C
I-95 NB Ramps at Market Street	0.49	21	C	0.73	26	C	0.67	25	C	0.85	41	D	0.78	24	C	0.81	25	C	0.78	32	C
I-95 SB Ramps at Market Street	0.44	18	B	0.65	23	C	0.6	22	C	0.86	33	C	0.74	25	C	0.75	26	C	0.7	27	C
U.S. Route 1 (State Street) at Pleasant Street	0.43	13	B	0.61	18	B	0.64	20	C	0.67	20	B	0.7	21	C	0.67	20	B	0.67	20	B
U.S. Route 1 (State Street) at Middle Street	0.4	15	B	0.66	30	C	0.53	24	C	0.79	33	C	0.66	23	C	0.8	31	C	0.65	23	C
U.S. Route 1 (Congress Street) at Maplewood Avenue	0.66	32	C	0.75	40	D	0.75	40	D	0.98	53	D	0.92	49	D	0.98	52	D	0.92	48	D
Maplewood Avenue at Hanover Street	0.24	11	B	0.36	15	B	0.4	15	B	0.59	17	B	0.47	16	B	0.58	17	B	0.48	16	B
Maplewood Avenue at Deer Street	0.49	33	C	0.6	37	D	0.63	35	D	1.00	49	D	0.79	32	C	0.98	45	D	0.81	32	C
Market Street at Albacore Connector	Unanalyzed			Unanalyzed			Unanalyzed			0.86	26	C	0.69	15	B	0.82	25	C	0.62	13	B
U.S. Route 1 Bypass at Albacore Connector	Unanalyzed			Unanalyzed			Unanalyzed			1.24	145	F	0.81	23	C	0.84	23	C	0.65	14	B
Market Street at Russell Street	Unsignalized			Unsignalized			Unsignalized			0.91	26	C	0.69	13	B	0.92	28	C	0.71	14	B
U.S. Route 1 Bypass at Oak Terrace	Unsignalized			Unsignalized			Unsignalized			Unsignalized			0.25	9	A	0.3	8	A	0.3	8	A
U.S. Route 1 Bypass at Bridge Street	Unsignalized			Unsignalized			Unsignalized			Unsignalized			0.8	34	C	0.72	29	C	0.59	23	C
Cook Street at Bridge Street / Government Street	Unsignalized			Unsignalized			Unsignalized			Unsignalized			0.65	16	B	0.88	29	C	0.81	26	C

* Volume to capacity ratio

+ Average delay expressed in seconds per vehicle.

^ Intersection level of service.

Unsignalized Intersection Capacity Analysis

The unsignalized intersection capacity analysis results are summarized in Table 6-7. It should be noted that the intersection of U.S. Route 1 Bypass/Bridge Street at Old Post Road/Oak Terrace in Kittery has an unusual existing traffic control pattern; therefore, for analysis purposes, the northbound and southbound approaches were assumed to operate under stop control (as exists in the field), and the eastbound and westbound approaches were assumed to be free-flowing. As such the westbound approach operates with slightly longer delays than indicated by the results.

Existing Results: Many of the unsignalized intersections in the Study Area operate at good levels of service with moderate peak hour delays. However, several intersections experience some level of delay during the one or more of the existing peak hours. These include the intersections of U.S. Route 1 Bypass/Bridge Street at Old Post Road/Oak Terrace in Kittery, Whipple Road at Woodlawn Avenue /Shapleigh Road in Kittery, ME Route 236 at I-95 Exit 2 Northbound Ramps in Kittery, Maplewood at Cutts Street in Portsmouth (Southbound Ramps to Route 1 Bypass), and U.S. Route 1 at Market Street/Pleasant Street in Portsmouth. It is primarily the side street movements that operate at poor levels of service which is typical for unsignalized side streets and driveways during peak hours.

No-Build Results: Under the 2035 No-Build alternative, some of the unsignalized intersections in the Study Area are expected to operate at good levels of service with moderate delays. However, many intersections were expected to experience some level of delay during the system peak hour. In addition to the intersections identified under the existing conditions, the intersections of Cook Street at Government Street/Bridge Street in Kittery and Maplewood Avenue at Northbound ramps to U.S. Route 1 Bypass in Portsmouth have one or more movements operating at LOS E or LOS F. It is again primarily the side street movements that operate at poor levels of service with long delays.

Build Results: The 2035 Build alternatives do not noticeably change the operations at the majority of the unsignalized intersections from the No-Build alternative. Intersections with poor levels of service still typically operate at the same levels and intersections with acceptable levels of service maintain those levels. The intersection of U.S. Route 1 at Water Street in Kittery, while maintaining good levels of service under the three Build alternatives, shows a significant change in operations under the Build 1 and Build 3 alternatives. This operational change was a direct result of the Memorial Bridge operations with increased delay on the minor approaches when the bridge is open to vehicular traffic. Similarly, the intersection of U.S. Route 1 at Pleasant Street/Market Street in Portsmouth shows an increase in delay from 2035 No Build for movements on U.S. Route 1 during the Build 1 and Build 3 alternatives as a direct result of traffic utilizing the Memorial Bridge.

The locations of Cook Street at Government Street/Bridge Street and U.S. Route 1 Bypass/Bridge Street at Old Post Road/Oak Terrace in Kittery are the unsignalized locations

Table 6.7
Unsignalized Intersection Capacity Analyses Summary

	2009 AM Existing			2009 PM Existing			2009 Existing			2035 No Build			2035 Build 1			2035 Build 2			2035 Build 3		
	2-MB, 2-SML			2-MB, 2-SML			2-MB, 2-SML			0-MB, 2-SML			2-MB, 2-SML			0-MB, 4-SML			2-MB, 4-SML		
Location / Movement	Demand*	Delay+	LOS^	Demand	Delay	LOS	Demand	Delay	LOS	Demand*	Delay+	LOS^	Demand	Delay	LOS	Demand	Delay	LOS	Demand	Delay	LOS
U.S. Route 1 at Water Street	705	1	A	1,065	1	A	1,065	1	A	175	3	A	1,290	2	A	175	2	A	1,245	1	A
EB movements from Water Street	15	14	B	15	14	B	15	12	B	5	9	A	15	13	B	5	9	A	15	13	B
WB movements from Water Street	5	20	C	20	21	C	20	21	C	20	9	A	25	21	C	20	9	A	25	20	C
NB movements from U.S. Route 1	240	1	A	530	1	A	530	1	A	80	-	-	650	1	A	80	-	-	615	1	A
SB movements from U.S. Route 1	445	1	A	500	1	A	500	1	A	70	3	A	600	1	A	70	3	A	590	1	A
U.S. Route 1 Bypass at Bridge Street	450	2	A	710	9	A	710	11	A	1,415	~	F	1,010	1	A	1,665	1	A	1,185	1	A
EB movements from U.S. Route 1 Bypass	365	1	A	205	3	A	205	3	A	515	2	A	265	-	-	670	-	-	345	-	-
WB movements from Bridge Street	55	6	A	445	8	A	445	9	A	815	17	C	690	1	A	910	1	A	770	1	A
NB movements from Oak Terrace	20	12	B	40	24	C	40	38	E	60	~	F	40	10	B	50	15	B	40	11	B
SB movements from Old Post Road	10	15	C	20	47	E	20	80	F	25	1480	F	15	13	B	35	18	C	30	14	B
Cook Street at Government Street / Bridge Street	525	3	A	1,025	4	A	990	4	A	1,730	26	D									
EB movements from Bridge Street	355	1	A	135	2	A	165	2	A	450	2	A	Signalized			Signalized			Signalized		
SB movements from Cook Street	110	14	B	150	23	C	165	27	D	195	237	F									
Whipple Road / Shapleigh Road at Woodlawn Avenue	895	30	B	1,720	42	F	1,555	61	E	2,005	~	F	1,980	~	F	2,010	~	F	1,985	~	F
EB lefts from Whipple Road	85	245	F	55	884	F	60	1,105	F	70	~	F	70	~	F	70	~	F	65	~	F
EB through/right from Whipple Road	90	20	C	140	38	E	170	94	F	200	238	F	200	212	F	210	273	F	200	225	F
WB movements from Woodlawn Ave	105	49	E	75	143	F	80	222	F	100	~	F	100	~	F	100	~	F	100	~	F
NB movements from Whipple Road	275	5	A	1,205	3	A	980	4	A	1250	5	A	1,230	5	A	1,250	5	A	1,240	5	A
SB movements from Shapleigh Road	340	1	A	245	2	A	265	2	A	385	2	A	380	2	A	380	2	A	380	2	A
Dennett Street at I-95 Off Ramp	395	4	A	585	6	A	580	6	A	905	17	C	725	7	A	695	7	A	570	6	A
WB movements from I-95 off ramp	135	12	B	235	14	B	235	14	B	465	34	D	305	17	C	320	15	C	265	13	B
Dennett Street at I-95 On Ramp	415	3	A	530	1	A	525	1	A	835	2	A	645	1	A	745	2	A	520	1	A
SB movements from Dennett Street	250	5	A	125	4	A	115	4	A	205	6	A	145	4	A	205	6	A	145	4	A
U.S. Route 1 at Pleasant Street/Market Street	820	14	B	1,225	46	E	1,020	30	D	1,145	33	D	1,240	59	F	1,145	33	D	1,220	54	F
WB movements from U.S. Route 1	385	17	C	445	37	E	535	45	E	545	51	F	640	100	F	545	51	F	625	89	F
NB movements from Pleasant Street	155	10	B	165	12	B	185	12	B	230	12	B	240	13	B	235	13	B	235	12	B
SB movements from Market Street	280	12	B	615	63	F	300	16	C	370	20	C	360	19	C	365	19	C	360	19	C
Market Street at Russell Street	1,375	3	A	1,385	29	A	1,170	9	A												
EB movements from Russell Street	130	30	D	255	160	F	255	42	E	Signalized			Signalized			Signalized			Signalized		
Maplewood Avenue at Cutts Street	575	7	A	975	20	B	855	11	B	1,110	15	B	1,085	14	B	1,100	16	C	1,080	14	B
EB movements from Maplewood Avenue	145	1	A	235	1	A	220	-	-	330	-	-	310	-	-	335	-	-	310	-	-
WB movements from Maplewood Avenue	325	7	A	640	10	A	505	7	A	610	8	A	610	8	A	590	8	A	600	8	A
NB movements from Cutts Street	70	14	B	80	144	F	110	37	E	150	71	F	145	64	F	155	78	F	150	60	F
SB movements from Cutts Street	35	21	C	20	185	F	20	44	E	20	59	F	20	55	F	20	55	F	20	54	F
Maplewood Avenue at U.S. Route 1 Bypass NB	650	3	A	1,095	3	A	935	3	A	1,340	5	A	1,290	4	A	1,325	4	A	1,275	4	A
WB movements from Maplewood Avenue	-	-	-	-	-	-	-	-	-	685	3	A	685	3	A	665	3	A	680	3	A
NB lefts from NB Ramp	20	12	B	45	22	C	35	17	C	45	38	E	45	34	D	40	36	E	40	33	D
NB rights from NB Ramp	150	10	B	135	11	B	150	11	B	180	13	B	185	13	B	175	13	B	175	12	B
ME Route 236 at I-95 Exit 2 NB Ramps	1,465	3	A	2,375	160	E	2,325	104	E	2930	1,837	F	2,830	1,795	F	2,880	1,763	F	2,845	1,750	F
EB rights from Exit 2 NB Ramps	110	13	B	220	13	B	185	12	B	300	16	C	225	14	B	190	14	B	205	14	B
WB lefts from I-95 NB / U.S. Route 1 SB	135	15	B	150	30	D	135	36	E	165	93	F	170	98	F	170	95	F	170	97	F
WB rights from I-95 NB / U.S. Route 1 SB	125	14	B	530	672	F	390	584	F	525	~	F	495	~	F	495	~	F	485	~	F
ME Route 236 at I-95 Exit 2 SB Ramps	1,640	1	A	2,120	1	A	2,120	1	A	2,575	1	A	2,725	1	A	2,815	1	A	2,745	2	A
EB lefts from SB Off Ramp	25	19	C	45	21	C	45	21	C	50	27	D	70	29	D	60	28	D	65	28	D
EB rights from SB Off Ramp	155	12	B	165	11	B	165	11	B	200	12	B	200	12	B	275	13	B	240	13	B

Legend
* Demand expressed in vehicles per hour.
+ Delay expressed in seconds per vehicle.
^ Level of service.
~Delay too large to calculate.
- No Data Available.

showing the greatest operational changes. As described in the signalized analysis section, U.S. Route 1 Bypass was proposed to be signalized at Oak Terrace and at Bridge Street in Kittery as is the intersection of Cook Street at Government Street/Bridge Street in Kittery. Old Post Road is assumed to be converted to a right-in/right-out access only at the Oak Terrace intersection in Kittery. The U.S. Route 1 Bypass/Bridge Street at Old Post Road/Oak Terrace intersection remains unsignalized and the rerouting of traffic from the restriction of Old Post Road allow this intersection to improve the minor legs' operations to LOS C or better in the Build 3 option.

Bridge Capacity Analysis

Capacity analyses were performed for the Sarah Mildred Long, Memorial, and I-95 High Level Bridges for the existing and future conditions. A key assumption in calculating bridge capacity is the number of bridge lifts during the peak hour. During the summer months, USCG regulations require the lift bridges to lift every half hour if there are vessels waiting to pass. Therefore, a worst-case of two lifts per hour was assumed for all Build and No-Build alternatives. In reality, analysis of the bridge lift records shows that the bridges rarely lift twice in one hour. The current average lift frequency is approximately once every two hours for the Sarah Mildred Long Bridge. Given this, alternative bridge lift frequencies of one lift or no lifts per hour were also analyzed for the No-Build and Build 1 alternatives. A no lift assumption would be more applicable to the Sarah Mildred Long Hybrid Bridge replacement option due to its increased vertical clearance over the water in the closed position.

Existing Results: The capacity analysis results for the bridges are summarized in Table 6-8. It should be noted that the existing bridge analyses assumed a worst case two-lifts per hour scenario for the two lift bridges.

The analysis results indicated that the bridges' critical approaches are operating at v/c ratios between 0.34 and 0.54 during the weekday morning peak hours, and at 0.85 during the weekday evening peak hours and between 0.69 and 0.82 during the system-wide peak hour. It should be noted that the v/c ratios during the weekday evening and the system-wide peak hour are approximately 0.85 on the critical approach, a level where operations appear to the average driver to be approaching capacity.

No-Build: Table 6-9 summarizes the analysis results for the 2035 No-Build alternative. This analysis was completed with river crossings at the I-95 High Level Bridge and the Sarah Mildred Long Bridge with the Sarah Mildred Long Bridge having two-lifts, one-lift and no lift alternatives. The Memorial Bridge is assumed to be closed. I-95 northbound will have a v/c ratio of 0.89 and a corresponding LOS D/E in the critical direction. More importantly, under this condition, the Sarah Mildred Long Bridge was projected to operate over capacity when there are two bridge lifts.

Under the 2035 No Build alternative with one and no bridge lifts, similar to the two-lift scenario, Sarah Mildred Long Bridge would continue to operate over capacity in the northbound direction.

I-95 High Level Bridge is anticipated to operate at LOS D in the northbound direction and LOS C in the southbound direction.

Table 6-8
2009 Existing Bridge Capacity Analysis

Location	Weekday Morning Peak			Weekday Evening Peak		
	Adj. Flow*	Capacity**	v/c***	Adj. Flow	Capacity	v/c
Memorial Bridge						
Northbound	218	844	0.26	709	838	0.85
Southbound	288	844	0.34	494	838	0.59
Sarah Mildred Long Bridge						
Northbound	419	956	0.44	848	1,033	0.82
Southbound	512	956	0.54	882	1,033	0.85
	Hourly Flow****	Capacity	v/c	Hourly Flow	Capacity	v/c
I-95 High Level Bridge						
Northbound	1,770	5,775	0.31	3,700	5,775	0.64
Southbound	2,870	5,775	0.50	3,130	5,775	0.54
Location	System-wide Peak					
	Adj. Flow	Capacity	v/c			
Memorial Bridge						
Northbound	616	897	0.69			
Southbound	523	897	0.58			
Sarah Mildred Long Bridge						
Northbound	864	1,056	0.82			
Southbound	796	1,066	0.75			
	Hourly Flow	Capacity	v/c			
I-95 High Level Bridge						
Northbound	4,000	5,775	0.69			
Southbound	3,200	5,775	0.55			

* Adjusted (by peak hour factor (PHF)) traffic flow expressed in vehicles per hour.
** Capacity expressed in vehicles per hour.
*** Volume to capacity ratio.
**** Hourly flow is the unadjusted peak hour volume expressed in vehicles per hour.

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TABLE 6-9
2035 BRIDGE CAPACITY ANALYSES – No Build

Location		Two Lift Sarah Mildred Long (SML)*			One Lift SML**		
		Volume	v/c	LOS	Volume	v/c	LOS
Interstate-95	NB	5,130	0.89	D/E	4,859	0.84	D
	SB	4,310	0.75	D	4,182	0.72	C
			Adjusted			Adjusted	
		Volume	Volume	v/c	Volume	Volume	v/c
Sarah Mildred Long	NB	980	1,065	1.07	1,250	1,358	1.09
	SB	960	1,043	1.04	1,085	1,179	0.94
Location		No Lift SML***					
		Volume	v/c	LOS			
Interstate-95	NB	4,651	0.81	D			
	SB	4,057	0.70	C			
			Adjusted				
		Volume	Volume	v/c			
Sarah Mildred Long	NB	1,458	1,585	0.96			
	SB	1,211	1,316	0.88			

^ Adjusted volumes calculated using a PHF of 0.92 for SML and PM Bridges.

* Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vehicles per hour (vph) for I-95, and 1,000 vph for SML Bridge assuming two lifts during peak hour.

** Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vph for I-95, and 1,250 vph for SML assuming one lift during peak hour.

*** Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vph for I-95, and 1,650 vph for SML Bridge assuming no lift during peak hour

Build: Tables 6-10 and 6-11 summarize the results from the three 2035 Build alternatives. Build 1 assumed all three bridges in operation with two lanes on both the Sarah Mildred Long and the Memorial Bridges. The lift bridges were assumed to operate with two-lifts, one-lift, and no lifts per hour. Under this scenario, the v/c ratio on I-95 northbound decreased from 0.89 (under the No Build condition) to 0.81 with two bridge lifts. Meanwhile, the Memorial Bridge was projected to have a v/c ratio of 0.82 with the Sarah Mildred Long Bridge having a v/c ratio of 0.91. These results are worse than the existing conditions on all of the bridges.

Under Build 1 with one-lift per hour, similar operations to the two-lift scenario occur. Volume to capacity ratios declined slightly on I-95 High Level Bridge with each decrease in number of bridge lifts on the other bridges. Both the Sarah Mildred Long and Memorial Bridges also have v/c ratios projected to be lower with the decreasing number of bridge lifts.

TABLE 6-10
2035 BRIDGE CAPACITY ANALYSES – Build 1

		Two Lift SML & Two Lift Memorial Bridge (MB)*			One Lift SML & One Lift MB**		
Bridge		Volume	v/c	LOS	Volume	v/c	LOS
Interstate-95	NB	4,690	0.81	D	4562	0.79	D
	SB	3,965	0.69	C	3887	0.67	C
			Adjusted			Adjusted	
		Volume	Volume	v/c	Volume	Volume	v/c
Sarah Mildred Long	NB	840	913	0.91	991	1077	0.86
	SB	770	837	0.84	853	927	0.74
Memorial	NB	645	701	0.82	626	680	0.62
	SB	580	630	0.74	576	626	0.57
		No Lift SML & No Lift MB***					
Bridge		Volume	v/c	LOS			
Interstate-95	NB	4,443	0.77	D			
	SB	3,696	0.64	C			
			Adjusted				
		Volume	Volume	v/c			
Sarah Mildred Long	NB	1,091	1,186	0.72			
	SB	1,045	1,135	0.69			
Memorial	NB	644	700	0.52			
	SB	575	625	0.46			

^ Adjusted volumes calculated using a PHF of 0.92 for SML and PM Bridges.

* Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vph for I-95, and 1,000 vph for SML Bridge and 850 vph for PM Bridge assuming two lifts during peak hour.

** Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vph for I-95, and 1,250 vph for SML Bridge and 1,100 vph for PM Bridge assuming one lift during peak hour.

*** Volume to capacity (v/c) ratios calculated using the directional capacity determined for each bridge to be 5,775 vph for I-95, and 1,650 vph for SML Bridge and 1,350 vph for PM Bridge assuming no lift during peak hour.

Build 2 assumed traffic on the I-95 High Level Bridge and on the Sarah Mildred Long Bridge with four lanes. This river crossing combination was analyzed with two bridge lifts. The I-95 High Level Bridge would operate similarly to Build 1 with a critical v/c ratio of 0.81 and LOS D in the northbound direction. Under this alternative, volumes on the Sarah Mildred Long Bridge increased substantially compared to the 2035 No Build and Build 1 conditions with only two lanes on the bridge. However, with four lanes on the bridge the critical v/c ratio decreased to 0.79 which is lower than the 2009 existing condition.

TABLE 6-11
2035 BRIDGE CAPACITY ANALYSES - Build 2 & Build 3 with Two-Lifts

Bridge		Build 2 (MB-0, SML-4)			Build 3 (MB-2, SML-4)		
		Volume	v/c	LOS	Volume	v/c	LOS
		Volume	v/c	LOS	Volume	v/c	LOS
Interstate-95	NB	4,650	0.81	D	4,480	0.78	D
	SB	4,055	0.70	C	3,755	0.65	C
			Adjusted			Adjusted	
		Volume	Volume	v/c	Volume	Volume	v/c
Sarah Mildred Long	NB	1,460	1,587	0.79	1,090	1,185	0.59
	SB	1,210	1,315	0.66	995	1,082	0.54
Memorial	NB	0	0	-	610	663	0.78
	SB	0	0	-	565	614	0.72

* Adjusted volumes calculated using a PHF of 0.92 for SML and PM Bridges.

** Volume to capacity (v/c) ratios calculated using the existing directional capacity previously determined for each bridge (5,775 vph for I-95, 1,000 vph for SML Bridge, and 850 vph for PM Bridge). SML four-lane alternative assumed to have a directional capacity of 2,000 vph.

Build 3 assumed that the Sarah Mildred Long Bridge would provide four lanes (either physcially or under a hybrid option) and Memorial Bridge will provide two lanes over the Piscataqua River. Like Build 2, Build 3 was analyzed with only two bridge lifts. Under this condition, approximately 200 vph per direction are shifted from I-95 to the Sarah Mildred Long Bridge compared to the other build alternatives. This reduction in traffic reduced the critical northbound v/c ratio on I-95 High Level Bridge to 0.78. The v/c ratio for the Sarah Mildred Long Bridge is substantially reduced compared to the other build alternatives and is projected to be 0.59 under this scenario. The Memorial Bridge v/c ratio decreased slightly compared to the Build 1 from 0.82 to 0.78 for the critical northbound direction.

Summary of Traffic Analyses

Traffic analyses were conducted for the three Piscataqua River bridges between the Portsmouth, New Hampshire and the Kittery, Maine as well as selected Study Area intersections. These analyses included 2009 existing alternative, 2035 No Build alternative, and three 2035 Build alternatives.

Existing: Analyses for the 2009 existing traffic demands indicate that many of the Study Area intersections operate at acceptable levels of service. Although some of the unsignalized intersections experienced delays during the peak hour conditions, no substantial deficiencies or constraints were identified at either the signalized or unsignalized intersections. The capacity analyses of the Sarah Mildred Long Bridge and the Memorial Bridge indicated that both bridges

are at v/c ratios of 0.85 during some of the peak hours. To the average driver these bridges appear to be approaching capacity under the existing conditions. However, the I-95 High Level Bridge was not approaching capacity in 2009.

No-Build: Under the 2035 No-Build alternative, the Memorial Bridge would be closed leaving the Sarah Mildred Long Bridge and I-95 High Level Bridge to process all of the traffic over the Piscataqua River. The intersection of Market and Russell Streets in Portsmouth received a traffic signal. All of the other intersections selected for detailed traffic operation analysis maintained their existing geometry and operation control as was analyzed in the existing conditions. Volumes throughout the Study Area increased due to background growth while volumes on the bridges increased due to both background growth and the Memorial Bridge closure. The critical approach on the I-95 High Level Bridge would experience a v/c ratio of 0.89 with volumes approaching LOS E operations. Volume demands on the Sarah Mildred Long Bridge would exceed capacity with two-lifts, one-lift, and no lifts, resulting in v/c ratios of 1.07, 1.09, and 1.06 respectively on the critical approach. Three of the signalized intersections in Portsmouth would be operating at or over capacity (U.S. Route 1 at Maplewood Avenue, Maplewood Avenue at Deer Street and U.S. Route 1 Bypass at Albacore Connector). From this evaluation it can be concluded that the No Build condition would not accommodate the projected 2035 system peak hour traffic volumes.

Build 1: The Build 1 alternative assumed all three bridges are in operation with two lanes on both the Sarah Mildred Long and the Memorial Bridges. Build 1 assumed operational improvements at the signalized intersection of U.S. Route 1 at Government Street and U.S. Route 1 at Walker Street in Kittery with individual signal controllers assumed at each intersection. Additionally, Build 1 in Kittery assumed U.S. Route 1 Bypass is signalized at Oak Terrace and Bridge Street, Old Post Road was modified to allow right-in/right-out only traffic at the Bridge Street intersection and Cook Street at Bridge Street/Government Street is signalized. Lastly, in Portsmouth this alternative assumed improvements at the intersection of U.S. Route 1 Bypass and the Albacore Connector to provide separate turn lanes on all three approaches. With these improvements all of the signalized intersections operated at LOS D or better with a maximum v/c ratio of 0.92. The unsignalized intersections were expected to operate at approximately the same levels of service as under the 2035 No Build alternative with the exception of U.S. Route 1 Bypass/Bridge Street at Old Post Road/Oak Terrace in Kittery where the adjusted traffic patterns result in improved levels of service. Overall operations improve at eight intersections with the remaining intersections operating at approximately the same levels as under the No Build condition.

The I-95 High Level Bridge would operate with a critical v/c ratio of 0.81 at LOS D under Build 1 with two-lifts. The Sarah Mildred Long Bridge will operate with a critical northbound directional v/c ratio of 0.91 and the Memorial Bridge with a critical v/c ratio of 0.82 under the two-lift worse case condition. Motorists under the existing conditions would tend to feel that the Sarah Mildred Long Bridge operated near capacity with the v/c at 0.85 during the 2009 weekday

evening peak hour. Future year traffic operations on the bridges would be at approximately the same levels as the existing conditions under the Build 1 condition.

Build 2: The Build 2 alternative assumed traffic flow on the I-95 High Level Bridge and on the Sarah Mildred Long Bridge with four lanes (two lanes in each direction). The same signalized improvements as in Build 1 were assumed leading to all of the signalized intersection operating at LOS D or better. However, similar to the No-Build alternative, the intersections of U.S. Route 1 at Maplewood Avenue and Maplewood Avenue at Deer Street in Portsmouth both are expected to operate with a v/c ratio approaching 1.0. Signal timings at these intersections were optimized to provide efficient progression through the intersections with the least delay. The unsignalized Study Area intersections operated at the same or better levels of service than the 2035 No Build alternative. Operations improved at five intersections with the remaining locations operating at approximately the same levels as the No Build alternative.

The I-95 High Level Bridge would operate with a critical v/c ratio of 0.81 in the northbound direction at a LOS D. With four lanes on the Sarah Mildred Long Bridge the critical v/c ratio decreases to 0.79. Operations were similar on the bridges to levels under the Build 1 alternative; however additional reserve capacity was available.

Build 3: The Build 3 alternative assumed that the Sarah Mildred Long Bridge would provide four lanes and Memorial Bridge will provide two lanes over the Piscataqua River. The signalized improvements were the same as assumed in the other Build alternative leading to signalized operations of LOS D or better at all of the signalized intersections. No capacity issues were anticipated to occur at these intersections with the largest v/c ratio being 0.92 at the intersection of U.S. Route 1 at Maplewood Avenue in Portsmouth. The unsignalized intersections were anticipated to operate at the same or better levels of service than the 2035 No Build alternative. As in Build 1, intersection operations improved at eight intersections while remaining at approximate the same No Build levels at the other locations.

Under Build 3, approximately 200 vph per direction were shifted away from I-95 High Level Bridge over to the Sarah Mildred Long Bridge compared to the other build alternatives. This reduction in traffic reduced the critical northbound v/c ratio on I-95 to 0.78. The v/c ratio for the Sarah Mildred Long Bridge was projected to be 0.59 under this scenario. The v/c ratio for the Memorial Bridge was projected to be 0.78 for the critical northbound direction. There was available capacity on all three bridges for future growth beyond 2035.

Conclusion: In conclusion, the 2035 No-Build alternative would not accommodate the future traffic volume demands within the Study Area. However, all three Build alternatives considered, in conjunction with the additional improvements identified, were viable alternatives from a traffic operations perspective.

Additional information regarding Traffic Analysis tasks and associated findings are found in the following documents included with this Study Report:

- ***Appendix #1 - Balanced Traffic and Seasonal Volume Adjustment***.
- ***Appendix #5 - Seasonal Adjustment Factor Calculation***.
- ***Appendix #6 - No Build Adjustments to Peak Hour Bridge Volumes***.
- ***Appendix #14 - Existing Conditions Traffic Analysis***.
- ***Appendix #15 - Memorial Bridge Closed Traffic Assessment.***
- ***Appendix #19 - Closure of Bridges During Construction***.
- ***Appendix #21 - Traffic Analysis Criteria***.
- ***Appendix #23 - 2035 Traffic Operational Analysis***.
- ***Appendix #26 – Baseline Growth and Summary***.
- ***Appendix #28 – 2015 Construction Impacts***.
- ***Appendix #29 – Traffic Forecasts Summary***.
- ***Appendix #33 – Travel Demand Model Methodology***.
- ***Appendix #45 - Bridge Capacity Analysis Summary Report***.

6.6. MULTIMODAL EVALUATION

This section summarizes the existing modes of transportation present within the Study Area, as well as the methodology and results of the multimodal evaluation conducted for the study.

6.6.1: Existing Modes

The first step in conducting the multimodal evaluation for this study was to define the services offered by each mode and identifying routes and facilities associated with each mode in the Study Area. A mode is a system for carrying transit passengers described by specific right-of-way, technology and operational features[11]. The modes identified in the Study Area include bus, paratransit services, bicycle, pedestrian and organized van/car pools. Freight rail also exists in the Study Area. A high level summary of these modes is identified as follows:

Bus Services

The following bus services were identified in the Study Area.

- Local Services: The local bus services include the Cooperative Alliance for Seacoast Transportation (COAST) and Wildcat Transit. These are both fixed-route bus services. Currently no fixed-route bus service operates between Kittery and Portsmouth.
- Interstate Bus Transit: Two inter-state buses travel along the I-95 corridor: Greyhound, Inc. and C&J. They both provide Boston-bound travel.

Paratransit Services

The following paratransit services were identified in the Study Area

- York County Community Action Corporation (YCCAC);
- The Cooperative Alliance for Seacoast Transportation (COAST);
- Other special population services in Rockingham County;
- Various private taxi and shuttle services; and

[11] Source: American Public Transportation Association

- Portsmouth Naval Shipyard (PNSY) Employee Transit. While there is no formal shuttle service operated by PNSY, a number of private taxi and shuttle services operate to bring employees to and from work each day. These private taxi and shuttles companies include, but are not limited to:
    - Great Bay Limousine;
    - Seacoast Airport Service;
    - Coastal Transportation Services;
    - Southwick Airport Shuttle;
    - Luxury Limousine; and
    - Mermaid Transportation Company.

Additionally, there are a number of van/car pools that operate to take employees to and from work at the PNSY. Many of these use park and ride lots located throughout the region.

Van/Car Pooling Services

The following van/car pooling services were identified in the Study Area:

- GO MAINE. GO MAINE is an organization that provides services and information to commuters and other travelers who live, work, or travel in the State of Maine.

Bicycle and Pedestrian Services

The following is a summary of the existing bicycle and pedestrian accommodations in the Study Area.

Sarah Mildred Long Bridge

Bike and pedestrian use is currently prohibited on the Sarah Mildred Long Bridge since the bridge is located on the U.S. Route 1 Bypass, a limited access facility. Although bike and pedestrian use is prohibited, bicyclists and pedestrians use of the Bridge has been observed. People are less likely to use the bridge because of unfavorable conditions such as high motor vehicle volumes and speeds, lack of adequate striped shoulders, very narrow (3 foot) safety sidewalks, inadequate pedestrian railings, and frequent summertime bridge openings.

Memorial Bridge

The Memorial Bridge carries U.S. Route 1 between Portsmouth and Kittery across the Piscataqua River and the East Coast Greenway (ECG) identified as The NH Seacoast Greenway (NHSG) in New Hampshire and the Eastern Trail (ET) in Maine. It includes wooden plank sidewalks (approximately six to seven feet wide) on both sides and those sidewalks narrow to approximately 5.5 feet in the area of the raised superstructure and lift span. The sidewalks on the southern approach to the bridge consist of open metal grating.

The Memorial Bridge is the only bike/pedestrian connection between Portsmouth and Kittery. The shortest alternative bicycle route between Kittery and Portsmouth is approximately 24 miles in length, traveling through the communities of Portsmouth, Newington, Dover, Elliot and Kittery. Trips of this distance would likely discourage most cyclists from making local Kittery -

Portsmouth trips, and certainly all pedestrians would seek alternate transportation modes if the connection across the Memorial Bridge were to be lost.

Regional Connections:
The Memorial Bridge is situated on a major regional bike route, the East Coast Greenway. The ECG is a developing 3000 mile north-south urban trail project that passes through Kittery and Portsmouth as it extends from Calais, Maine to Key West, Florida. The section of the EGC within southern Maine is known as the Eastern Trail, and the section within New Hampshire is known as the New Hampshire Seacoast Greenway. These two routes are currently connected by the Memorial Bridge.

Freight Rail Services
This section includes a summary of the freight rail lines for the Sarah Mildred Long Bridge. These rail lines include the Portsmouth Branch and its connecting freight lines: Main Line West, Main Line East, and the Newington Branch.

Infrastructure
The Sarah Mildred Long Bridge is a double-deck truss bridge which spans the Piscataqua River between Portsmouth and Kittery. Completed in 1940, the bridge supports the U.S. Route 1 Bypass Highway on the upper level and a single track freight rail on the lower level. To accommodate various sizes of passing cargo ships and recreational watercraft and to minimize vehicular traffic disruption, the bridge has two lifting mechanisms. One of these mechanisms raises both the rail and highway and is used to accommodate large passing watercraft. For smaller watercraft, a retractable section of the rail allows the vehicular traffic not to be disrupted.

Freight Lines
The following is a summary of the freight rail lines in the Study Area.

Portsmouth Branch Freight Line
The freight rail line on the Sarah Mildred Long Bridge is one segment of a rail network owned by Boston and Maine Corporation (BM) and operated by Springfield Terminal Railway Company (STRY), a subsidiary of Pan Am Railways (formerly the Guilford Rail System). This rail segment is part of the Portsmouth Branch, an active 10-mile segment that extends from Newfields, New Hampshire through the Portsmouth Yard across the Piscataqua River through Kittery, Maine and to PNSY. Currently, this Portsmouth Branch is used solely to service PNSY.

The frequency of freight service provided on the Portsmouth Branch by STRY is as required. Two sidings, located in Portsmouth serve customers located along the rail line in addition to the Portsmouth Yard. Prior reports have classified the condition of the infrastructure along the Portsmouth branch as poor, though the track structure has been rated good to fair. Specifically, the surface condition of the track is good, and the drainage, ballast and tie conditions are fair. The track structure consists of 72, 75, 100 and 112 pound rail with wood ties.

Connecting Freight Lines

The Portsmouth Branch is connected to three other freight lines in Portsmouth, each owned by BM and operated by STRY. These lines include the Newington Branch, Main Line West, and Main Line East. These three lines are currently used exclusively for freight rail traffic, with the exception of the Main Line West, which shares a corridor with the Amtrak-operated Downeaster service for the Northern New England Passenger Rail Authority (NNEPRA) from Portland, Maine to Boston, Massachusetts.

Truck Services

Primary truck services to the region are through localized deliveries to both downtown Portsmouth and Kittery. No major truck distribution carriers were identified within the Study Area. Weight limit posting on the Memorial Bridge (ten tons for the past several years and three tons as of Nov. 20, 2009) bans all vehicles except for passenger cars and pick-up trucks from using that bridge. Heavier trucks servicing downtown Portsmouth and Kittery utilize either the Sarah Mildred Long Bridge (now posted at 10 tons in July, 2009) or the I-95 High Level Bridge. This includes deliveries to PNSY.

Layover/Storage Facilities

The only documented area for layover and storage is at the Port of Portsmouth. Specific facility capacity and turnover data was not obtained.

6.6.2: Potential Future Passenger Transportation Opportunities

This evaluation of transit and other passenger transportation opportunities considers how the bridge alternatives support or preclude future passenger transportation expansions.

Rail

The Pan Am Railway (PAR) Portsmouth Branch provides a railroad connection between Portsmouth, Kittery, PNSY, and the Main Line West in Newfields, New Hampshire. The Amtrak Downeaster operates along the Main Line West, with nearby stations in Exeter, Durham, and Dover, New Hampshire. Massachusetts Bay Transportation Authority (MBTA) commuter rail service operates along the Main Line West between Haverhill, Massachusetts and Boston. The Haverhill terminus for this service is slightly over 30 track miles from downtown Portsmouth. The MBTA also operates a commuter rail route over the former Eastern Route Main Line, which terminates in Newburyport, Massachusetts. The Newburyport terminus is approximately 20 miles from Portsmouth. While the Portsmouth Branch provides an active railroad connection to Portsmouth, the track along most of the Eastern Route Main Line has been removed.

To not preclude future expansion of MBTA commuter rail, it is worthwhile to consider possible expansion routes. Past planning studies have considered the possible extension of the MBTA Newburyport Line service from Newburyport to Portsmouth. This service could also potentially be extended to Kittery via the Sarah Mildred Long Bridge. The simplest terminus for this

service would be in Portsmouth, perhaps near the Portsmouth Yard. A central Portsmouth commuter rail station could be a logical location for a multi-modal transportation center with connections to both sides of the river.

The PAR Portsmouth Branch also provides a potential commuter or regional rail connection between Portsmouth/Kittery and Portland, Maine. This corridor could also potentially connect to the Town of Durham/University of New Hampshire and Dover. There are no plans to do this however.

Local Bus

No fixed-route public transit is currently offered in Kittery, to PNSY, or in nearby Maine communities. The Memorial and Sarah Mildred Long Bridges could connect future fixed-route service in Maine to Portsmouth. Because of its concentration of employment opportunities, PNSY would likely be the largest transit service generator with a bridge connection to Portsmouth. Local transit connecting to PNSY could also conceivably serve central Kittery and retail along Route 1, including the Kittery Outlets.

Transit-only or high-occupant vehicle (HOV) lanes are not foreseeable on either bridge. Transit-only lanes in the Market Square area of downtown Portsmouth should be evaluated as part of future transit service upgrades. Signal priority for transit and transit queue jumps at strategic locations should also be evaluated. These locations include downtown Portsmouth, approaches to both bridges, the Portsmouth Shipyard gateway, and central Kittery.

Regional Bus

U.S. Route 1 is a potential regional transit corridor between Portsmouth and southeastern Maine coastal communities. A limited stop corridor along U.S. Route 1 could follow either bridge to Portsmouth. Intercity motorcoach service would likely follow Interstate 95 to Portsmouth, as Greyhound service does today.

6.6.3: Evaluation of Transit Alternative

The section describes the feasibility and viability of a zero-fare, high frequency bus transit system between the downtowns of Portsmouth and Kittery by bicyclists and pedestrians currently using the Memorial Bridge. This evaluation included an estimate of the potential usage of the bus transit system, an estimate of resulting bicycle and pedestrian usage on the Sarah Mildred Long Bridge, and other observations. This bus transit system assessment assumes the Memorial Bridge is closed to all modes of traffic.

Definition of Proposed Bus Transit System

The proposed bus transit system route was assumed based on two objectives: 1) service or be in close proximity to the majority of the origins and destinations identified in the bicycle-pedestrian O&D survey, and 2) be time competitive with the existing origins and destinations factoring in the alternate travel time if bicycles and pedestrians switched to the Sarah Mildred Long Bridge. Figure 6-11 identifies the proposed bus transit system route and station stops.

Figure 6-11
Proposed Bus Transit System Route and Station Stops

In Figure 6-11, the proposed bus transit system services primarily the downtowns of Portsmouth and Kittery, and Badgers Island. The majority of the origins and destinations identified in the bicycle-pedestrian O&D survey also service these same areas. Five station stops were identified: 1) South end of existing Memorial Bridge on Daniel Street, 2) Portsmouth Downtown area (Market and Bow Street), 3) Kittery downtown (Government and Newmarch Street near entrance to PNSY), 4) U.S. Route 1 at Government and Walker Street (near Gourmet Alley and John Paul Jones Park), and 5) Badgers Island. The final route and stops could be modified if deemed appropriate to better serve Study Area needs.

Since time and convenience are key factors in bus transit system utilization, a convenient 10-minute headway was assumed. The one-way route distance is approximately 2.5 miles and the round trip travel time with stops and recovery was estimated to be 30 minutes. This would require three (3) buses to operate the service with a fourth bus assumed as a spare. Additionally, given the documented high demand of bicycles and pedestrians using the Memorial Bridge for all trip purposes, an 18-hour day (5 am – 11 pm), 365 day per year service was assumed. This length of day service is anticipated to cover the vast majority of all bicycle and pedestrian trips crossing the Memorial Bridge.

Results of Proposed Bus Transit System Analysis

The following section summarizes the estimated percent of existing bicycle and pedestrian trips that were calculated to shift to the proposed bus transit system. First, current trip times from trip lengths for bicycles and pedestrians were developed based on the weekday data available from the bicycle and pedestrian origin and destination survey. Understanding trip time was essential in determining which trip purposes might shift to bus transit vs. either eliminating the trip across

the river altogether or maintaining their current mode via the Sarah Mildred Long Bridge. Next, weekday bicycle-pedestrian origin and destination data was summarized to determine the percentage of each trip purpose, by trip mode (bicycle or pedestrian), that currently crosses the Memorial Bridge. Then, the likelihood that the various trip purposes would shift to the proposed bus transit system was estimated. These estimates were based on engineering judgment regarding trip purpose and origin or destination data. Finally, the total percentage of trips that would shift to the proposed bus transit system was determined by multiplying the estimated shift percentages by the number of bicycle and pedestrian trips by trip type. This yielded the estimated number of potential trips to shift which were then divided by the total number of trips.

Table 6-12 summarizes the estimated percent of bicycle and pedestrian trips to shift to the proposed bus transit system.

Table 6-12
Estimated Percent of Bicycle and Pedestrian Trips to Shift to Transit

Purpose	Bicycle	Pedestrian	Total
Exercise	0%	0%	0%
Food	0%	100%	60%
Home	100%	100%	100%
Personal Business	0%	100%	69%
Recreation/Leisure	42%	33%	38%
Shopping	0%	100%	100%
Work	33%	100%	74%
Totals	26%	67%	52%

From Table 6-12, 52 percent of the existing bicycle-pedestrian trips crossing the Memorial Bridge were estimated to shift to the proposed bus transit system. Bicycles accounted for 26 percent of these trips, while pedestrians comprised a greater percentage at 67 percent.

Additional information regarding Multimodal Evaluation tasks and associated findings can be found in the following documents included with this Study Report:

- ***Appendix #4 – Multi Modal Existing Conditions.***
- ***Appendix #16 – Pedestrian Bicycle Assessment with Memorial Closed***.
- ***Appendix #25 - Multi Modal Evaluation***.
- ***Appendix #32 - Transit Alternative Assessment***.
- ***Appendix #42 - Connections Pedestrian and Bicycle Origin and Destination Survey, Summary Report***.

6.7. AIR QUALITY ANALYSIS

The section summarizes the potential future highway air quality impacts of the 2035 No Build Alternative (Memorial Bridge closed) and the 2035 Build Alternative conducted as part of this study. The air quality analysis assumes that both the Memorial Bridge and Sarah Mildred Long Bridge are open with two lanes. Based on a review of the 2035 traffic operational analysis

results, the two lane bridge options were selected for air quality analysis purposes since they provide a more conservative (congested) assessment of impacts for air quality conditions than four lane bridge options. Impacts associated with four lane bridge options would be less than determined herein for the two lane bridge options.

This assessment conducted a local (microscale) air quality analysis to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) by evaluating air quality impacts of 2035 No Build and Build conditions. The analysis also evaluated air quality impacts associated with the 2009 Existing Condition. The local or hotspot analysis evaluated carbon monoxide (CO) and particulate matter (PM). The air quality study assumes that if the 2035 Build Alternative that was selected for analysis purposes (the Alternative with the highest traffic demands and delays) meets the NAAQS, then all other alternatives would have lower concentrations and can be assumed to also meet the NAAQS. The Study Area is within the Ozone Maintenance area for Maine and New Hampshire.

Methodology

The microscale analysis evaluated air quality impacts associated with the project for the 2009 Existing Condition and 2035 No Build and 2035 Build Alternatives. The pollutants of concern included CO, PM_{10} and $PM_{2.5}$ concentrations at the most congested intersection, based upon traffic in the Study Area. The intersection selected for microscale air quality modeling was selected following the procedures outlined by the EPA guidelines[12]. These procedures require that the intersections be ranked by their levels of service (LOS) and their total traffic volumes and that the air quality analysis model the highest ranked intersection. The intersection of Congress Street at Maplewood Street in Portsmouth was selected for the analysis because it was the most congested intersection in the Study Area. The air quality results calculated at this intersection represent the highest concentrations within the Study Area and it is expected that concentrations at other locations would be lower than this representative intersection.

Results

The results of the air quality analysis demonstrate that all of the pollutant (CO, $PM_{2.5}$ and PM_{10}) concentrations for the 2009 Existing, and 2035 No-Build and Build Alternatives meet the NAAQS. The 1-hour and 8-hour CO values are well below the NAAQS standard of 35.0 ppm and 9 ppm respectively, and are consistent with the City of Portsmouth‘s designation as a CO Maintenance Area. Similarly, the values for 24-hour PM_{10}, 24-hour $PM_{2.5}$ and annual $PM_{2.5}$ are also well below the NAAQS standard of 150 ug/m^3, 35 ug/m^3 and 15 ug/m^3 respectively.

The results also show that projected concentrations at the study receptor locations are similar under the future 2035 No-Build and Build Alternatives. The projected PM concentrations are virtually the same between the No-Build and Build Alternatives. The 2035 Build Alternative CO concentrations are generally slightly less than the 2035 No Build Alternative.

[12] *Guidelines for Modeling Carbon Monoxide from Roadway Intersection*, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Technical Support Division; Research Triangle Park, NC; EPA-454/R-92-005; November 1992.

Additional information regarding Air Quality analysis and associated findings can be found in the following document included with this Study Report:

- ***Appendix #24 - Future Air Quality Analysis.***

6.8. NOISE ANALYSIS

The section provides a summary of the highway traffic noise analysis performed for this study. This includes noise background, noise criteria, noise monitoring methodology, existing condition sound levels.

Background

Sound (noise) is described in terms of loudness, frequency, and duration. Loudness is the sound pressure level measured on a logarithmic scale in units of decibels (dB). For community noise impact assessment, sound level frequency characteristics are based upon human hearing, using an A-weighted (dBA) frequency filter. The A-weighted filter is used because it approximates the way humans hear sound. The most common way to account for the time varying nature of sound (duration) is through the equivalent sound level measurement, referred to as L_{eq}. The L_{eq} averages the background sound levels with short term transient sound levels and provides a uniform method for comparing sound levels that vary over time. The time period used for highway noise analysis is typically one hour. The peak hour L_{eq} represents the noisiest hour of the day or night and usually occurs during the peak periods of automobile and truck traffic. FHWA guidelines and criteria require the use of the one hour L_{eq} for assessing highway traffic noise impacts on different land uses.

The following general relationships exist between hourly highway traffic noise levels and human perception:

- A 1 or 2 dBA increase/decrease is not perceptible to the average person;
- A 3 dBA increase/decrease is a doubling/halving of acoustic energy, but is just barely perceptible to the human ear; and
- A 10 dBA increase/decrease is a tenfold increase/decrease in acoustic energy, but is perceived as a doubling/halving in loudness to the average person.

Noise Abatement Criteria

Highway traffic noise can adversely affect common human activities, such as communication. FHWA has established Noise Abatement Criteria (NAC) to help protect the public health and welfare from excessive highway traffic noise. Recognizing that different areas are sensitive to noise in different ways, the NAC varies according to land use. The FHWA NAC is described in Table 6-13. MaineDOT and NH DOT endorse the FHWA procedures and consider highway traffic noise impacts to occur when existing or future sound levels approach (within 1 dBA), are at, or exceed the NAC.

Table 6-13
Noise Abatement Criteria (NAC) One-Hour, A-Weighted Sound Levels (dBA)

Activity Category	$L_{eq}(h)$*	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purposes.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

* $L_{eq}(h)$ is an energy-averaged, one-hour, A-weighted sound level in decibels (dBA).

Source: 23 CFR Part 772 from the Code of Federal Regulations (CFR) - *Procedures for Abatement of Highway Traffic Noise and Construction Noise.*

Methodology

This highway traffic noise analysis evaluated the traffic data in the Study Area to determine the time period that the highest sound levels are expected to occur. Traffic data was reviewed to identify the peak traffic hours of the day. This review of the traffic data revealed that the highest traffic volumes occurred during the weekday evening peak hours. It is important to note that the various intersections throughout the Study Area peak at different times during the weekday evening peak period. As such, the individual intersection peak hour volumes were used in the noise evaluation.

A noise monitoring program was conducted to establish existing peak hour sound levels at eight noise monitoring locations within the Study Area. All noise monitoring data was conducted using a type one noise monitor (Larson Davis – Model 824) in conformance with the FHWA noise monitoring guidelines[13]. These sound level values were used to calibrate the noise model and to help establish existing conditions. All existing and future sound levels were calculated using the FHWA's approved highway noise model, the Traffic Noise Model (TNM) 2.5[14]. The TNM input data includes peak hour traffic volumes, vehicle mix, vehicle speeds, and roadway and receptor geometry. The future sound level predictions are based on the weekday evening peak hour traffic data. The noise analysis calculated the sound levels at each receptor location and compared the results to the existing conditions and the FHWA noise impact criteria.

[13] *Measurement of Highway Related Noise*, US Department of Transportation, Federal Highway Administration FHWA-PD-96-046, May 1996.

[14] Federal Highway Administration's Traffic Noise Model (FHWA TNM) Version 2.5, February 2004.

Existing Conditions

The Study Area was evaluated to identify receptor locations that have outdoor activities and would be sensitive to highway traffic noise, such as residential receptors located within 500 feet from the edge of the major Study Area roadways of U.S. Route 1 Bypass and U.S. Route 1. The Study Area was split into eight sections, four in Kittery and four in Portsmouth.

Sound level data was collected on Wednesday, April 8, 2009 at eight locations within the Study Area during the evening peak hour period. The dominant noise sources observed included general traffic and truck traffic on major Study Area roadways, predominantly I-95, U.S. Route 1 Bypass, and U.S. Route 1. The measured noise levels are presented in Table 6-14.

Table 6-14
Noise Monitoring Data

Monitoring Location	Measured Sound Level (dBA)
Kittery, ME	
M1-Oak Terrace - western cul-de-sac	55
M2-Bridge Street / Oak Terrace – at Condos	62
M3-Commercial Street – half way between Government Street & Water Street	50
M4-Badgers Island West - east end of cul-de-sac	53
Portsmouth, NH	
M5-Albacore Park - northwest corner of parking lot	56
M6-Northwest Street - between #136 and #76	61
M7-High Street - southwest corner of High Street & Hilton Connector	53
M8-Court Street - 100 feet south of Atkinson Street	60

The results of the noise monitoring indicated that the sound levels in the Study Area range from approximately 50 to 62 dBA. All of these sound levels are below the NAC for residential land uses of 66 dBA, i.e. are not within 1 dBA of Activity Category B (67 dBA) as defined in Table 6-13. The existing sound level data were used to calibrate the TNM to accurately predict highway traffic sound levels throughout the Study Area.

Existing and Future Sound Levels (Modeled)

The TNM was used to calculate the existing and future sound levels at all the receptor locations in the Study Area based upon roadway geometry, traffic volumes, and vehicle speeds. Table 6-15 summarizes the 2009 Existing, 2035 No Build, and 2035 Build modeled sound levels.

Table 6-15
Modeled Sound Levels

No.	Monitoring Location	2009 Existing (dBA)	2035 No Build (dBA)	Delta 2035 No Build to 2009 (dBA)	2035 Build (dBA)	Delta 2035 Build to 2009 (dBA)
	Kittery, ME					
R1(M)	Oak Terrace	56.8	58.0	1.2	57.9	1.1
R2(M)	Bridge Street / Oak Terrace	59.3	60.5	1.2	60.4	1.1
R3(M)	Commercial Street	51.6	50.0	-1.6	52.4	0.8
R4(M)	Badgers Island (west)	54.2	55.8	1.6	54.9	0.7
R5	Juniper Point/Prince Avenue	50.6	51.9	1.3	51.8	1.2
R6	Main Street / E Street	51.6	52.3	0.7	52.5	0.9
R7	Love Lane	55.4	56.0	0.6	56.7	1.3
	Portsmouth, NH					
R8(M)	Albacore Park	58.3	59.6	1.3	59.5	1.2
R9(M)	Northwest Street	60.6	61.9	1.3	61.9	1.3
R10(M)	High Street	54.0	55.0	1.0	54.7	0.7
R11(M)	Court Street	57.7	57.7	0.0	57.7	0.0
R12	Mill Pond Way	57.5	58.0	0.5	58.0	0.5
R13	Prescott Park	46.1	46.0	-0.1	46.7	0.6

Source: TNM by VHB.
2035 No Build: U.S. Route 1 Memorial Bridge closed.
2035 Build: U.S. Route 1 Memorial Bridge reopens with two travel lanes.

The modeled 2009 Existing sound levels ranged from 46.1 to 60.6 dBA. The 2009 Existing condition was compared to two future conditions: the 2035 No Build Alternative (Memorial Bridge closed) and the 2035 Build Alternatives (Memorial Bridge and Sarah Mildred Long Bridge open with the two lane option). Traffic volumes and roadway geometrics were adjusted to reflect the future year conditions.

Conclusions

Study Area modeled sound levels were determined to range from 46.1 to 60.6 dBA in the 2009 Existing condition and from 46.0 to 61.9 dBA in the 2035 No-Build condition and from 46.7 to 61.9 dBA in the 2035 Build Alternatives conditions. All of the 2035 No-Build and Build Alternative project sound levels resulted in nominal increases in sound over the existing conditions (which are not expected to be perceptible to the average person) and are below the NAC for residential areas. As such, the sensitive noise receptors within the Study Area are not expected to be impacted by highway traffic noise associated the alternatives being considered in this study. Therefore, no highway noise mitigation was determined to be required at this time.

Additional information regarding Noise analysis and associated findings can be found in the following documents included with this Study Report:

- ***Appendix #12 – Existing Conditions Noise***.
- ***Appendix #22 - Future Noise Conditions.***

6.9. NATURAL RESOURCE IMPACT EVALUATION

The natural resource impact evaluation assessed the impact to natural resources for each alternative. The natural resources analyzed included:

- River water quality impacts;
- Natural areas, terrestrial and aquatic habitat;
- Threatened and endangered species;
- Special aquatic sites including wetlands; and
- Floodplains/floodways.

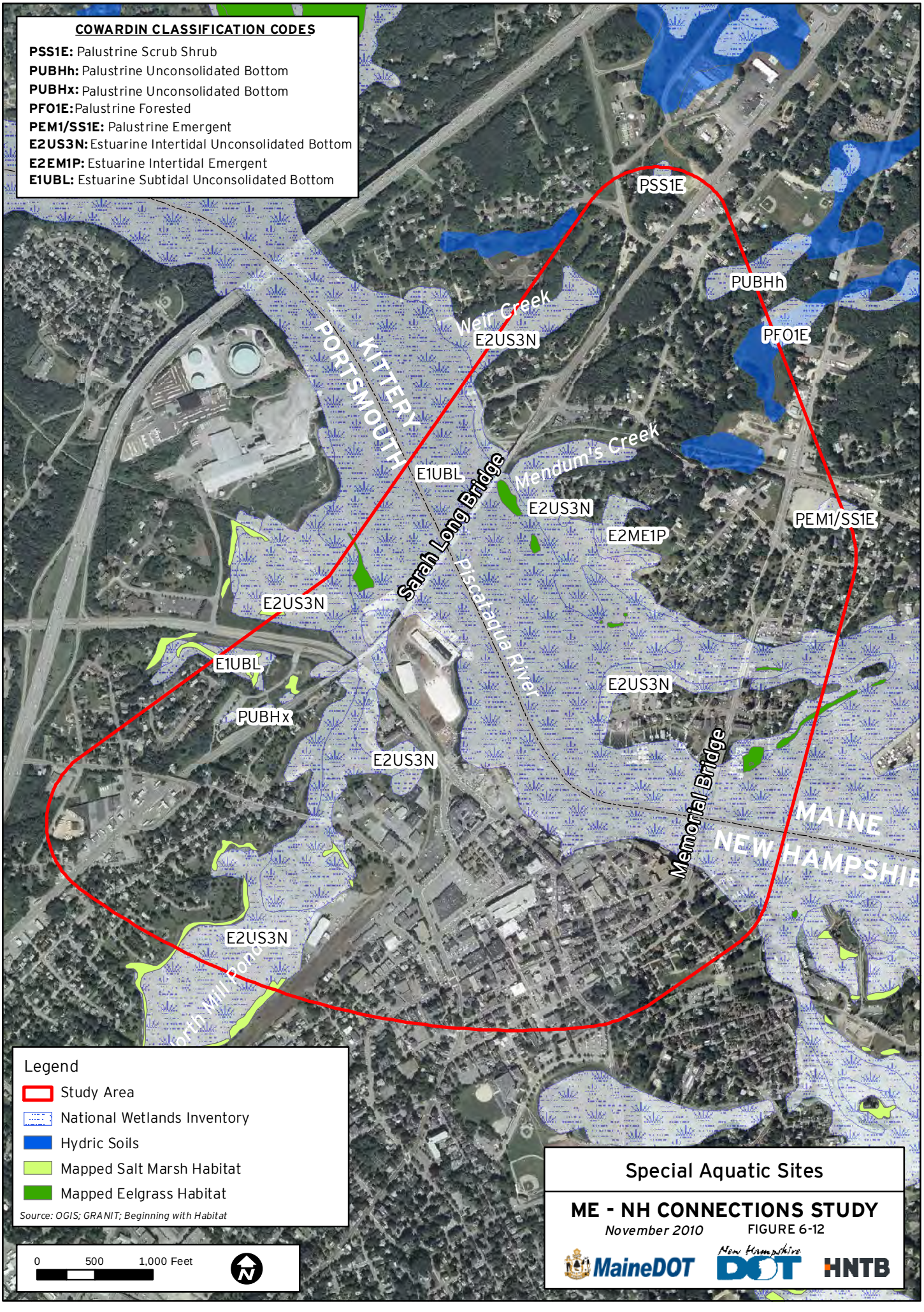
Existing natural resources in the Study Area are illustrated on the following figures: Figures 6-12 (Special Aquatic Sites); 6-13 (Surface Waters and Groundwater Features); 6-14 (Natural Communities); 6-15 (FEMA Special Flood Hazard Areas); and, 6-16 (Geology).

SPECIAL AQUATIC SITES EVALUATION

Special aquatic sites were mapped using GIS data layers available from New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT) and the Maine Office of Geographic Information Systems (MEGIS) as well as information from the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) web soil survey. United States Geological Survey (USGS) Quad maps were reviewed, and a windshield survey was conducted. The municipal offices in both Kittery and Portsmouth were also consulted regarding wetland resources. As shown on Figure 6-12, Special Aquatic Sites, the Memorial Bridge and Sarah Mildred Long Bridge cross the Piscataqua River, a near-coastal estuarine system. As shown on Figure 6-14, salt marches are mapped at several locations within the Study Area, with one near the Sarah Mildred Long Bridge approach in Portsmouth.

An area of mapped eelgrass habitat is located east (downstream) of the Memorial Bridge on the Maine shore of the Piscataqua River. Two other mapped eelgrass areas are located in the vicinity of the Sarah Mildred Long Bridge: one area east (downstream) of this bridge on the Maine shore and one area west (upstream) of this bridge on the New Hampshire shore. Other special aquatic sites, such as National Wetland Inventory (NWI) wetlands and mapped saltmarsh habitat exist within the Study Area. Hydric soils are present in the Study Area, but not in close proximity to any of the remaining alternatives.

In order to determine preliminary impacts, the GIS map data were layered over aerial photos and the conceptual designs. In addition to estimating potential permanent impacts, temporary impacts to the Piscataqua River as related to the number of new bridge piers to be placed in the river or existing bridge piers to be removed from the river were also identified for each


COWARDIN CLASSIFICATION CODES
PSS1E: Palustrine Scrub Shrub
PUBHh: Palustrine Unconsolidated Bottom
PUBHx: Palustrine Unconsolidated Bottom
PFO1E: Palustrine Forested
PEM1/SS1E: Palustrine Emergent
E2US3N: Estuarine Intertidal Unconsolidated Bottom
E2EM1P: Estuarine Intertidal Emergent
E1UBL: Estuarine Subtidal Unconsolidated Bottom
PSS1E
PUBHh
PFO1E
PEM1/SS1E
E2US3N
E1UBL
E2ME1P
PUBHx
Weir Creek
Mendum's Creek
PORTSMOUTH
KITTERY
Sarah Long Bridge
Piscataqua River
Memorial Bridge
MAINE
NEW HAMPSHIRE
Legend
Study Area
National Wetlands Inventory
Hydric Soils
Mapped Salt Marsh Habitat
Mapped Eelgrass Habitat
Source: OGIS; GRANIT; Beginning with Habitat
0
500
1,000 Feet
N
Special Aquatic Sites
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-12
MaineDOT
New Hampshire DOT
HNTB

alternative. The potential wetland impacts are broken down by Cowardin Classification Codes.

THREATENED AND ENDANGERED SPECIES EVALUATION

The threatened and endangered species evaluation documented known occurrences of threatened and endangered species and significant wildlife habitat based on GIS data layers available from NH GRANIT and MEGIS, maps and publications from the Maine Department of Conservation, New Hampshire Fish and Wildlife, New Hampshire Natural Heritage Bureau, Maine Department of Inland Fisheries and Wildlife, and Maine Wildlife and Natural Areas Program. U.S. Fish and Wildlife Service (USFWS) Maine and New Hampshire field offices were contacted and both noted that there are no federally listed species in the Study Area, but the Maine division noted that the New England Cottontail, a candidate species, does occur within the Study Area. The New Hampshire field office listed the following potential species: eastern cougar, gray wolf and puritan tiger beetle have been listed as extirpated in New Hampshire. Gray wolf is not known to be present in New Hampshire, however populations from Canada may occur and there is no federally designated critical habitat in the State of New Hampshire.

The National Marine Fisheries Service (NMFS) guide to Essential Fish Habitat (EFH) designation identified EFH in and surrounding the Study Area for the following species: Atlantic salmon, Atlantic cod, haddock, Pollock, whiting, red hake, white hake, winter flounder, yellowtail flounder, windowpane flounder, American plaice, Atlantic halibut, Atlantic sea scallop, Atlantic sea herring, bluefish, Atlantic mackerel and bluefin tuna. However, further communication and coordination with the NMFS Protected Resources Division indicated that there are no species listed or designated critical habitat under the jurisdiction of NMFS that are known to occur in the Study Area. In addition, the Protected Resources Division commented that there is no designated critical habitat or essential fish habitat for Atlantic salmon in the Piscataqua River. The New Hampshire state list of threatened and endangered species provided by New Hampshire Fish and Game lists several threatened and endangered species that may be present in the Study Area: Blanding‘s turtle and shortnose sturgeon are listed as endangered. Communications with NMFS indicate there have been no recorded incidents of shortnose sturgeon spawning or migrating into or within the Piscataqua River, nor has foraging, overwintering or resting habitat been documented in the Piscataqua River. Per the Wednesday, October 6, 2010 Federal Register, Volume 75, No. 193, NMFS has proposed that Atlantic Sturgeon be listed as a threatened species in the Gulf of Maine, including the Piscataqua River. Bald eagle and peregrine falcon are listed as threatened in New Hampshire. Other species that are listed as threatened and have the potential to be found in the Study Area are bridle shiner and spotted turtle.

SURFACE WATERS AND GROUNDWATER EVALUATION

This evaluation documented existing surface water, groundwater and drinking water resources within the Study Area. Resource data was collected from MEGIS and NH GRANIT. No aquifers or public drinking water wells are located in the Study Area. As shown on Figure 6-13,

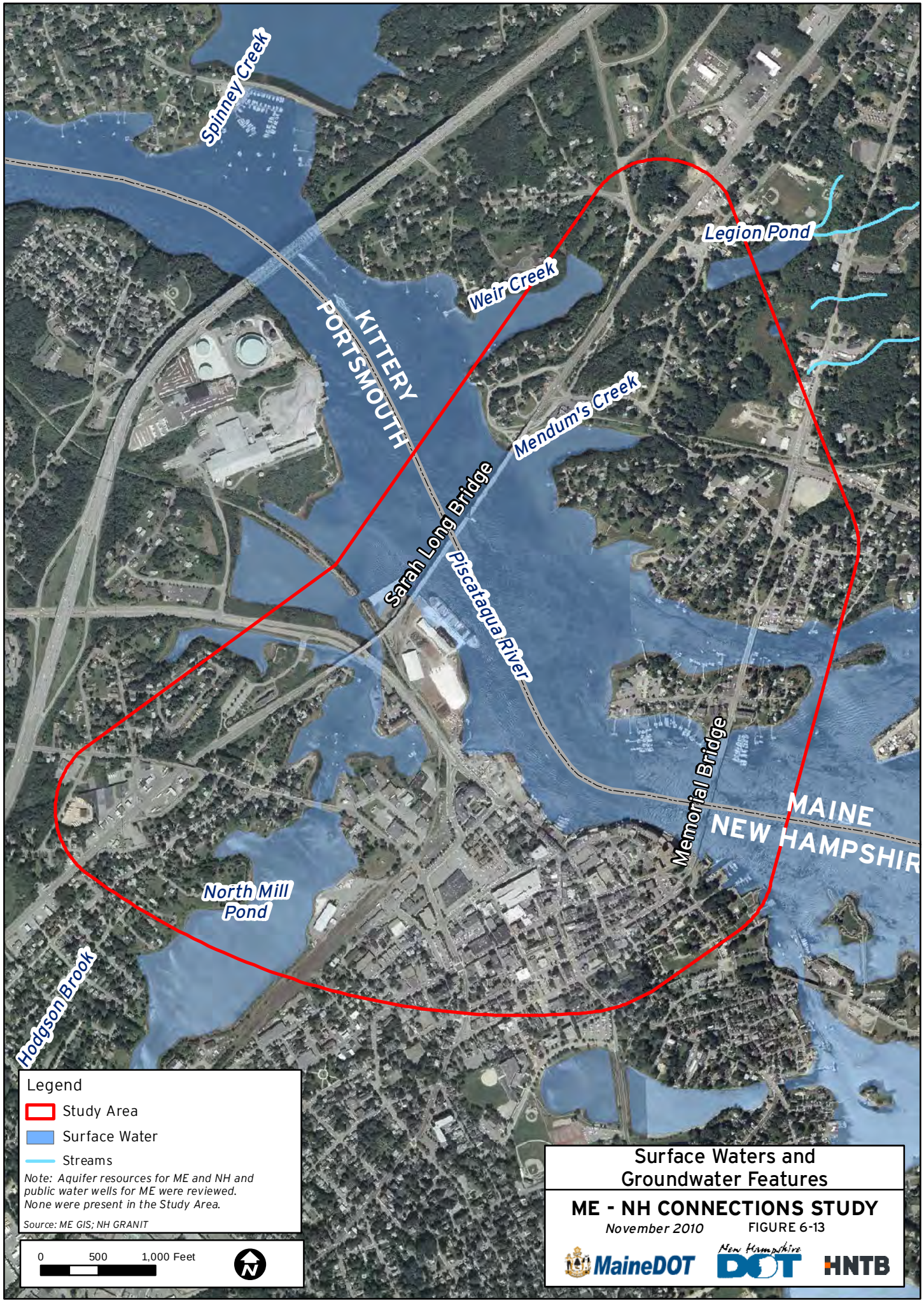
surface waters in the vicinity of the Memorial Bridge and the Sarah Mildred Long Bridge include the Piscataqua River; Mendum‘s Creek, Legion Pond, and Weir Creek in Kittery; and, North Mill Pond in Portsmouth. The Piscataqua River, which defines the boundary between Portsmouth and Kittery, is an estuarine river in the Study Area. The Study Area is approximately three miles upstream from the ocean outlet at Portsmouth Harbor. North Mill Pond is located within the Study Area on the north side of Portsmouth and is considered a Great Pond and is given additional protection in the State of New Hampshire as a public waterbody and is subject to the provisions of the Comprehensive Shoreland Protection Act (NH RSA 483-B). It is a 58.9 acre salt water pond that is fed by the tidal waters of the Piscataqua River and by the freshwater flow of Hodgson Brook. In Kittery there are several small ponds in the north of the Study Area. Legion Pond, located on the northeast edge of the Study Area, is a 4.5 acre pond that is surrounded by residential development. There are two smaller ponds to the east of Legion Pond as well as tributaries that connect the ponds. Two tributaries drain into Legion Pond and one drains Legion Pond to the Piscataqua River. At the Piscataqua River in Kittery there are two inlets, Mendum‘s Creek and Weir Creek.

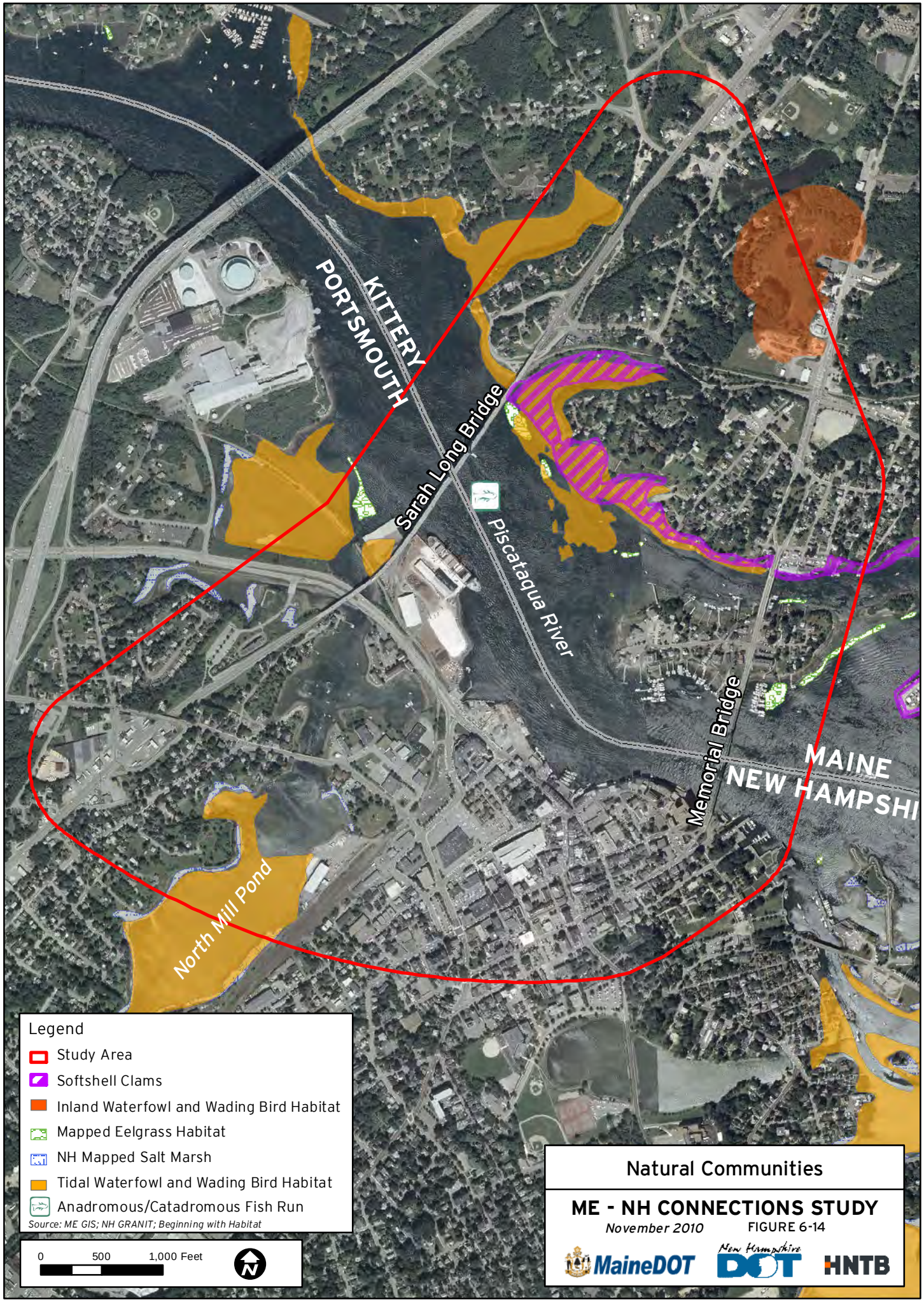
NATURAL AREAS, TERRESTRIAL, AND AQUATIC HABITAT EVALUATION

This evaluation described existing natural areas, terrestrial habitats and aquatic habitats within the Study Area. Sources of information, including the New Hampshire Wildlife Action Plan (2006) and the Beginning with Habitat program in Maine were used to identify the natural communities within the Study Area. Data layers from NH GRANIT and MEGIS were also reviewed. The Beginning with Habitat program, a part of the Maine Department of Inland Fisheries and Wildlife, compiles habitat information from multiple sources to create one source of information about habitat of statewide and national importance. The Study Area includes mostly developed lands. Several tidal waterfowl and wading bird habitats exist within the Study Area including an area along the Portsmouth shore adjacent to the Sarah Mildred Long Bridge and an area along the Kittery shore of the Piscataqua River at both the Memorial and Sarah Mildred Long Bridge locations. This latter area is also designated softshell clam habitat. An inland waterfowl and wading bird habitat is located to the north of the Study Area in Kittery.

The Piscataqua River is listed as an anadramous and catadramous fish run. The area surrounding the Piscataqua River is mapped as riparian habitat, and has a 250-foot wide shoreland protection zone surrounding it. The Piscataqua River is mapped as a high value habitat for priority trust species according to the USFWS. Priority trust species are species that regularly occur in the Gulf of Maine and meet one of the following criteria: are federally endangered, threatened or candidate species, are migratory birds, sea-run fish or marine fish that show significant and persistent declining population, have been identified by multiple states in the Gulf of Maine watershed as threatened or endangered, or are identified as a species of concern by U.S. Shorebirds Conservation Plan, Colonial Waterbird Plan or Partners in Flight.

Vernal pool data from MEGIS and NH GRANIT indicate no vernal pools in the Study Area.


Spinney Creek
Legion Pond
Weir Creek
KITTERY
PORTSMOUTH
Mendum's Creek
Sarah Long Bridge
Piscataqua River
Memorial Bridge
MAINE
NEW HAMPSHIR
North Mill Pond
Hodgson Brook
Legend
Study Area
Surface Water
Streams
Note: Aquifer resources for ME and NH and public water wells for ME were reviewed. None were present in the Study Area.
Source: ME GIS; NH GRANIT
0
500
1,000 Feet
N
Surface Waters and Groundwater Features
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-13
MaineDOT
New Hampshire DOT
HNTB


KITTERY
PORTSMOUTH
Sarah Long Bridge
Piscataqua River
Memorial Bridge
MAINE
NEW HAMPSHI
North Mill Pond
Legend
Study Area
Softshell Clams
Inland Waterfowl and Wading Bird Habitat
Mapped Eelgrass Habitat
NH Mapped Salt Marsh
Tidal Waterfowl and Wading Bird Habitat
Anadromous/Catadromous Fish Run
Source: ME GIS; NH GRANIT; Beginning with Habitat
0
500
1,000 Feet
N
Natural Communities
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-14
MaineDOT
New Hampshire DOT
HNTB

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) – SPECIAL FLOOD HAZARD AREA EVALUATION

This analysis evaluated documented floodplain and flood hazard areas from the FEMA map service center and FEMA Geographic Information System data layers available from NH GRANIT and MEGIS. FEMA definitions for flood zones found within the Study Area are as follows:

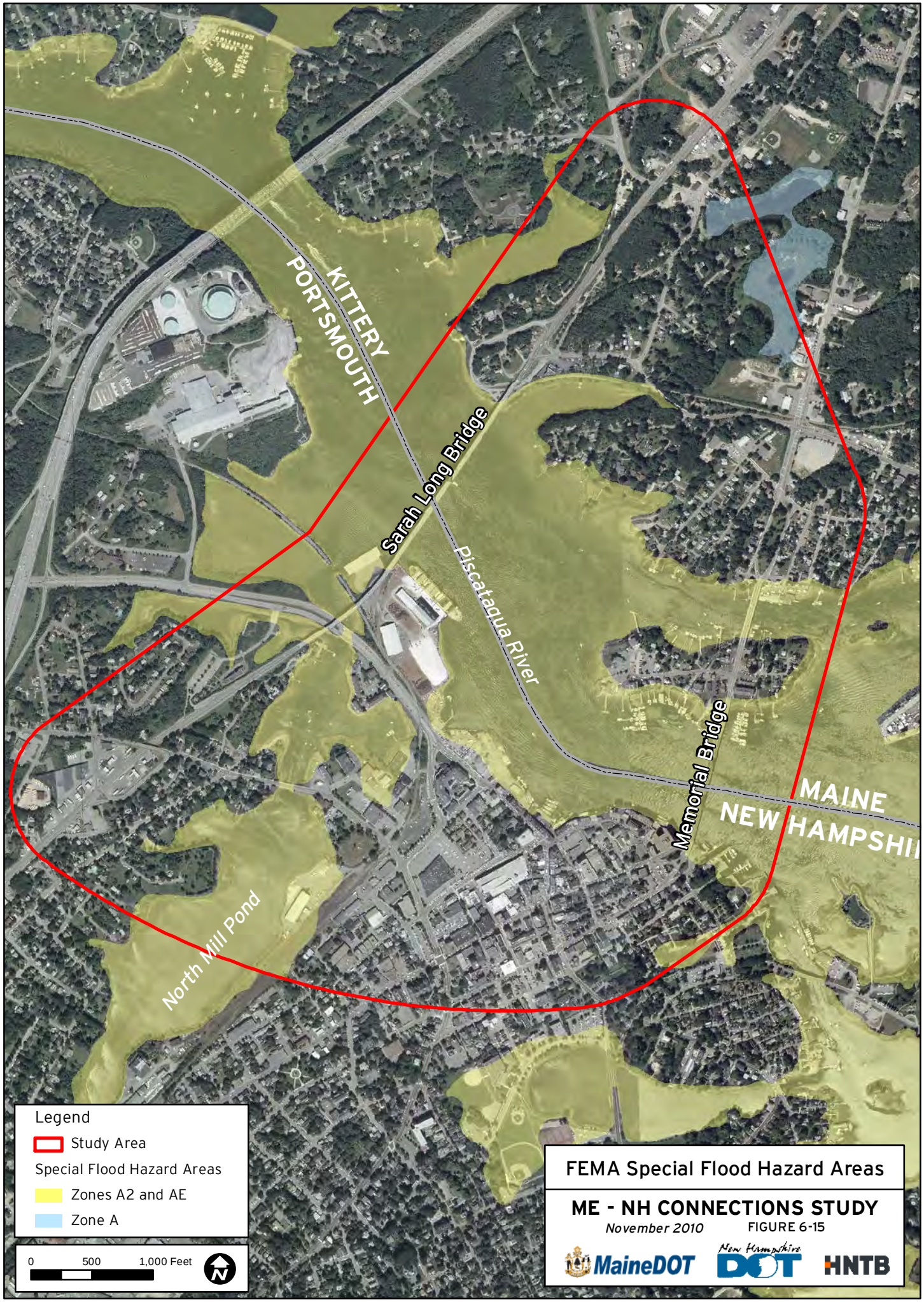
- Zone A – Special Flood Hazard Area inundated by the 100 year flood, determined by approximate method. No base flood elevation or flood hazard factors determined.
- Zone A2 – This is a numbered A Zone. Special Flood Hazard Area inundated by the 100 year flood, determined by detailed method. Base flood elevations shown and zones subdivided by flood hazard factors.
- Zone AE – Special Flood Hazard Area inundated by the 100 year flood, determined by detailed method. Base flood elevations shown and zones subdivided by flood hazard factors. AE Zones are now used on new format Flood Insurance Rate Maps (FIRMs) instead of numbered A Zones.

As shown on Figure 6-15, the Piscataqua River special flood hazard area includes the river and extends inland on both the Portsmouth and Kittery shorelines. In Portsmouth, the special flood hazard area is Zone AE with a base flood elevation of 9 feet as referenced to the National Geodetic Vertical Datum (NGVD) of 1929. The Zone AE area generally follows the shoreline except for two areas. The area extends past the shoreline of the Piscataqua River on the west side of the Study Area where the floodplain extends to include all of North Mill Pond and its shoreline. On the south side of the Study Area the Zone AE area extends away from the shoreline towards Washington Street near the Strawbery Banke Historic District.

In the Study Area in Kittery, there are two special flood hazard areas; a Zone A2 area surrounding the Piscataqua River and a Zone A area further north. The Zone A2 area has a base flood elevation of 9 feet as referenced to NGVD 1929 and generally follows the shoreline of the Piscataqua River. The Zone A2 area extends into a small inlet to the east of Route 1 that stops at Government Street. The Zone A area is in the northern part of the Study Area. The Zone A area includes Legion Pond and another small pond. It also includes several small unnamed tributaries that drain the area.

PHYSICAL GEOGRAPHY, SOILS, AND GEOLOGY EVALUATION

The evaluation documented information regarding the physical geography, soils and geology of the Study Area. Sources of information include the Web Soil Survey and Geographic Information Systems and soil layers available from the USDA and NRCS. Geological information from the New Hampshire and Maine Geological Surveys was also collected to document the bedrock, surficial geology and other geological features within the Study Area, as shown on Figure 6-16. In Portsmouth ground elevation ranges from approximately 10 feet at the


KITTERY
PORTSMOUTH
Sarah Long Bridge
Piscataqua River
Memorial Bridge
MAINE
NEW HAMPSHI
North Mill Pond
Legend
Study Area
Special Flood Hazard Areas
Zones A2 and AE
Zone A
0
500
1,000 Feet
N
FEMA Special Flood Hazard Areas
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-15
MaineDOT
New Hampshire DOT
HNTB

shoreline of the Piscataqua River and along the shores of North Mill Pond to 50 feet in the southwest corner of the Study Area. In Kittery, ground elevation ranges from 10 feet at the shoreline of the Piscataqua River to a high point of 60 feet just east of Interstate 95. Although there is some topographical relief in the Study Area, the topography is generally flat and representative of a low coastal area.

In Portsmouth, soils are mostly described as Urban land or Urban land-Canton complex. Urban land is an area where most of the surface is covered by urban structures. The Urban land-Canton complex is a gravelly fine sandy loam. There are also small areas of Chatfield-Hollis-Canton complex. This is a fine sandy loam to gravelly fine sandy loam.

In Kittery, soils are mostly described as Urban land and Lyman fine sandy loam. Urban land is an area where most of the surface is covered by urban structures. The Study Area also has some small areas of Biddeford Mucky Peat. The majority of soils in the Study Area are well drained to somewhat excessively well drained. There are small areas of Biddeford Mucky Peat in York County that are very poorly drained. Lyman fine sandy loam is a somewhat excessively drained soil. York County also contains some inclusions within the Lyman fine sandy loam that are well drained and somewhat excessively drained Hermon soils, moderately well drained Scio and Skerry soils, and somewhat poorly drained and poorly drained Brayton soils.

In Rockingham County there are no prime farmland soils within the evaluation and analysis Study Area. In York County the Lyman fine sandy loam with 3 to 8 percent slopes is considered a farmland soil of statewide importance. This type of farmland soil is protected by the Farmland Protection Policy Act (FPPA), which seeks to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses, even when active agricultural activities are not currently on-going.

Additional information regarding natural resource impact evaluation and associated findings can be found in the following documents included with this Study Report.

- ***Appendix #34 – Special Aquatic Sites Impact Memo***
- ***Appendix #35 – Endangered Species Impact Memo***
- ***Appendix #37 – Surface Water Resource Impact Tech Memo***
- ***Appendix #38 – Habitat Resource Impact Tech Memo***
- ***Appendix #39 - FEMA Resource Impact Tech Memo***
- ***Appendix #40 - Physical Geography, Soils and Geology***

6.10. PHYSICAL RESOURCE IMPACT EVALUATION

The physical resource impact evaluation measured the impact of each Build Alternative and included:

- Impacts to neighborhoods;
- Impacts to community resources (publicly owned property);
- Impacts to commercial properties; and

- Impacts to residential properties.

This evaluation documented the potential physical resource impacts of the alternatives that remained after the fatal flaw analysis. Property data for Portsmouth was collected from the Portsmouth Assessor‘s Department, Portsmouth Department of Public Works, and the Portsmouth Planning Department and is up to date as of September 2009.

Property data for Kittery was collected from the Kittery Assessor‘s Department and the Kittery Planning Department and is up to date as of April 2009. This property data was collected in GIS and Microsoft Excel format and was overlaid with the conceptual design alternatives to determine areas of impact. An area of impact was defined as an area where the edge of slope line (also known as ―limit of disturbance”) falls outside of the existing road right-of-way. The GIS property lines that were used are for planning purposes only and all potential impacts are approximate.

Figures 6-17 and 6-18 identify the community facilities within the Study Area.

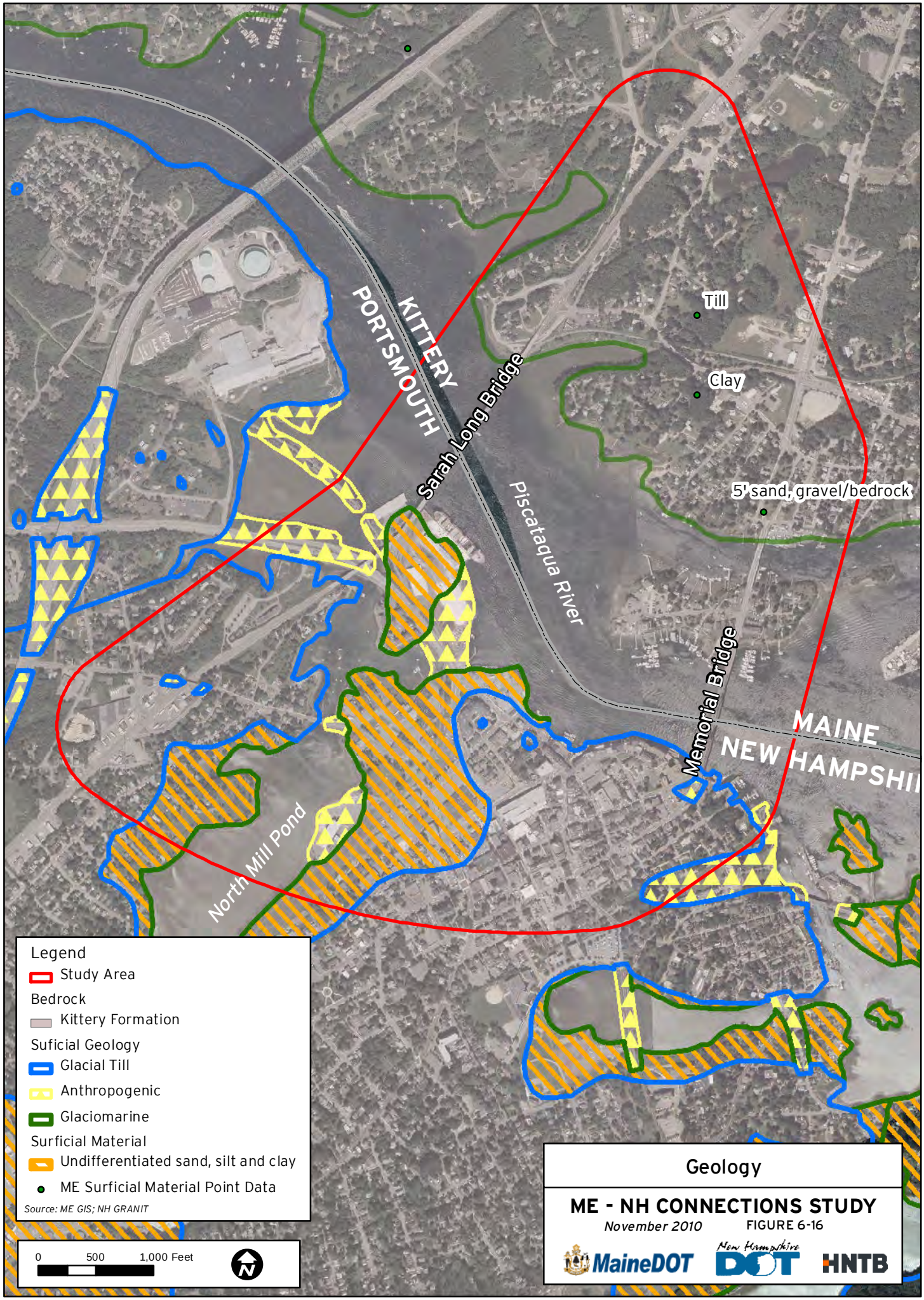
Additional information regarding Physical Resource Impact evaluation and associated findings can be found in the following document included with this Study Report:

- ***Tech Memo #36 - Property Resource Impact Tech Memo***.

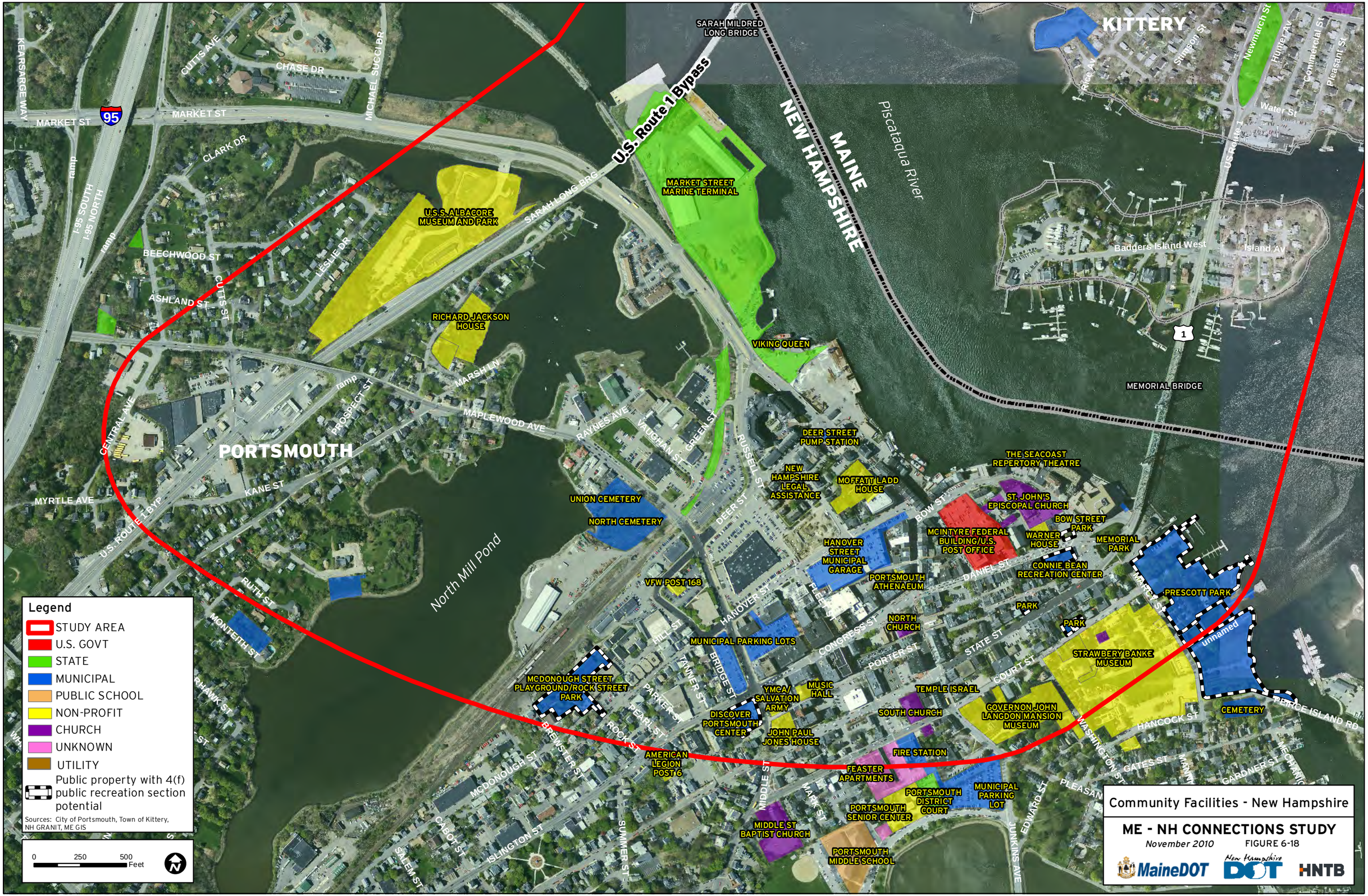
6.11. LAND USE IMPACT EVALUATION

The land use impact evaluation assessed each alternative‘s impact to existing zoning and activity centers in both communities within the Study Area. This included evaluation of existing land use maps, zoning maps, comprehensive plans, and current and planned activity centers. This analysis also evaluated existing socio-economic conditions and provided future housing, population, and job growth forecasts for the Study Area in the Year 2035.

Background data and trends on population, households and employment were collected from the City of Portsmouth Master Plan, 2000, Town of Kittery Comprehensive Plan, 1999 as well as in consultation with the Planners from each community. In addition, U.S. Census 1990 and 2000 data was collected at the block level and aggregated to the Traffic Analysis Zones (TAZ) level in the Study Area. To estimate current 2007/2008 base conditions for population and households, each community‘s share of the American Community Survey (ACS) estimates at the County Level were applied. Employment estimates were obtained from the State of Maine Department of Labor for Kittery and from the New Hampshire Department of Labor for Portsmouth. The employment estimates were then allocated proportionally to each TAZ based on the community‘s share of employment and in consultation with the community planners and PNSY to validate and adjust findings based on local knowledge. In 2007, Kittery‘s population was estimated at 9,987 and projected to increase by 1,964 to 11,951 in 2035 and the population of Portsmouth in 2007, estimated at 21,497 and is projected to increase by 1,544 to 23,041 in 2035.


KITTERY
PORTSMOUTH
Sarah Long Bridge
Piscataqua River
Memorial Bridge
MAINE
NEW HAMPSHI
North Mill Pond
Till
Clay
5' sand, gravel/bedrock
Legend
Study Area
Bedrock
Kittery Formation
Suficial Geology
Glacial Till
Anthropogenic
Glaciomarine
Surficial Material
Undifferentiated sand, silt and clay
ME Surficial Material Point Data
Source: ME GIS; NH GRANIT
0
500
1,000 Feet
N
Geology
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-16
MaineDOT
New Hampshire DOT
HNTB


SEWAGE TREATMENT PLANT
CENTRAL MAINE POWER
South Eliot Rd
Spinney Cove Dr
Penhallow Ln
Old Dennett Rd South
Dennett Rd
Valles Rd
KINGDOM HALL OF JEHOVAH'S WITNESSES
MEMORIAL FIELD
Page St
Old Post Rd
Pinkham Av
Harris Av
Gray Lodge Rd
95
I-95
PISCATAQUA RIVER BRIDGE
Cove Lndg
Walker Av
Adams Ln
Tara Ln
Legion Pond
Red Mill Ln
I-95 SOUTH
I-95 NORTH
Paul St
Cook St
Rudolph Av
KITTERY
COOK PROPERTY
State Rd
Oak Terr
Bridge St
Path Av
Lyndon Wy
Dunlea Av
Hillcrest Av
Lewis Av
George St
Lutts Av
Rogers Rd
Whipple Rd
CHURCH OF CHRIST
Love Ln
Pine St
Wentworth St
Central Av
Jones Av
Dame St
Walker St
Traip Av
Knight Av
Town Lndg
Stoddard St
Church St
Ottis Av
Main St
Gerrish Ct
Old Armory Wy
Commercial St
Pleasant St
Conie Ln
Water St
WALKER STREET FIRE STATION
ST. MARK'S UNITED METHODIST CHURCH
JOHN PAUL JONES MEMORIAL PARK
Hunter Av
OLD TOWN BARN/ DPW STORAGE
Stimpson St
Rice Av
Langton St
Juniper Pt
Prince Av
Mendum Av
RAILROAD RIGHT-OF-WAY
SARAH MILDRED LONG BRIDGE
Piscataqua River
MAINE
NEW HAMPSHIRE
PORTSMOUTH
MICHAEL SUPCIT DR
MEMORIAL BRIDGE
CEMETERY
US Route 1
Badger's Island
Legend
STUDY AREA
U.S. GOVT
STATE
MUNICIPAL
PUBLIC SCHOOL
NON-PROFIT
CHURCH
UNKNOWN
UTILITY
Public property with 4(f) public recreation section potential
Sources: City of Portsmouth, Town of Kittery, NH GRANIT, ME GIS
0 250 500 Feet
Community Facilities - Maine
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-17
MaineDOT
New Hampshire DOT
HNTB


KITTERY
SARAH MILDRED LONG BRIDGE
U.S. Route 1 Bypass
NEW HAMPSHIRE
MAINE
Piscataqua River
MARKET STREET MARINE TERMINAL
U.S.S. ALBACORE MUSEUM AND PARK
SARAH LONG BRG
RICHARD JACKSON HOUSE
VIKING QUEEN
MEMORIAL BRIDGE
Badgers Island West
Island Av
Water St
Rice Av
Simpson St
Newmarch St
Hunter Av
Commercial St
Pleasant St
U.S. Route 1
KEARSARGE WAY
MARKET ST
CUTTS AVE
CHASE DR
MICHAEL SUCCI DR
CLARK DR
I-95 SOUTH ramp
I-95 NORTH ramp
BEECHWOOD ST
LESLIE DR
ASHLAND ST
CUTTS ST
MARSH LN
PROSPECT ST
MAPLEWOOD AVE
RAYNES AVE
VAUGHAN ST
GREEN ST
RUSSELL ST
CENTRAL AVE
PORTSMOUTH
DEER STREET PUMP STATION
THE SEACOAST REPERTORY THEATRE
NEW HAMPSHIRE LEGAL ASSISTANCE
MOFFATT LADD HOUSE
ST. JOHN'S EPISCOPAL CHURCH
BOW ST
BOW STREET PARK
MCINTYRE FEDERAL BUILDING/U.S. POST OFFICE
WARNER HOUSE
MEMORIAL PARK
MYRTLE AVE
KANE ST
U.S. ROUTE 1 BYP
UNION CEMETERY
NORTH CEMETERY
North Mill Pond
HANOVER STREET MUNICIPAL GARAGE
CONNIE BEAN RECREATION CENTER
PORTSMOUTH ATHENAEUM
DANIEL ST
MARCY ST
PRESCOTT PARK
VFW POST 168
HANOVER ST
FLEET ST
CONGRESS ST
NORTH CHURCH
PARK
RUTH ST
MONTEITH ST
HILL ST
MUNICIPAL PARKING LOTS
PORTER ST
STATE ST
COURT ST
STRAWBERY BANKE MUSEUM
unnamed
BRIDGE ST
TANNER ST
MCDONOUGH STREET PLAYGROUND/ROCK STREET PARK
PARKER ST
PEARL ST
YMCA/ SALVATION ARMY
MUSIC HALL
TEMPLE ISRAEL
CEMETERY
PEASE ISLAND RD
DISCOVER PORTSMOUTH CENTER
JOHN PAUL JONES HOUSE
SOUTH CHURCH
GOVERNOR JOHN LANGDON MANSION MUSEUM
HANCOCK ST
WASHINGTON ST
ROCK ST
BREWSTER ST
AMERICAN LEGION POST 6
FIRE STATION
GATES ST
MARNE
GARDNER ST
MCDONOUGH ST
FEASTER APARTMENTS
MIDDLE ST
MARK ST
PORTSMOUTH DISTRICT COURT
MUNICIPAL PARKING LOT
EDWARD ST
PLEASANT
CABOT ST
ISLINGTON ST
SUMMER ST
SALEM ST
MIDDLE ST BAPTIST CHURCH
PORTSMOUTH SENIOR CENTER
PORTSMOUTH MIDDLE SCHOOL
JUNKINS AVE
Legend
STUDY AREA
U.S. GOVT
STATE
MUNICIPAL
PUBLIC SCHOOL
NON-PROFIT
CHURCH
UNKNOWN
UTILITY
Public property with 4(f) public recreation section potential
Sources: City of Portsmouth, Town of Kittery, NH GRANIT, ME GIS
0
250
500
Feet
Community Facilities - New Hampshire
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-18
MaineDOT
New Hampshire DOT
HNTB

Household size for both communities is similar with Kittery averaging 2.29 persons per household for 2000-2007 and Portsmouth averaging 2.04 persons per household in 2000 and 2.13 in 2007. Most employment within the Study Area of Kittery is located on Badgers Island, around Memorial Bridge and along the U.S. Route 1 corridor. Employment within the Study Area of Portsmouth is concentrated along the waterfront between the Sarah Mildred Long and Memorial Bridges, in the historic downtown district and about ½ mile south of the Sarah Mildred Long Bridge in the area served by medical facilities.

The land use of the portion of the Study Area in Kittery is predominately residential adjacent to both the Sarah Mildred Long and Memorial Bridges. Commercial land use in Kittery is focused primarily along U.S. Route 1 and the U.S. Route 1 Bypass approximately ½ mile north of each bridge. Kittery's zoning within the Study Area has a residential focus. Commercial zones in Kittery are located adjacent to the Outlet Malls in the vicinity of the Sarah Mildred Long Bridge and there also is an allowance of low density mixed use development in the vicinity of the Memorial Bridge. The portion of the Study Area located in Portsmouth includes a high degree of dense commercial and residential land uses concentrated along the waterfront and adjacent to the Memorial Bridge. Similar to Kittery, Portsmouth's Study Area zoning is primarily residential along the U.S. Route 1 Bypass. Commercial and mixed use development in Portsmouth is provided in the central business district and in the vicinity of the Memorial Bridge. Areas designated for future commercial growth and investment in the Kittery Study Area are approximately ½ mile north of the Sarah Mildred Long and Memorial Bridges toward the Outlet Mall area. Future residential growth in Kittery is designated on both sides of the Memorial Bridge approaches in the waterfront area. In the Portsmouth Study Area, the focus of commercial growth and investment is directed in the Central Business District and an area along the U.S. Route 1 Bypass ½ mile south of the Sarah Mildred Long Bridge, supporting current land use and zoning practices. Residential areas in Portsmouth are concentrated on the east side of the Sarah Mildred Long Bridge and the east side of the Memorial Bridge and reflect Portsmouth's plans to support current land use patterns. The land use pattern in each municipality reflects a focus and higher density of mixed residential and commercial uses and activity centered around the Memorial Bridge Connection.

Figure 6-19 (Activity Centers – ME), Figure 6-20 (Activity Centers – NH), and Figure 6-21 (Lane Use/Zoning) provide a graphical overview of existing land use features for the Study Area.

Additional information regarding Land Use Impact evaluation and associated findings can be found in the following documents included with this Study Report:

- ***Appendix #8 – Socio Economic Conditions and Future Projections***.
- ***Appendix #9 - Land Use Base Conditions***.

0 0.5 1
Miles

Legend
- Study Area
- Commercial
- Residential

Source: City of Portsmouth; Town of Kittery; ME GIS; NH GRANIT

Route 1 North
Durgin Pines
Kittery Mall Area
236 North
Development Potential
Dennett Road West
Shepherd's Cove
The Circle
KITTERY
Bypass
Shapleigh Rd
Admiralty Village
Gerrish Island Community
Kittery Point
Gourmet Alley
Cooke Street
Kittery Foreside
Shipyard
PORTSMOUTH
MAINE
NEW HAMPSHIRE

Kings Ct
Kelsey Ln
Cutts Rd
I-95
Idlewood Ln
Adams Rd
Picott Rd
Wilson Rd
Route 236
Fernald Rd
Jewett Ln
Manson Rd
Ryle Way
Dexter Ln
US Route 1
Ripley Rd
Ox Point Dr
Dana Ave
Adams Dr
Trafton Ln
Cedar Dr
Zakayla Ln
Lewis Rd
Highpointe Cir
Orelly Ln
Lynch Ln
Cranberry Ln
Pinkhams Ln
Abes Way
Norton Rd
Miller Rd
High Pasture Rd
Bartlett Rd
Charles Hill Rd
Short Farm Rd
Ridgewood Dr
Armour Dr
Martin Rd
Leach Rd
Sunset Dr
Nordia Ln
Dennett Rd
I-95 Ramp
Emery Ln
Ranger Dr
Valles Rd
Old Post Rd
Palmer Ave
Rogers Rd
Page St
Dion Ave
Eliot Rd
Gray Lodge Rd
Tara Ln
Cook St
State Rd
Manson Ave
Phelps St
Moore St
Howard St
Woodlawn Ave
Philbrick Ave
Cross St
Wyman Ave
Tilton Ave
Newson Ave
George St
Ford Ln
Love Ln
Whipple Rd
Mendum Ave
Walker St
Government St
Water St
Badger's Is
Goose Pt
Haley Rd
Lori Ln
Tuckers Cv
Crocketts Neck Rd
Bond Rd
Tudor Dr
Bowen Rd
Duncan Way
Follett Ln
Coleman Ave
Pepperrell Rd
Foyes Ln
Keene Ave
Brave Boat Harbor Rd
Cutts Island Ln
Chauncey Creek Rd
Seapoint Rd
Thaxter Ln
Tower Rd
Goodwin Rd
Pocahontas Rd
PREBLE WAY
RALEIGH WAY
OSPREY DR
KEARSARGE WAY
ramp
I-95 NORTH
CHASE DR
MARKET ST
MCGEE DR
LESLIE DR
MAPLEWOOD AVE
WOODBURY AVE
MEADOW RD
I-95 SOUTH
US ROUTE 1 BYP
DENNETT ST
BOYD RD
BARTLETT ST
MCDONOUGH ST
ISLINGTON ST
STATE ST
MIDDLE ST
COURT ST
JUNKINS AVE
MARCY ST

Activity Centers - Maine

ME - NH CONNECTIONS STUDY
November 2010 FIGURE 6-19

MaineDOT New Hampshire DOT HNTB

Legend

Study Area

Commercial

Residential

Source: City of Portsmouth; Town of Kittery; ME GIS; NH GRANIT

0 0.5 1

Miles

PORTSMOUTH

KITTERY

Pease Air Force Base

Pannaway Manor

Woodbury Ave

Commerce Way Office Park

Maplewood

Osprey Landing

Atlantic Heights

Borthwick Ave

Cate Street

West End

Islington Street

Downtown

Dennett Street

Outer Islington

Ocean Road

Industrial Park

Lafayette Road

Patriots Park

Elwin Park

Tucker's Cove

Lincoln Ave

Sagamore Ave

South End

AVIATION AVE

ROCHESTER AVE

NEW HAMPSHIRE AVE

INTERNATIONAL DR

RYE ST

OAK AVE

SPAULDING TPKE

SPAULDING TPKE ramp

DURGIN LN

GOSLING RD

ECHO AVE

OSPREY DR

WOODBURY AVE

MCGEE DR

unnamed

GRAFTON DR

NH 33

ramp

I-95 SOUTH

I-95 NORTH

I-95

Eliot Rd

Emery Ln

Martin Rd

Dennett Rd

BORTHWICK AVE

BOYD RD

DENNETT ST

CLINTON ST

CUTTS ST

MARKET ST

Tara Ln

Ranger Dr

US Route 1 Byp

Old Post Rd

Page St

State Rd

Walker St

George St

Love Ln

Rogers Rd

Manson Ave

Halstead St

Cross St

Whipple Rd

US Route 1

OCEAN RD

BANFIELD RD

WBBX RD

SIMS AVE

MIDDLE RD

GREENLEAF AVE

U.S. ROUTE 1 BYP

ISLINGTON ST

HANOVER ST

STATE ST

MIDDLE ST

SOUTH ST

UNION ST

BROAD ST

ELWYN AVE

JUNKINS AVE

MARCY ST

JONES AVE

SAGAMORE AVE

DENISE ST

HERITAGE AVE

COACH RD

LAFAYETTE RD

WEST RD

PEVERLY HILL RD

MIRONA RD

MCKINLEY RD

WILSON RD

ELWYN RD

TAFT RD

HARDING RD

LANG RD

EASTWOOD DR

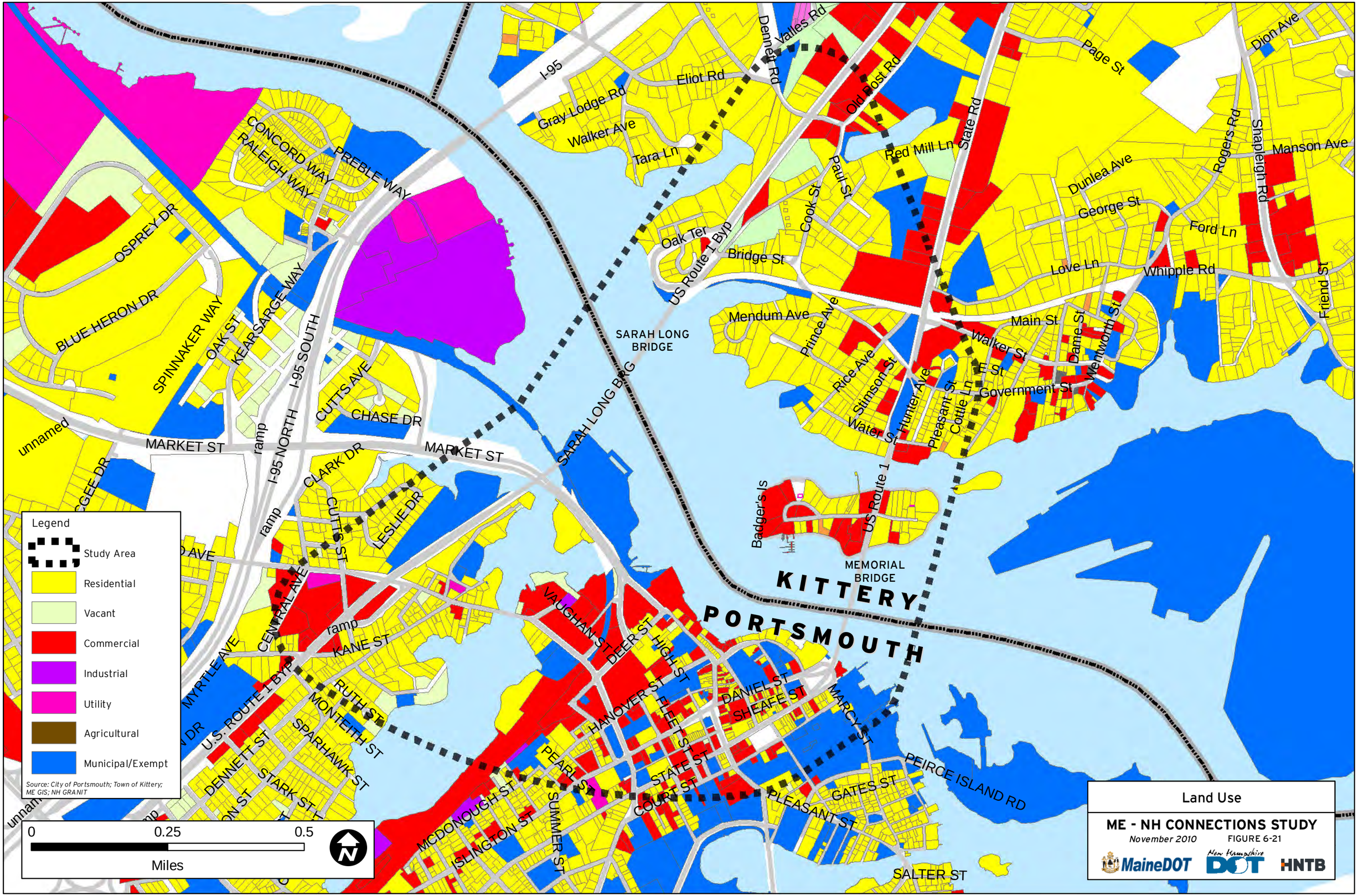
NEW HAMPSHIRE

Activity Centers - New Hampshire

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-20

MaineDOT New Hampshire DOT HNTB


I-95
Eliot Rd
Gray Lodge Rd
Walker Ave
Tara Ln
Dennett Rd
Valles Rd
Old Post Rd
Red Mill Ln
State Rd
Page St
Dion Ave
Rogers Rd
Shapleigh Rd
Manson Ave
Dunlea Ave
George St
Ford Ln
Love Ln
Whipple Rd
Friend St
Oak Ter
Bridge St
US Route 1 Byp
Cook St
Paul St
Mendum Ave
Prince Ave
Rice Ave
Stimson St
Water St
Hunter Ave
Pleasant St
Cottle Ln
Walker St
E St
Government St
Dame St
Wentworth St
Main St
CONCORD WAY
RALEIGH WAY
PEEBLE WAY
OSPREY DR
BLUE HERON DR
SPINNAKER WAY
OAK ST
KEARSARGE WAY
I-95 SOUTH
CUTTS AVE
CHASE DR
unnamed
MARKET ST
ramp
I-95 NORTH
CLARK DR
CUTTS ST
LESLIE DR
SARAH LONG BRG
SARAH LONG BRIDGE
Badger's Is
US Route 1
MEMORIAL BRIDGE
KITTERY
PORTSMOUTH
CENTRAL AVE
MYRTLE AVE
KANE ST
RUTH ST
MONTEITH ST
SPARHAWK ST
U.S. ROUTE 1 BYP
DENNETT ST
STARK ST
VAUGHAN ST
DEER ST
HIGH ST
FLEET ST
HANOVER ST
DANIEL ST
SHEAFE ST
MARCY ST
STATE ST
COURT ST
PEARL ST
SUMMER ST
MCDONOUGH ST
ISLINGTON ST
PEIRCE ISLAND RD
GATES ST
PLEASANT ST
SALTER ST
Legend
Study Area
Residential
Vacant
Commercial
Industrial
Utility
Agricultural
Municipal/Exempt
Source: City of Portsmouth; Town of Kittery; ME GIS; NH GRANIT
0
0.25
0.5
Miles
N
Land Use
ME - NH CONNECTIONS STUDY
November 2010
FIGURE 6-21
MaineDOT
New Hampshire DOT
HNTB

6.12. HISTORIC IMPACT EVALUATION

The preliminary Historic Impact evaluation assessed the level of effect to all historic properties listed or eligible for listing on the National Register of Historic Places in the area of potential effect, in accordance with Section 106 of the National Historic Preservation Act. The historic impact evaluation also identified each alternative's ability to satisfy the provisions of Section 4(f) of the Department of Transportation Act of 1966.

The evaluation summarized information developed in New Hampshire, augmented with new research on the Maine side of the Piscataqua River. File searches were conducted at the two State Historic Preservation Offices, which are the New Hampshire Division of Historical Resources (NH DHR) and the Maine Historic Preservation Commission (MHPC), to identify all previous survey in the Connections Study Area. National Register listed and eligible properties and historic districts were identified on base maps and in the Report data base. All previously documented areas and individual properties in the Study Area in Portsmouth and Kittery determined to be National Register eligible are shown on base maps and listed below.

1. U.S.S. Albacore {National Historic Landmark (NHL)}, Portsmouth
2. Richard Jackson House (NHL), Portsmouth
3. Moffatt-Ladd House (NHL), Portsmouth
4. MacPheadris-Warner House (NHL), Portsmouth
5. John Paul Jones House (NHL), Portsmouth
6. Governor John Langdon House (NHL), Portsmouth
7. George Rogers House {Listed on the National Register (NR Listed), Portsmouth
8. North Cemetery (NR Listed), Portsmouth
9. The Hill (NR Listed), Portsmouth
10. St. John's Church (NR Listed), Portsmouth
11. Portsmouth Athenaeum (NR Listed), Portsmouth
12. New Hampshire Bank (NR Listed), Portsmouth
13. Old Portsmouth Public Library (NR Listed), Portsmouth
14. Rockingham Hotel (NR Listed), Portsmouth
15. South Church (NR Listed), Portsmouth
16. John Paul Jones Memorial Park (NR Listed), Kittery
17. Strawberry Banke Historic District (NR Listed), Portsmouth

18. Cole‘s Gulf Station {Eligible for Listing on the National Register (NR Eligible), Portsmouth
19. Cutts Mansion (NR Eligible), Portsmouth
20. Memorial Bridge (NR Eligible), Portsmouth and Kittery
21. Sarah Mildred Long Bridge (NR Eligible), Portsmouth and Kittery
22. U.S. Route 1 Bypass Historic District (NR Eligible), Portsmouth
23. Christian Shore Historic District (NR Eligible), Portsmouth
24. Creek Neighborhood Historic District (NR Eligible), Portsmouth
25. Eastern Railroad Historic District (NR Eligible), Portsmouth
26. Memorial Bridge Historic District (NR Eligible), Portsmouth
27. U.S. Route 1 Bypass – Maine (NR Eligible), Kittery
28. Portsmouth Naval Shipyard Rail Spur (NR Eligible), Kittery
29. Warren‘s Lobster House Sign (NR Eligible), Kittery
30. #6 Water Street, Kittery (NR Eligible), Kittery
31. #14 Stimson Street, Kittery (NR Eligible), Kittery

Figures 6-22 and 6-23 show the location of existing historic resources for Kittery, Maine and Portsmouth, New Hampshire respectively for the Study Area.

Additional information regarding historic resources can be found in the following document included with this Study Report:

- ***Appendix #54 – Summary Report on Historic Resources.***

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Historical Resources in the Study Area

Study Area

National Historic Landmarks (NHL) (NHL)

1. U.S.S. Albacore
2. Richard Jackson House
3. Moffatt-Ladd House
4. MacPheadris-Warner House
5. John Paul Jones House
6. Governor John Langdon House
7. Wentworth Gardner House

Individual Properties and Historic Districts Listed on the National Register of Historic Places (NRHP)

8. George Rogers House
9. North Cemetery
10. The Hill
11. St. John's Church
12. Portsmouth Athenaeum
13. New Hampshire Bank
14. Old Portsmouth Public Library
15. Rockingham Hotel
16. South Church
17. John Paul Jones Memorial Park
18. Strawbery Banke Historic District
19. Franklin Block

Individual Properties and Historic Districts not in the Portsmouth Local Historic District Previously Determined Eligible for Listing on the NRHP

Individual Properties

20. Cole's Gulf Station
21. Cutts Mansion
22. Memorial Bridge
23. Sarah Mildred Long Bridge
24. Badger's Island Bridge

Historic Districts

25. U.S. Route 1 Bypass Historic District
26. Christian Shore Historic District
27. Creek Neighborhood Historic District
28. Eastern Railroad Historic District
29. Memorial Bridge Historic District

Other Properties Determined Eligible for Listing on the NRHP

30. U.S. Route 1 Bypass
31. Portsmouth Naval Shipyard Rail Spur
32. Warren's Lobster House Sign
33. 6 Water Street (Maine)
34. 14 Stimson Street (Maine)

Areas that might have National Register eligibility as historic districts

Areas that have historical resources that might have National Register eligibility as individuals

Portsmouth Local Historic District*

* Boundary accurate as of 2003

Source: City of Portsmouth; Town of Kittery, NH GRANIT, ME GIS

0 0.25 0.5 Miles

Historical Resources - Maine

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-22

MaineDOT New Hampshire DOT HNTB

Historical Resources in the Study Area

Study Area

National Historic Landmarks (NHL) (NHL)

1. U.S.S. Albacore
2. Richard Jackson House
3. Moffatt-Ladd House
4. MacPheadris-Warner House
5. John Paul Jones House
6. Governor John Langdon House
7. Wentworth Gardner House

Individual Properties and Historic Districts Listed on the National Register of Historic Places (NRHP)

8. George Rogers House
9. North Cemetery
10. The Hill
11. St. John's Church
12. Portsmouth Athenaeum
13. New Hampshire Bank
14. Old Portsmouth Public Library
15. Rockingham Hotel
16. South Church
17. John Paul Jones Memorial Park
18. Strawbery Banke Historic District
19. Franklin Block

Individual Properties and Historic Districts not in the Portsmouth Local Historic District Previously Determined Eligible for Listing on the NRHP

Individual Properties

20. Cole's Gulf Station
21. Cutts Mansion
22. Memorial Bridge
23. Sarah Mildred Long Bridge
24. Badger's Island Bridge

Historic Districts

25. U.S. Route 1 Bypass Historic District
26. Christian Shore Historic District
27. Creek Neighborhood Historic District
28. Eastern Railroad Historic District
29. Memorial Bridge Historic District

Other Properties Determined Eligible for Listing on the NRHP

30. U.S. Route 1 Bypass
31. Portsmouth Naval Shipyard Rail Spur
32. Warren's Lobster House Sign
33. 6 Water Street (Maine)
34. 14 Stimson Street (Maine)

Areas that might have National Register eligibility as historic districts

Areas that have historical resources that might have National Register eligibility as individuals

Portsmouth Local Historic District*

* Boundary accurate as of 2003

Source: City of Portsmouth; Town of Kittery, NH GRANIT, ME GIS

0 0.25 0.5 Miles

N

Historical Resources - New Hampshire

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-23

MaineDOT New Hampshire DOT HNTB

6.13. ARCHEOLOGICAL IMPACT EVALUATION

The potential for impact to archaeological resources was evaluated by assessing areas for archaeological sensitivity. Phase O/IA studies were performed. Archeological resource impact analysis was focused along the section of U.S. Route 1 adjacent to the Memorial Bridge and sections of the U.S. Route 1 Bypass adjacent to the Sarah Mildred Long Bridge only.

This assessment included review of site files, technical reports, maps, photographs and secondary resources to determine archaeologically sensitive areas ranked "high," "moderate," and "low" within the Area of Potential Effect (APE). The work included an inspection of the APE to confirm sensitive areas identified during the background research review. The APE extended approximately 1,000 to 2,500 feet inland from the Piscataqua River and 200 feet from the highway centerlines on either side of the two bridges.

Figures 6-24 thru 6-28 provide a graphical overview of the archaeological sensitivity along the U.S. Route 1 Bypass and U.S. Route 1 within the Study Area.

Additional information regarding Archeological Impact evaluation and associated findings can be found in the following document included with this Study Report:

- ***Appendix #55 – Summary Report on Archeological Sensitivity Assessment***.

6.14. PRELIMINARY LEVEL COST ANALYSIS

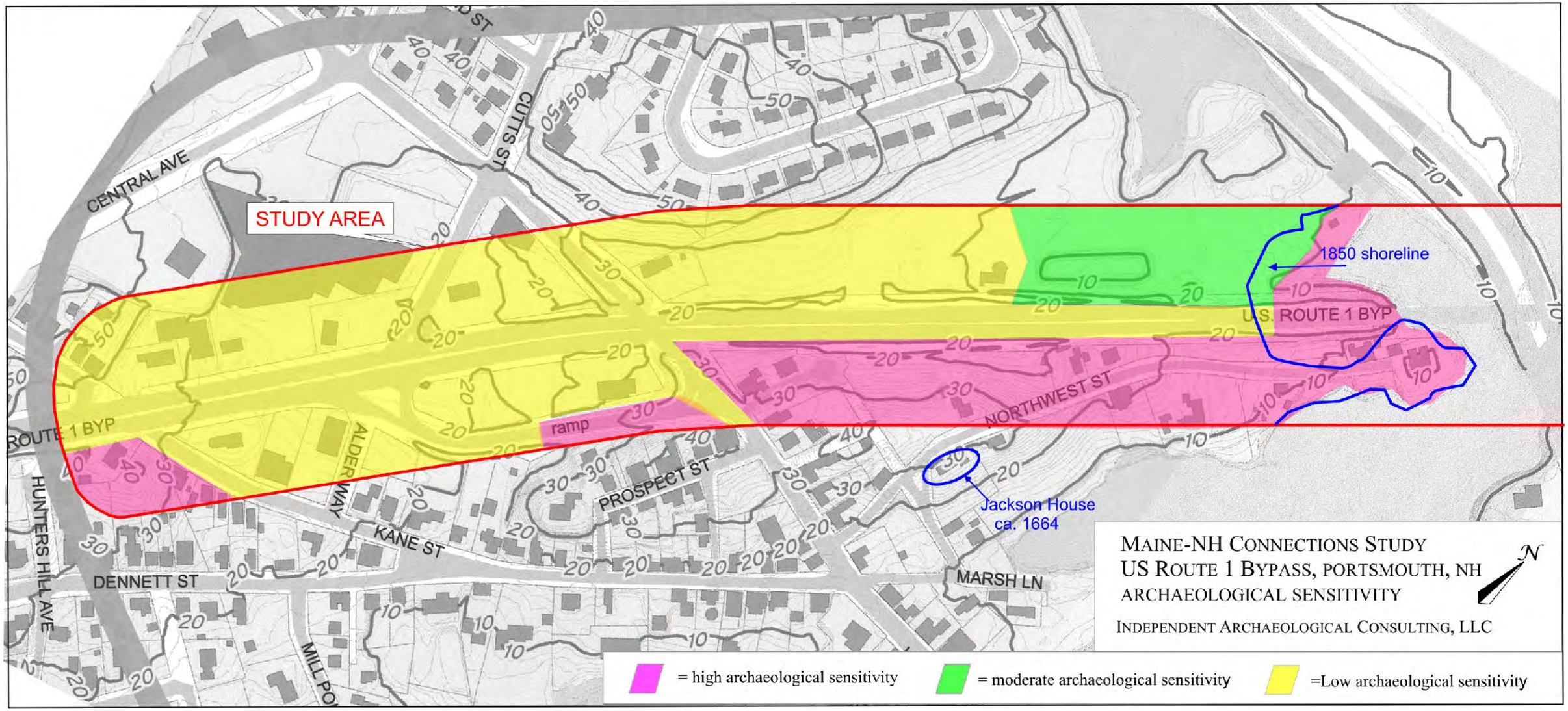
This section summarizes the preliminary level cost analysis conducted as part of this study. The planning level costs developed as part of the preliminary level cost analysis were not based on engineering plans or designs for the alternatives concepts, but rather are based on a compilation of assumptions, unit costs from other projects, percentage factors and best estimates of what the work may cost. No alternatives were dismissed based on the planning level costs developed. Actual costs may vary from these planning level costs once design engineering is completed. A range of costs was developed for each alternative.

LIFE-CYCLE COST ANALYSIS

The life-cycle cost analysis (LCCA) was an evaluation technique used to compare and evaluate the economical feasibility of the design alternatives over an assumed service life-cycle. For the purpose of this LCCA, the assumed service life-cycle was 100 years for all alternatives.

Cost categories comprising Life Cycle cost included:

- Capital Cost– Planning level cost associated with building the asset and putting it into initial service. Capital cost included all bridge, highway, rail and right-of-way costs associated with each alternative, but did not include any mitigation costs (e.g., wetlands, historic, etc.).
- Operation and Maintenance Cost – Planning level costs over a 100-year period associated with periodic capital reinvestment needs and the day to day operation and maintenance of movable bridge lift spans (excluding power and incidental costs). Operation and Maintenance cost included all costs accrued after initial service associated with

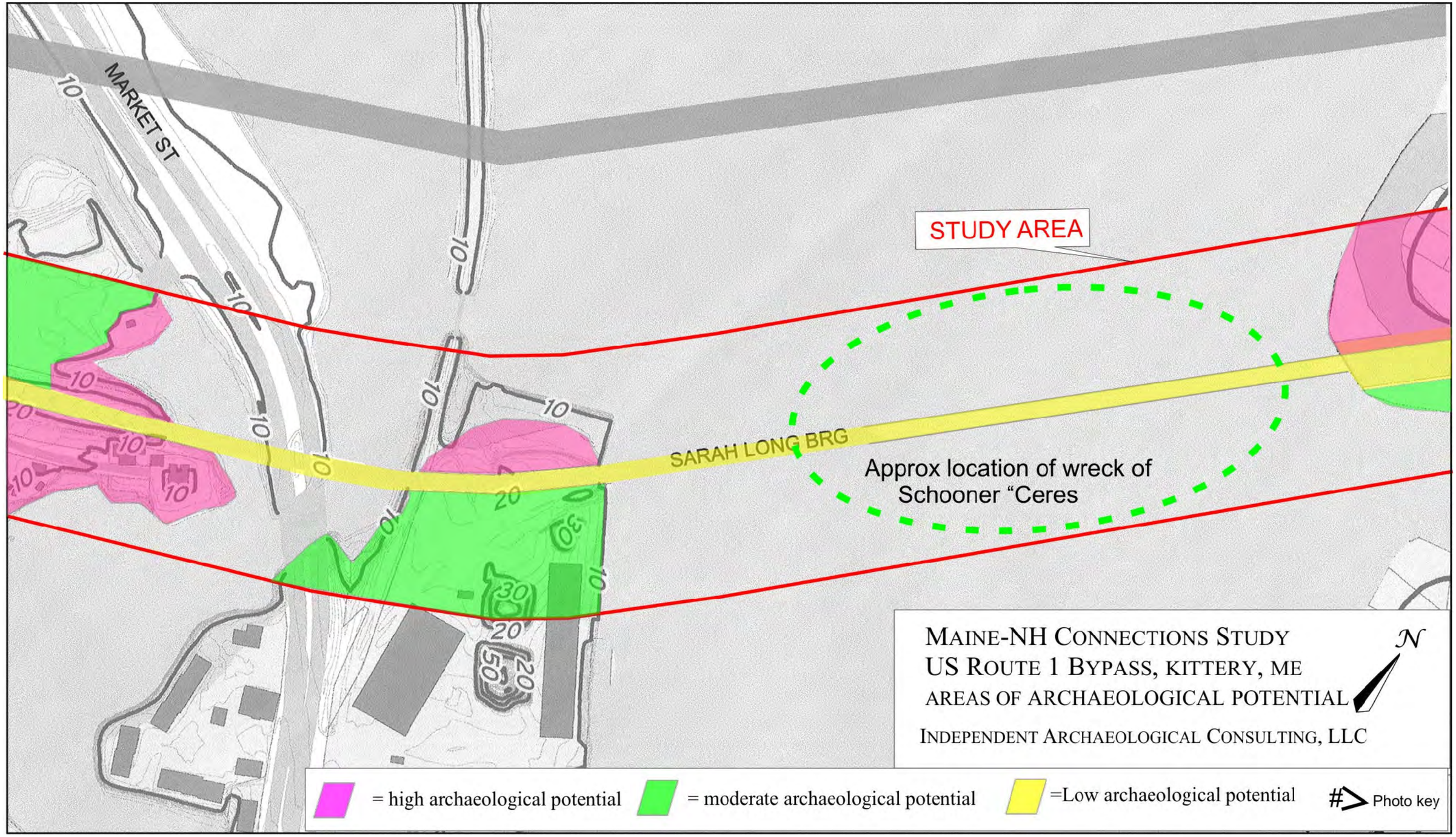


Areas of Archaeological Potential

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-24

MaineDOT New Hampshire DOT HNTB

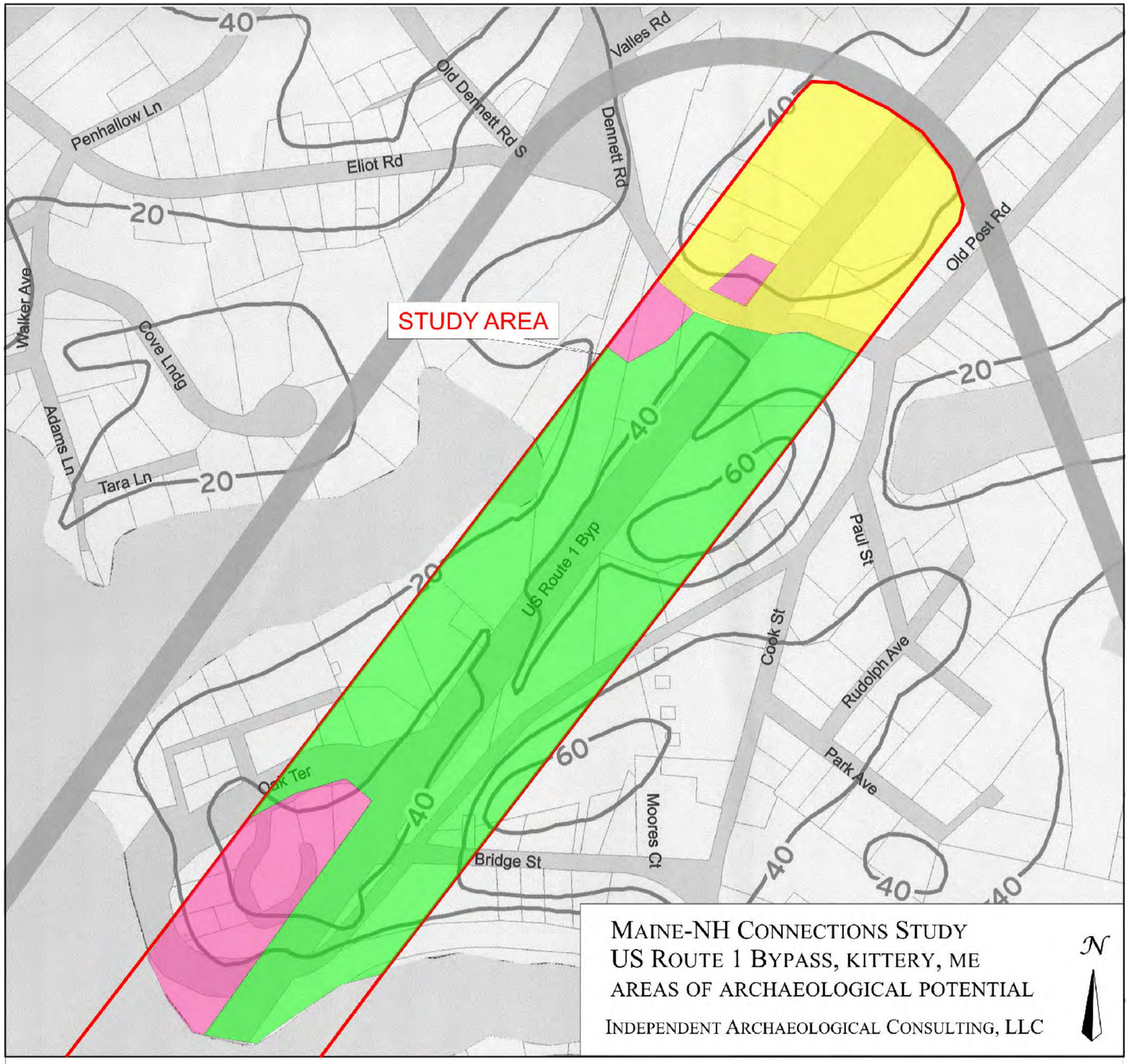


Areas of Archaeological Potential

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-25

MaineDOT New Hampshire DOT HNTB

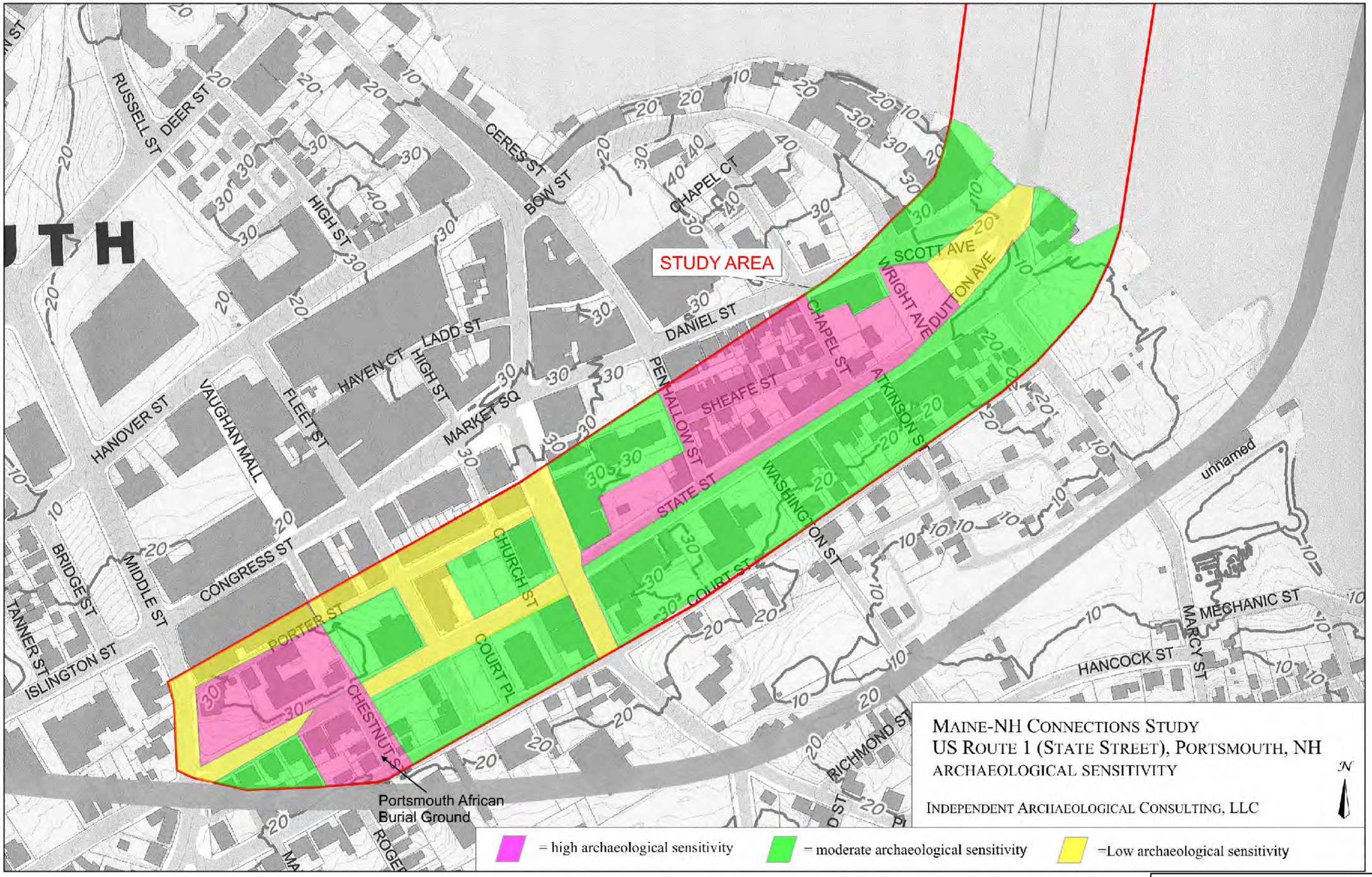


Areas of Archaeological Potential

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-26

MaineDOT New Hampshire DOT HNTB



Areas of Archaeological Potential

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-27

MaineDOT New Hampshire DOT HNTB

Areas of Archaeological Potential

ME - NH CONNECTIONS STUDY

November 2010 FIGURE 6-28

MaineDOT New Hampshire DOT HNTB

preventive activities intended to extend, preserve, improve, or restore the life of the asset as well as labor costs to operate the facility over the life of the asset.

Table 6-16 provides a summary of the Life Cycle costs for each alternative.

Table 6-16
Summary of Life-Cycle Costs by Alternative (Costs in Millions of Dollars)

Alternative	Range of Capital Costs	Range of Operation and Maintenance Costs	Range of Life Cycle Costs
No-Build	$18-$22	$126-$154	$144-$176
4	$166-$204	$121-$149	$287-$353
5a	$229-$281	$94-$116	$323-$397
5b	$265-$325	$103-$127	$368-$452
6a	$233-$287	$94-$116	$327-$403
6b	$265-$325	$103-$127	$368-$452
7	$238-$292	$103-$127	$341-$419
8	$238-$292	$103-$127	$341-$419
9	$251-$309	$94-$116	$345-$425
10	$224-$276	$94-$116	$318-$392
11	$197-243	$89-$111	$287-$353

BENEFIT-COST ANALYSIS

A benefit-cost analysis was used in this study for determining the benefits and the costs of the various alternatives. The process involved comparing the present worth cost of the total expected design year benefits of one or more actions against their respective total expected 100 year life-cycle costs in order to assess relative economic feasibility. Benefits and costs were adjusted for the time value of money, so that all flows of benefits and flows of project costs over time (which tend to occur at different points in time) were expressed on a common basis in terms of their ~~–p~~resent value."

For this study, the transportation benefits for each build alternative were derived by calculating the cost savings from three areas: (1) reduced VHT, (2) reduced VMT, and (3) reduced system delays versus the No-Build Alternative. The analysis did not consider delays caused by bridge openings. This additional analysis will be conducted during the Sarah Mildred Long Bridge

environmental documentation phase and will likely change the benefit-cost ratios. The estimated cost of each build alternative included all capital, and operation and maintenance costs.

Vehicle Hours Traveled – The design year (Year 2035) VHT costs were determined by converting the peak hour VHT to an annual value using the *Peak-Hour Mobility Benefit Multiplier Table*, developed by the MaineDOT Bureau of Transportation Systems Planning. The annual VHTs were then multiplied by a weighted average time value of $13.40 per hour to calculate the "Total VHT Cost". The $13.40 per hour assumes 5.2 percent heavy truck traffic at a rate of $39.00 per hour and 94.8 percent passenger car traffic at a rate of $12.00 per hour. Note that the 5.2 percent truck traffic and 94.8 percent passenger car traffic were derived using automatic traffic recording (ATR) class count data for the two lower-level crossings. VHT benefits were calculated as the difference between the No-Build Alternative and each of the build alternatives. As noted above, the analysis did not consider delays caused by bridge openings. This additional analysis will be conducted during the Sarah Mildred Long Bridge environmental documentation phase.

Vehicle Miles Traveled – The design year (Year 2035) VMT costs were determined by converting from the peak hour VMT to an annual value using the *Peak-Hour Mobility Benefit Multiplier Table* developed by the MaineDOT Bureau of Transportation Systems Planning. Vehicle operating costs were assumed to be $0.15 per VMT and safety costs were assumed to be $0.10 per VMT for a total cost of $0.25 per VMT. This value of $0.25 per VMT was multiplied by the VMTs developed using the regional model to obtain the "Total VMT Costs". VMT benefits were calculated as the difference between the No-Build Alternative and each of the build alternatives. As noted above, the analysis did not consider delays caused by bridge openings. This additional analysis will be conducted during the Sarah Mildred Long Bridge environmental documentation phase.

System Delays – The design year (Year 2035) system delays were generated using Synchro model total delay outputs. The design year system delay costs were determined by converting from the peak hour system delays to an annual value using the *Peak-Hour Mobility Benefit Multiplier Table* developed by the MaineDOT Bureau of Transportation Systems Planning. The annual system delays were then multiplied by the weighted average time value of $13.40 per hour to calculate the "Total System Delay Cost". Note that the $13.40 per hour was developed using the same assumptions as described in the VHT section above. System delay benefits were calculated as the difference between the No-Build Alternative and each of the build alternatives. The total design year benefits were calculated as the sum of the present worth values of the VHT, VMT, and System Delay benefits.

Capital, and Operation and Maintenance (O&M) Costs – Planning level Capital, and O&M costs for the assumed 100 year life-cycle were obtained from the LCCA. These planning level costs represent the net present value of future costs for each build alternative over an assumed

100 year life-cycle. The net present value of the planning level life-cycle costs for each build alternative was then used to calculate an annualized Capital, and O&M costs.

Table 6-17 summarized the results of the benefit-cost analysis.

Table 6-17
Summary of Benefit-Cost Ratios by Alternative

Alternative	Annualized Total Costs	Total Design Year Benefits	Benefit:Cost Ratio
No-Build	$ 7,078,145	$ -	
4	$ 12,585,554	$ 8,933,292	1.62
5a	$ 14,422,158	$ 8,933,292	1.22
5b	$ 16,386,783	$ 9,489,706	1.02
6a	$ 14,633,951	$ 8,933,292	1.18
6b	$ 16,375,439	$ 9,489,706	1.02
7	$ 15,213,595	$ 6,282,577	0.77
8	$ 15,202,251	$ 6,282,577	0.77
9	$ 15,271,659	$ 9,426,308	1.15
10	$ 14,098,471	$ 6,433,493	0.92
11	$ 13,094,186	$ 6,433,493	1.07

Additional information regarding Cost Analysis and associated findings can be found in the following documents included with this Study Report:

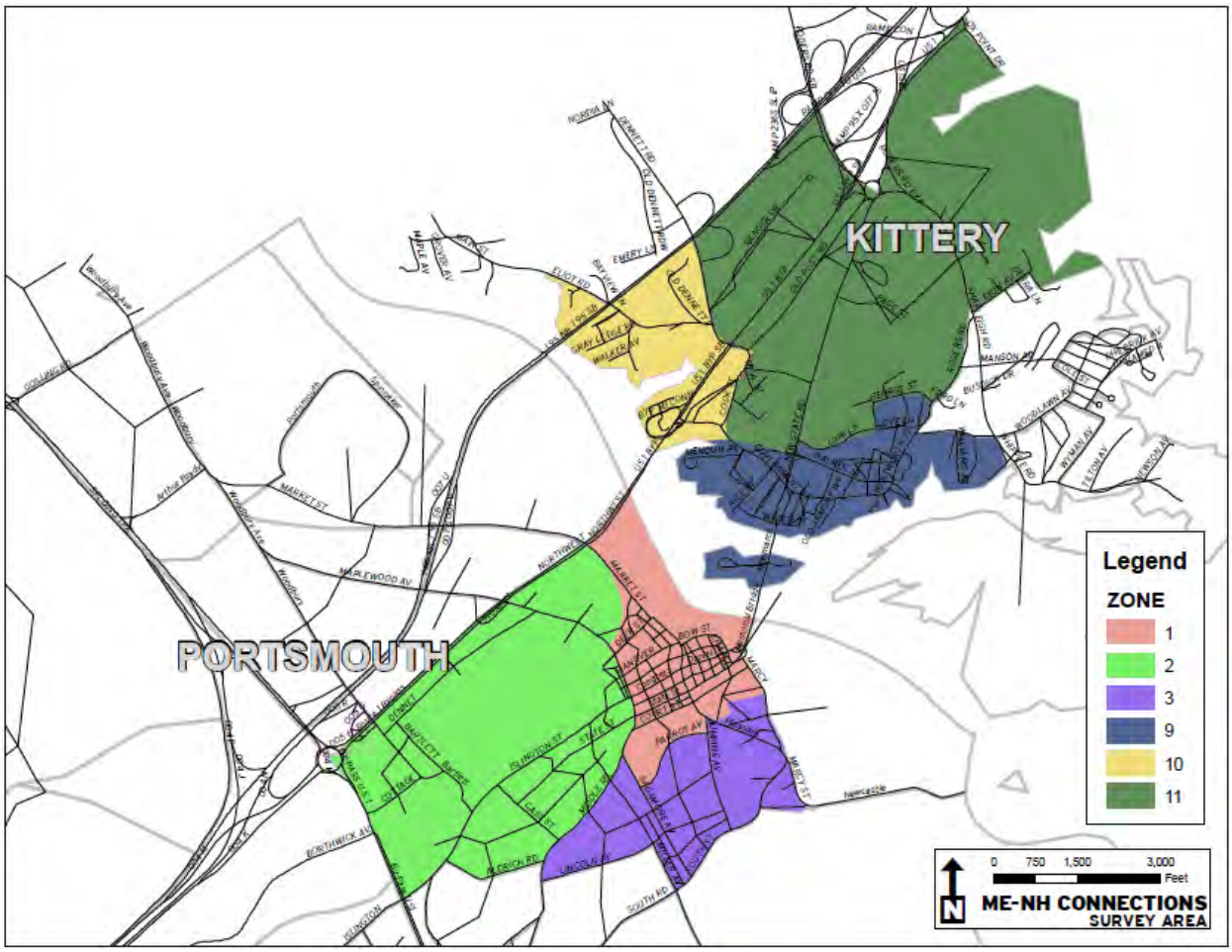
- ***Appendix #18 – Benefit Cost Methodology***.
- ***Appendix #30 - Life Cycle Cost Analysis (LCCA)***.

6.15. BUSINESS IMPACT ASSESSMENT

This section summarizes the business impact assessment conducted as part of this study.

Two independent surveys were conducted during March 2010: an exit survey of customers and a survey of business owners. Figure 6-29 identifies the survey area and corresponding zones relative to the Business Impact assessment.

Figure 6-29: Survey Area Map with Zones



***Exit Survey*:** This survey questioned customers as they were leaving a sample of businesses in order to get a snapshot of business trade areas and the extent to which customers are originating from or headed to the opposite side of the Piscataqua River via the Memorial Bridge. Interviewers were stationed for selected two to three hour periods at a total of 15 businesses from Thursday, March 18, through Saturday, March 20, 2010. During these periods they randomly intercepted customers as they were leaving the business and administered a brief questionnaire. A cross-section of businesses with customer traffic was selected with the assistance of local chambers of commerce and Stakeholder Committee members. These included convenience and destination retailers, restaurants, and personal service businesses.

Seven of the businesses were located in Downtown Portsmouth (Zone 1 on Figure 6-29). Eight of the businesses were located in Kittery in Zones 9, 10, and 11 on the attached map, including six centered on or near U.S. Route 1 in the pathway of the Memorial Bridge and two located on the U.S. Route 1 Bypass in the pathway of the Sarah Mildred Long Bridge.

Six percent of the interviews were conducted between 7 and 9 a.m. over the three days; 25 percent between 9 a.m. and 1 p.m.; 53 percent between 1 and 6 p.m.; and 6 percent between 6 and 8 p.m.

The survey intercepted and completed interviews with 1,505 customers. While these are statistically representative only of the businesses in which the interviews were conducted, the number and distribution of interviews yield results that provide good insight to trade areas and the use of Memorial Bridge by customers of businesses with walk-in traffic.

***Business Survey*:** This survey was a mail-out to 330 businesses of all types located in the pathways to and from the Memorial and Sarah Mildred Long Bridges, within Zones 1-4 in Portsmouth and Zones 9-11 in Kittery, as shown on Figure 6-29. The surveys were mailed with stamped, self-addressed return envelopes on March 11, 2010, with a deadline of March 25, 2010 to return them. Of the 330 mailings, 247 were in Portsmouth and 83 were in Kittery. Forty of the mailings were returned as undeliverable, reducing the sample to 290. Of these, a total of 96 returned completed questionnaires, a rate of 33 percent, which would be well within the range of what would be expected in a mail-out survey.

This survey sought information from the businesses about the places of origination of their customers, reliance of their customers on the three bridges between Kittery and Portsmouth, how a temporary closing of the Memorial Bridge to vehicles in fall 2009 affected sales, share of customers who arrive at the business on foot or by bicycle, and their perceptions of the likelihood that customers would find alternative routes to their businesses if the Memorial Bridge were closed to vehicles in the future.

Because returns from mail-out surveys are not random, the results are not applicable to statistical tests of significance and cannot reliably be extrapolated to all businesses in the Study Area. However, they provide important impressions and, as long as appropriate caution is exercised, contribute to an understanding of potential impacts.

Summary of Key Findings

The Exit Survey of more than 1,500 customers patronizing a cross-section of 15 businesses in Portsmouth and Kittery provides an indication of the percentage of customers that would be ~~–at~~ risk" for these types of businesses (retailers, restaurants, and personal service establishments) if the Memorial Bridge were closed to vehicles. By ~~–at~~ risk" we mean that these customers would need to find an alternative route to the businesses. Considering the shares of customers who said they had crossed the bridge immediately before arriving at the business and considering the

modes of transportation (auto, walking, bicycling), a gross estimate of such "at risk" customers would be:

- Portsmouth Downtown Zone 1: 15 percent to 20 percent
- Kittery Zones 9 and 11: 35 percent to 40 percent
- Kittery Zone 10: 10 percent to 15 percent

Not all of these customers would be lost, because some would find acceptable alternative routes. Based on responses in the Business Survey, it would not be unreasonable to assume that approximately half of the customers would find alternative routes. This would imply an impact on these types of walk-in businesses (retailers, restaurants, and personal service establishments) of:

- Portsmouth Downtown Zone 1: 7 percent to 10 percent
- Kittery Zones 9 and 11: 17 percent to 20 percent
- Kittery Zone 10: 5 percent to 8 percent

The overall impact to all businesses in the surveyed area would be somewhat less than this because some businesses in the area do not rely on walk-in traffic and would be less affected by a closure to vehicles (though some respondents in the business survey noted that their employees, if not their customers, would be affected).

Another benchmark from the business survey was the comparison of Oct-Nov 2009 sales versus the average of Oct-Nov sales for the three previous years. The median response was 10 percent to 14 percent decline. Considering a possible background change due to recession of a six percent decline, this suggests a median decline in the four percent to eight percent range due to the six week closure of the bridge to vehicles. The background changes may have been more severe for recession-sensitive businesses included in the survey, such as building contractors; and for businesses that rely on pass-by traffic immediately en route to or from the Memorial Bridge.

These different ways of examining the possible overall impact on customers and sales of closing the Memorial Bridge to vehicles reach fairly consistent results within a range of eight percent to 17 percent depending on location – *for businesses that rely on customer traffic*. These are, of course, synthesized results for the area as a whole. Individual businesses would be affected differently: businesses that are convenience-oriented, that rely primarily on pass-by traffic, and that are immediately en route to the Memorial Bridge may be impacted more (i.e., up to or more than a 17 percent impact); businesses that are destination-oriented, that rely primarily on traffic coming to the business for a specific reason, and that draw from an area that would not be as dependent on the Memorial Bridge may be impacted less (i.e., eight percent or less). But an

eight percent to 17 percent impact on customers/sales for businesses with customer traffic in the area studied would be a reasonable conclusion based on the available information.[15]

Regional Economic Effect

This analysis assessed the region-wide economic impacts of each alternative. The ~~"r~~egion" for purpose of this study would be the Primary Market Area for Zones 1, 9, 10, and 11 (Figure 6-29), as indicated by the Exit Survey. A shopping area's Primary Market Area typically accounts for 60 to 70 percent of the area's sales. In this case, it comprises the 16 municipalities that account for approximately two-thirds of the traffic captured in the Exit Survey. These extend from York, ME in the north to Hampton Falls, NH in the south, and west to Dover, NH and So. Berwick, ME. They are partly within the Portsmouth, NH-ME Metro area, partly within the Rochester-Dover, NH-ME Metro area, and partly just outside of these two metro areas.

If a decision were made that led to an average loss of eight percent to 17 percent of sales or customers for businesses that rely on customer traffic in a particular part of the region, would this reverberate to a region-wide loss of this economic activity? In our judgment this would be unlikely.

There would be a region-wide loss only if (1) it caused regional and visitor demand for the affected goods and services to decline, or (2) there were not substitute locations or businesses within the region to take up the slack. As to the first possibility, there is no evidence to suggest that overall regional and visitor demand for the affected goods and services would decline. As to the second possibility, there are a number of commercial centers in Portsmouth and Kittery that are and/or could be alternative locations unconstrained by the status of the Memorial Bridge for the types of affected businesses in the impacted area. There undoubtedly are competing areas elsewhere within the region as well.

Additional information regarding Business Impact Assessment and associated findings can be found in the following document included with this Study Report:

- ***Appendix #44 – Customer and Business Survey Results Reliance on Memorial Bridge to Access Businesses Proximate to Bridge in Portsmouth and Kittery***.

6.16. ENVIRONMENTAL CLEARANCES ASSESSMENT

The environmental clearances assessment evaluated and documented each alternatives' ability to obtain the necessary Coast Guard permit or permits as well as satisfying the procedural requirements of the NEPA process. This assessment is based upon discussions with relevant state and federal agencies throughout the Study Process and Study Team opinion of permit requirements. No separate documents were prepared for this assessment.

[15] This estimate is based in part on the perception of businesses participating in the survey as to the likelihood that their customers continued to come to their establishments during the fall 2009 bridge closure. For perspective, the additional travel time to the affected zones from a variety of points in the area via the Sarah Long Bridge ranges from a half-minute to about five minutes.

7.0 Development of Evaluation Criteria and Measures of Effectiveness (MOEs)

This chapter describes the evaluation criteria and Measures of Effectiveness (MOEs) developed to assist in screening the alternatives and identifying one or more preferred alternatives to be carried forward. Further documentation of impacts as required under NEPA and Section 4(f) of the U.S. DOT Act of 1966 would be required for all alternatives. Under NEPA, FHWA makes a determination as to the level of documentation required, either as Individual Categorical Exclusions, Environmental Assessments or Environmental Impacts Statements. Based on the alternatives recommended for NEPA evaluation, FHWA will determine the appropriate NEPA Class of Action.

EVALUATION CRITERIA

Evaluation criteria were developed for comparing all of the study alternatives that were carried forward from the Final Fatal Flaw Report. Evaluation criteria to address the various study needs and goals were divided into the nine following categories in the matrix:

- Structural Improvement
- Mobility for the Year 2035
- Accessibility
- Planning Level Cost Estimates in 2010 Dollars
- Historic (Section 106)
- Natural Environment
- Physical Environment
- Environmental Clearances
- Use of Section 4(f) Properties

Each of the nine categories included several MOEs for comparing the performance of each alternative. Several of the MOEs were described quantitatively while others were described qualitatively. In order to provide an overview comparison of the alternatives, each MOE for each alternative was assigned a color (where appropriate) to represent each alternative's performance against the other alternatives including the No-Build Alternative. In other words, a green color was assigned to the best performing alternatives, a red color was assigned to the worst performing alternatives, and a yellow color was assigned to alternatives performing in the middle range when compared to the other alternatives. This color representation treats every criterion as equal, but in transportation decision-making and permitting, certain criteria may carry greater weight than others due to environmental clearance or policy requirements. The following provides a description of the criteria and corresponding MOEs used and how each is rated.

These ratings were used in screening the alternatives and provide a basis for determining which alternatives can be dismissed from further consideration and those alternatives that can be carried

forward. Figure 8-18 provides a summary of the remaining alternatives following the fatal flaw analysis and their relative performance for each MOE. Where possible, the effects of each MOE are provided individually for the Memorial Bridge and the Sarah Mildred Long Bridge.

7.1. STRUCTURAL IMPROVEMENT

Satisfying Structural and Functional Needs

This criterion evaluates two things: the structure and the functional life of the bridge alternatives. For structural, the condition of the parts that make up and support the bridge were considered. Would the alternative periodically replace certain pieces in poor condition but keep the overall intent of the structure in place (rehabilitation), or would the alternative replace all pieces with a new structure (replacement)? As an example, a house requires maintenance. Roofing, painting and siding would wear out over time. Homeowners must choose between repair and replacement based on condition, opportunity and cost.

The functional life of a bridge is indicated by the ability of the bridge to accommodate the vehicular, pedestrian, bicycle and marine needs reliably over the desired timeframe. Generally, older structures may not meet current functional life requirements whereas newer structures are likely to meet these same requirements.

- Alternative provides improved structural and functional life (100 year life) to each bridge:
    - Considered red if no improvement done to the bridge.
    - Considered yellow if the bridge is rehabilitated.
    - Considered green if the bridge is replaced.

Lift Span Reliability

Lift span reliability looks at the proposed condition of the lift span to evaluate its dependability for providing reliable and adequate lift span operation over the desired timeframe.

- Alternative provides improved lift span reliability (100 year life) to each bridge:
    - Considered red if no improvement to the bridge lift span.
    - Considered yellow if the bridge lift span is rehabilitated.
    - Considered green if the bridge lift span is replaced.

7.2. MOBILITY

2035 Vehicle Miles Traveled (VMT)

Vehicle miles traveled is the total number of miles driven by all vehicles within a given time period (usually the afternoon peak hour) and geographic area. A region's VMT is influenced by factors such as efficiency of the highway system and location of jobs, housing and activity centers. For the alternatives, year 2035 PM Peak Hour VMT was calculated and summed for the Study Area. Less VMT is preferred over high VMT.

- Lowest VMT = 121,901 Highest VMT = 123,982 Average VMT=122,942
    - Alternatives with lowest VMT's considered green – 121,901 to 122,595
    - Alternatives with average VMT's considered yellow – 122,596 to 123,288

- Alternatives with highest VMT's considered red – 123,289 to 123,982

2035 Vehicle Hours Traveled (VHT)

Vehicle hours traveled is the total number of hours driven within a given time period (usually the afternoon peak hour) and geographic area. VHT is primarily influenced by the level of congestion within that geographical area. For the alternatives, year 2035 PM Peak Hour VHT was calculated and summed for the Study Area. Low VHT is preferred over high VHT

- Lowest VHT = 4,041 Highest VHT = 4,148 Average VHT=4,095
  - Alternatives with lowest VHT's considered green – 4,041 to 4,077
  - Alternatives with average VHT's considered yellow – 4,078 to 4,112
  - Alternatives with highest VHT's considered red – 4,113 to 4,148

Intersection Level of Service (LOS)

Level of service is a measure to determine the effectiveness of the transportation infrastructure. LOS is commonly used to analyze highways and is also used to analyze intersections, transit, bicycle and pedestrian facilities. The LOS system grades the effectiveness of the transportation infrastructure by rating it with the letters A through F, with A being the least congested and F the most congested. With LOS A, individual motorists are practically unaffected by the presence of other vehicles on the road. Ability to maneuver and level of comfort is excellent, as the driver needs to provide minimal attention to driving conditions. On the other hand, LOS F is synonymous with congestion and stop and go traffic that is typical of some of the worst driving conditions.

For the Alternatives, the number of intersections with undesirable level of service (LOS F) were compared to the No-Build Alternative.

- Under the No-Build Alternative, 5 of the 25 Study Area intersections that were evaluated are projected to be at LOS F operations by 2035. This No-Build condition is the benchmark for comparison purposes to the Build alternatives.
- By comparison, the matrix indicates the number of intersections where traffic operations are projected to remain at a LOS F in 2035 for each alternative.

<u>Results for Matrix:</u>

- Alternatives with 4 or more intersections at LOS F are considered red.
- Alternatives with 2 or 3 intersections at a LOS F are considered yellow.
- Alternatives with 0 to 1 intersection at a LOS F are considered green.

Available Bridge Vehicular Capacity

Available bridge vehicular capacity is determined by estimating how many vehicles are using a bridge at a certain time (volume) compared to the maximum number that could use the bridge if it was at full capacity (capacity). This ratio of the volume to capacity provides a numerical comparison. Ratios that are equal to or greater than 1.0 indicate that a bridge is at or over the capacity it can accommodate. This measure can also be used to determine congestion levels and

identify solutions to increase capacity, such as adding additional travel lanes to increase the roadway's or bridge's capacity.

- The Alternative provides the volume to capacity ratio for each bridge in the PM peak Hour in 2035 :
    - Considered red if volume to capacity (v/c) greater than 1.0.
    - Considered yellow if v/c is between 0.85 and 1.0.
    - Considered green if v/c is less than 0.85.

Local Road Traffic Impacts

Three local (non-state routes) roads in close proximity to the Sarah Mildred Long and Memorial Bridges that are generally residential in nature and maintained by the municipalities were identified: Bridge Street/Oak Terrace (Kittery), Government Street (Kittery), and Maplewood Avenue (Portsmouth). In this criterion the likelihood of an alternative to increase traffic volumes along those roads is evaluated.

- Alternatives that increase traffic volumes along all three local (non-state route) roads identified above as compared to the No-Build Alternative are considered red.
- Alternatives that increase traffic volumes along one or two local (non-state route) roads identified above as compared to the No-Build Alternative are considered yellow.
- Alternatives that do not increase traffic volume on the local (non-state route) roads identified above as compared to the No-Build Alternative are considered green.

Mobility During Construction

Mobility during construction evaluates if the bridges are closed to all modes of traffic during construction. Based on the traffic analyses that were conducted for this Study, both bridges would not be constructed at the same time due to traffic impacts that would occur on the I-95 High Level Bridge. This measure of effectiveness also assumes that the Memorial Bridge is closed for all alternatives, so it is not included in the evaluation. Only the positive impacts of keeping the Sarah Mildred Long Bridge open during construction of the Sarah Mildred Long Bridge are considered.

- Alternatives that keep the Sarah Mildred Long Bridge open to traffic during construction are considered green.
- Alternatives that close Sarah Mildred Long Bridge to traffic during construction are considered red.

Emergency Access

Emergency access relates to the alternatives ability to accommodate fire, ambulance, and other emergency services. Here we measure whether alternatives impede, maintain or improve the ability of emergency vehicles to cross the river.

- Alternatives that close the Memorial Bridge to vehicle traffic, reducing or impeding emergency accessibility between the 2 communities are considered red.

- Alternatives that replace the Memorial Bridge and rehabilitate the Sarah Mildred Long Bridge or replace it with a standard lift bridge that maintains existing emergency accessibility between the 2 communities are considered yellow.
- Alternatives that replace one or both bridges improving emergency accessibility between the 2 communities by providing a wider cross section are considered green.

Evacuation Access

Evacuation access relates to the existence of adopted[16] evacuation route plans. The evacuation plans use all three bridges and include provisions if one or more of the existing three bridges are not available for evacuation purposes. This measure of effectiveness measure relates to how well an alternative maintains or improves the existing emergency evacuation plans over the river.

- Alternatives that close the Memorial Bridge to vehicle traffic, reducing or impeding capacity between the 2 communities as it relates to existing evacuation plans are considered red.
- Alternatives that rehabilitate both bridges that maintain existing capacity between the 2 communities as it relates to existing evacuation plans are considered yellow.
- Alternatives that replace one or both bridges between the 2 communities improve capacity by providing a wider cross section as it relates to existing evacuation plans are considered green.

7.3. ACCESSIBILITY

Accessibility to Portsmouth, Kittery Downtowns

This criterion measures the ability of the alternative to provide access to vehicular, bicycle, pedestrian and transit modes of transportation between Kittery and Portsmouth downtowns.

- Alternatives that reduce accessibility to the downtowns to all modes of traffic (vehicle, pedestrian and bicycle) are considered red.
- Alternatives that reduce accessibility to the downtowns to vehicular traffic are considered yellow.
- Alternatives that maintain or improve current accessibility to the downtowns for all modes of traffic are considered green.

Accessibility to Portsmouth Naval Shipyard

Ability of the alternative to provide safe and efficient access to PNSY, one of the region's largest employers.

- Alternatives that reduce accessibility to PNSY to one or more modes of traffic (vehicle, pedestrian and bicycle) are considered red.
- Alternatives that maintain current accessibility to PNSY to all modes of traffic are considered yellow.

Bridge Design Features/Vehicle

[16] Add citation(s) for evacuation plans

Current design guidelines indicate that travel lanes should be 11 to 12-feet wide. Presently the Memorial Bridge has 11-foot wide travel lanes and the Sarah Mildred Long Bridge has 12-foot wide travel lanes. This criterion measures whether the alternatives would improve, maintain or reduce these features for each bridge.

- Considered red if the bridge design features for vehicular traffic do not provide meet current state and federal design guidelines.
- Considered green if the bridge design features for vehicular traffic meet current state and federal design guidelines.

Bridge Design Features/Marine

Current navigational clearances on the Memorial Bridge (260foot horizontal, 150 foot vertical) have been determined to meet current navigational needs. Current navigational clearances on the Sarah Mildred Long Bridge (200 foot horizontal, 135 foot vertical) coupled with the navigational channel skew to the bridge have been identified as not meeting future navigational needs. This criterion measures whether the alternatives would reduce, maintain or improve navigational clearances at the Sarah Mildred Long Bridge. The vertical navigational clearances refer to the lift span in the closed position for vehicular traffic use.

- Considered red if maintaining existing horizontal and vertical navigational clearances on the Sarah Mildred Long Bridge for marine traffic.
- Considered yellow if improving horizontal navigational clearances on the Sarah Mildred Long Bridge for marine traffic.
- Considered green if improving both horizontal and vertical navigational clearances on the Sarah Mildred Long Bridge for marine traffic.

Bridge Design Features/Bicycle

Current design guidelines indicate that minimum bicycle lane width with no curb or gutter should be four feet. The recommended width of a bicycle lane from the face of curb or guardrail is five feet. Presently the Memorial Bridge has bicycle access but no bicycle lanes and the Sarah Mildred Long Bridge has no bicycle access. This criterion measures whether the alternative does not, partially, or completely meets current bicycle guidelines for shoulder widths. The Memorial Bridge is a part of the East Coast Greenway.

- Considered red if current state and federal design guidelines for bicycles are not provided.
- Considered yellow if current state and federal design guidelines for bicycles are partially provided.
- Considered green if current state and federal design guidelines for bicycles are completely provided.

Bridge Design Features/Pedestrian

Current design guidelines indicate that desirable sidewalk widths should be five or more feet wide. Presently the Memorial Bridge has a six foot wide sidewalk and the Sarah Mildred Long

Bridge does not allow pedestrians but has a three foot wide walk for bridge worker access. This criterion measures whether the alternative does not, partially, or completely meets current pedestrian guidelines for each bridge. The Memorial Bridge is a part of the East Coast Greenway.

- Considered red if current state and federal design guidelines for pedestrians are not provided.
- Considered yellow if current state and federal design guidelines for pedestrians are partially provided.
- Considered green if current state and federal design guidelines for pedestrians are completely provided.

Bridge Design/Rail Line

A rail line is required for PNSY and is maintained for all alternatives.

- Alternatives that accommodate simultaneous rail and vehicular access across the Piscataqua River and are considered green.
- Alternatives that do not accommodate simultaneous rail and vehicle access across the Piscataqua River and are considered yellow.

7.4. PLANNING LEVEL COST ESTIMATES

The planning level cost estimates and resulting cost-derived measures of effectiveness were based on preliminary concept plans only without benefit of survey or design information. As such, the costs are considered to be "ballpark" only and may change significantly once design work is completed. Therefore, the capital, operation and maintenance, and life cycle costs in Figure 8-18 are presented as a cost range based on the conceptual design plans. Alternatives have not been dismissed based on these planning level cost estimates. The planning level cost estimates will be refined in the next study phase for only those alternatives that advance from this study.

The range of planning level costs is identified below.

Capital Cost

Capital cost includes all initial construction costs associated with a given build alternative, including all engineering, construction, and anticipated right of way needs. Wetland and other mitigation, permitting and other miscellaneous capital costs are not included in the present capital cost ranges.

Lowest Range of Cost = $18M to $22 M Highest Range of Cost = $265 to $325M

- Alternatives that have the highest capital costs (top 1/3 of range) are considered red.
- Alternatives that have moderate capital costs (middle 1/3 of range) are considered yellow.
- Alternatives that have the lowest capital costs (bottom 1/3 of range) are considered green.

Operation and Maintenance Costs

Lift bridges require an operational cost for staffing as well as utility costs for powering the lift span and communications that are not required on fixed span bridges such as the I-95 High Level Bridge. Maintenance costs include all costs after completion of construction, including routine preventive maintenance and periodic major capital reinvestments to extend and preserve the life of the bridge, such as painting, redecking, etc. Operation and maintenance costs for each build alternative were estimated and summed over a 100 year bridge life cycle. Utility costs have not been included.

Lowest Range of Cost = $89M to $111M Highest Range of Cost = $126M to $154M

- Alternatives that have the highest operation and maintenance costs (top 1/3 of range) are considered red.
- Alternatives that have an average operation and maintenance costs (middle 1/3 of range) are considered yellow.
- Alternatives that have the lowest operation and maintenance costs (bottom 1/3 of range) are considered green.

Life Cycle Costs

Life cycle costs include both the capital cost as well as the 100 year operation and maintenance costs.

Lowest Range of Cost = $144M to $176M Highest Range of Cost = $368M to $452M

- Alternatives that have the highest life cycle costs (top 1/3 of range) are considered red.
- Alternatives that have average life cycle costs (middle 1/3 of range) are considered yellow.
- Alternatives that have the lowest life cycle costs (bottom 1/3 of range) are considered green.

Travel Time Delay Cost

The inability for the transportation system to adequately accommodate travel results in an increased travel time cost that can be measured and quantified. Travel time delay cost is calculated by multiplying the Study Area travel delay time by a weighted average value of time that includes both cars and trucks. For the alternatives, year 2035 Afternoon Peak Hour travel time cost was calculated and summed for the Study Area. A value of $12 per hour for passenger vehicles and $39 per hour per trucks was used, resulting in a weighted value of $13.40 per hour.

Lowest Cost = $15,620 Highest Cost = $22,970

- Alternatives that have the highest travel time costs (top 1/3 of range) are considered red.
- Alternatives that have moderate travel time costs (middle 1/3 of range) are considered yellow.

- Alternatives that have the lowest travel time costs (bottom 1/3 of range) are considered green.

Benefit/Cost Ratio

A benefit to cost ratio relates the benefits of each alternative, expressed in monetary terms, relative to its overall costs, also expressed in monetary terms. All benefits and costs are generally expressed in present values. Present value is essentially the amount of money that would have to be invested today to meet all future costs, given an assumed annual rate of inflation and the time period when each cost would be incurred over the next 100 years. Benefits are calculated as the reduction in travel time cost ($13.40 per hour weighted average), reduction in travel distance cost, and reduced economic impacts of crashes resulting from safety improvements. The cost is the Life Cycle Cost annualized for each alternative. A high benefit cost ratio is preferred over a low benefit cost ratio.

- Benefit/cost ratios that are less and 1.0 are considered red.
- Benefit/costs ratios that are about 1.0 are considered yellow.
- Benefit/costs ratios that are greater than 1.0 are considered green.

Business Survey Impacts

This criterion measures business owners' and patrons' estimation of the impacts that would occur to businesses immediately adjacent to the Memorial Bridge should vehicle traffic be prohibited across the bridge under selected Alternatives. See Appendix 44 for details regarding the Customer and Business Survey Results Report.

- Alternatives that close the Memorial Bridge to all modes of traffic are considered red.
- Alternatives that close the Memorial Bridge to vehicular access only are considered yellow.
- Alternatives that maintain or improve the Memorial Bridge for all modes of traffic (vehicle, bicycle and pedestrian) between Kittery and Portsmouth are considered green.

Regional Economic Impacts

This criteria is also derived from Appendix 44 – Customer and Business Survey Results Report. It measures the overall regional economic impact should vehicles be prohibited across the Memorial Bridge. The region under this measure of effectiveness is defined as the Labor Market Areas (LMA) of coastal Maine and New Hampshire that includes Kittery and Portsmouth. It was determined that the closing of the Memorial Bridge would not have a measurable regional economic impact and therefore all alternatives are considered green.

7.5. PRELIMINARY HISTORIC EVALUATION

Impacts to National Register-Listed or Eligible Historic Bridges

National Register Listed or Eligible properties are in five categories (building, structure, object, site, and district). Both the Memorial and the Sarah Mildred Long Bridges fall under the structure category. This criterion evaluates the impact of the alternatives on each bridge based

on whether none, one, or both of the bridges are replaced and/or removed. The preliminary historic evaluation indicates that removal, replacement or rehabilitation of either the Memorial Bridge or the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement because certain elements of the bridges that contribute to their historic significance would likely be retained if the rehabilitation can be done in accordance with the U.S. Secretary of the Interior's Standards and Guidelines for Preservation Planning to preserve key elements of the structure that contribute to its historic significance.

For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge.

- Alternatives that remove or replace both bridges are considered red.
- Alternatives that rehabilitate one bridge and replace one bridge are considered yellow.

Other Historic Resource Impacts

This criterion measures potential impacts to other historic resources based on preliminary Section 106 effects findings on Maine and New Hampshire resources. The number of properties having no effect, no adverse effect, and adverse effects findings has been tallied.

Lowest adverse effect= 0 Highest adverse effect= 13 Average adverse effect= 7

- The alternatives that have the highest number of "adverse effect" impacts to other historic resources are considered red (top ⅓ of range).
- The alternatives that have a moderate number of "adverse effect" impacts to other historic resources are considered yellow (middle ⅓ of range).
- The alternatives that have the lowest number of "adverse effect" impacts to other historic resources are considered green (bottom ⅓ of range).

Archaeological Resource Impacts

An archaeological resource is defined as evidence of past activity (ancient Native American or historic) that survives below ground. The archeological sensitivity of the project area was assessed by a qualified archaeologist based on research, historic maps, results of previously conducted archaeological surveys, and limited field reconnaissance. This criterion measures potential impacts to archeologically sensitive areas based on potential construction associated with each bridge.

- Alternative considered red if potential bridge work impacts areas of high archaeological sensitivity.
- Alternative considered yellow if potential bridge work impacts areas of moderate archaeological sensitivity.
- Alternative considered green if potential bridge work would have no impact on potential archaeological resources.

7.6. NATURAL ENVIRONMENT

River Quality Impacts

The measure of effectiveness for river quality impacts relates to the number of piers to be removed, replaced or placed in the river. The Memorial Bridge has 12 existing river piers and the Sarah Mildred Long Bridge has 15 existing river piers. It is assumed a new Sarah Mildred Long Bridge would have 17 river piers. (It is assumed that the rehabilitation of the Sarah Mildred Long Bridge would remove and replace 3 river piers.)

Lowest Impacts = 0 – 15 total piers added, removed or replaced in the river
Moderate Impacts = 16 - 30 total piers added, removed or replaced in the river
High Impacts = 31 – 44 total piers added, removed or replaced in the river

- Alternatives that require the greatest amount of work in the river have the highest impacts and thus considered red. Work includes both the removal of and installation of river piers.
- Alternatives that require a moderate amount of work in the river are considered yellow. Work includes both the removal of and installation of river piers.
- Alternatives that require the least amount of work in the river are considered green. Work includes both the removal of and installation of river piers.

Air Quality

This assessment conducted a local (microscale) air quality analysis to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS) by evaluating air quality impacts of 2035 No Build and Build conditions. The analysis also evaluated air quality impacts associated with the 2009 Existing Condition. The local or hotspot analysis evaluated carbon monoxide (CO) and particulate matter (PM). The air quality study assumes that if the 2035 Build Alternative that was selected for analysis purposes (the Alternative with the highest traffic demands and delays) meets the NAAQS, then all other alternatives would have lower concentrations and can be assumed to also meet the NAAQS. Air quality is not considered to be negatively impacted by any of the proposed bridge alternatives and therefore all alternatives are considered green.

Aquatic Habitat

Permanent aquatic habitat loss is measured by the number of additional bridge piers to be placed in the river for each alternative versus what exists today (27 piers).

Lowest Impacts = less that 27 piers
Moderate Impacts = 27 piers
High Impacts = more that 27 piers

- Alternatives that increase the number of bridge piers in the river versus what exists today are considered red.
- Alternatives that maintain the same number of bridge piers in the river versus what exists today are considered yellow.

- Alternatives that reduce the number of bridge piers in the river versus what exists today are considered green.

Access to River

This criterion looked at whether each alternative impacted public access to the Piscataqua River.

- Alternatives that require relocation to public access to the river are considered red.
- Alternatives that require minor adjustment or temporary closure to public access to the river are considered yellow.
- Alternatives that do not impact public access to the river are considered green.

None of the alternatives impact current access to the river.

Threatened and Endangered Species (T&E)

This criterion measures the potential for impacts to threatened and endangered species. Available information was obtained from federal and state agencies, but field investigations have not been performed. Several species are identified in the Study Area, but specific locations of these species in relation to the potential work areas of each alternative is not known at this time. Therefore each alternative is indicated as "Undetermined" at the time of publication of this report.

Wetlands

Wetlands are perennially wet areas supported by a spring or other water source, also called "wetland," "marsh," or "swamp." This criterion measures the quantified impact to wetlands for each alternative. The impact values below are from the Department of the Army Programmatic General Permit for the State of New Hampshire. It is not anticipated that any wetlands in Kittery will be impacted by any of the alternatives.

- Alternatives that require an Individual Corps Permit (greater than 3 acres of impact) are considered red.
- Alternatives that require a Corps Programmatic General Permit (less than 3 acres of impact) are considered yellow.
- Alternatives that do not require a Corps permit (no wetland impact) are considered green.

Floodplain/Floodway

Floodplain/floodways are the part of a stream through or over which water may flow at some time. This criterion measures the quantified impact to floodplains/floodways in square feet (sf) for each alternative.

Lowest impacts = 0 sf Highest impacts = 36,800 sf Average impacts = 18,400 sf

- Alternatives that have the highest impacts to floodplains/floodways are considered red (top ⅓ of range).

- Alternatives that have moderate impacts to floodplains/floodways are considered yellow (middle ⅓ of range).
- Alternatives that have the lowest impacts to floodplains/floodways are considered green (bottom ⅓ of range).

7.7. PHYSICAL ENVIRONMENT

Neighborhood Traffic Impacts

A neighborhood is defined as people living near one another in a particular district or area. Five neighborhoods were identified within close proximity to both the Memorial and Sarah Mildred Long Bridges that could experience traffic volume changes as a result of changed traffic patterns by some of the alternatives: 1) Badgers Island (Kittery), 2) Newmarch Street/Government Street (Kittery), 3) Bridge Street/Cook Street (Kittery), 4) Downtown Portsmouth along State Street/Daniel Street (Portsmouth), and 5) Maplewood Avenue (Portsmouth). Reduced traffic through neighborhoods is considered a positive impact and additional traffic through neighborhoods is considered to be a negative impact. This criterion measures traffic impact by the number of neighborhoods that would experience increased vehicular traffic for each alternative.

- Alternatives that increase roadway use through 3 - 5 neighborhoods are considered red.
- Alternatives that increase roadway use through 1 - 2 neighborhoods are considered yellow.
- Alternatives that maintain or reduce roadway use through neighborhoods are considered green.

Publicly Owned Property Impacts

A publicly owned property is a school, town or city office, etc - any building that is owned by a municipal, county, state or federal entity. This criterion measures the quantified impact for each alternative to publicly owned property. Publicly owned property impacts range from zero sf to a high of 26,402 sf.

Lowest Public Property Impact = 0 to 8,800 sf (bottom ⅓ of range)
Moderate Public Property Impact = 8,801 to 17,601 sf (middle ⅓ of range)
Highest Public Property Impact = 17,602 to 26,402 sf (top ⅓ of range)

- Alternatives that have the highest public property impacts are considered red.
- Alternatives that have moderate public property impacts are considered yellow.
- Alternatives that have the lowest public property impacts are considered green.

Commercial Property Impacts

A commercial property is any privately owned business on land zoned for commercial use. This criterion measures the quantified impact for each alternative to commercial property. An impact means a portion of the property may be acquired. Commercial property impacts range from zero sf to a high of 5,163 sf.

Lowest Commercial Property Impact = 0 to 1,721 sf (bottom ⅓ of range)
Moderate Commercial Property Impact = 1,722 to 3,442 sf (middle ⅓ of range)
Highest Commercial Property Impact = 3,443 to 5,163 sf (top ⅓ of range)

- Alternatives that have the highest commercial property impacts are considered red.
- Alternatives that have moderate commercial property impacts are considered yellow.
- Alternatives that have the lowest commercial property impacts are considered green.

Residential Property Impacts

A residential property is any privately owned dwelling unit on land zoned for residential use. This criterion measures the quantified impact for each alternative to residential property. An impact means a portion of the property may be acquired. Residential impacts range from zero sf to a high of 26,294 sf.

Lowest Residential Property Impact = 0 to 8,765 sf (bottom ⅓ of range)
Moderate Residential Property Impact = 8,766 to 17,529 sf (middle ⅓ of range)
Highest Residential Property Impact = 17,530 to 26,294 sf (top ⅓ of range)

- Alternatives that have the highest residential property impacts are considered red.
- Alternatives that have moderate residential property impacts are considered yellow.
- Alternatives that have the lowest residential property impacts are considered green.

Business or Residential Displacements

A displacement means that an active business or occupied residence would require complete acquisition. This criterion measures the number of displacements currently identified by alternative and also provides the assessed value of displacements.

Lowest number of displacements = 0
Moderate number of displacements = 1
Highest number of displacements = 2

- Alternatives that require the highest number of displacements are considered red.
- Alternatives that require a moderate number of displacements are considered yellow.
- Alternatives that require the lowest number of displacements are considered green.

Noise

The Traffic Noise Model (TNM) was used to calculate the existing and future sound levels at all the receptor locations in the Study Area for each alternative. A noise level increase of 15 dbA over existing levels or a noise level exceeding 66 dbA require noise abatement such as vegetated buffers, sound walls, etc.

- Alternatives that increase noise levels by more than 15 dbA over existing levels or have a noise level exceeding 66 dbA are considered red.
- Alternatives that increase noise levels between 3 and 15 dbA are considered yellow.
- Alternatives that decrease noise levels or increase noise levels by less than 3 dbA are considered green.

7.8. ENVIRONMENTAL CLEARANCES

US Coast Guard Permitability

- Alternatives that are not regarded as permitable are considered red.
- Alternatives that are regarded as permitable are considered green.

Level of NEPA Documentation

The National Environmental Policy Act (NEPA) regulates the process of new construction in order to protect the environment, including the natural and built environment. FHWA will determine the appropriate NEPA Class of Action.

- Alternatives that are regarded to have significant NEPA impacts and sizable public comments that may require the preparation of an Environmental Impact Statement are considered red.
- Alternatives that may have significant NEPA impacts and may require the preparation of an Environmental Assessment are considered yellow.
- Alternatives that may be advanced as NEPA Categorical Exclusions are considered green.

7.9. USE OF SECTION 4(f) PROPERTIES

Section 4(f) applies to use of any publicly owned public park, recreation area, or wildlife and waterfowl refuge and any land from an historic site of national, state or local significance.

Section 4(f) Historic Properties

This criterion measured the number of historic Section 4(f) properties that may be impacted by each alternative.

Lowest impacts = 3 Highest impacts = 8 Average impacts = 6

- Alternatives that have the highest number of affected historic 4(f) Properties are considered red (top ⅓ of range).
- Alternatives that have a moderate number of affected historic 4(f) Properties are considered yellow (middle ⅓ of range).
- Alternatives that have the lowest number of affected historic 4(f) Properties are considered green (bottom ⅓ of range).

Other Section 4(f) Properties

This criterion measured the number of other Section 4(f) properties that may be impacted by each alternative.

Lowest impacts = 1 Highest impacts = 3 Average impacts = 2

- Considered red if three Section 4(f) Properties are impacted.
- Considered yellow if two Section 4(f) Properties are impacted.
- Considered green if one Section 4(f) Properties is impacted

The Alternatives Evaluation Matrix summarizing the results of the Evaluation Criteria Rating for the MOEs is shown on Figure 8-18, located in Chapter 8.

8.0. Results of Detailed Evaluation of Alternatives

This chapter summarizes the results of the detailed evaluation and analysis identified in Chapter 7 for each of the Alternatives carried forward from the Fatal Flaw Analysis. This summary includes an identification of benefits and impacts of the No-Build Alternative and the Build Alternatives.

8.1. NO-BUILD ALTERNATIVE

The No-Build Alternative assumes that no new construction would occur with the exception of a traffic signal installation at the intersection of Market and Russell Streets in Portsmouth to alleviate traffic congestion from the closure of the Memorial Bridge. The No-Build Alternative assumes that the existing Memorial Bridge would not be available for use in 2035 due to structural issues. It has been determined that without improvements, the Memorial Bridge would have to be closed within one to three years. The Memorial Bridge was recently closed to vehicular traffic to make necessary structural repairs, and upon its reopening has been posted at a three-ton weight limit, effectively prohibiting all vehicles except automobiles and pickup trucks. The No-Build Alternative assumes that the Sarah Mildred Long Bridge would remain open, but with a reduced weight limit posting. The results of the No-Build evaluation are:

- Engineering Analysis – The No-Build Alternative would not address any of the engineering issues or parameters necessary to accommodate the 2035 design year traffic.
- Traffic Analysis – This alternative yields the highest VMT (123,982) and VHT (4,148) due to the closure of the Memorial Bridge. Has the highest number of intersections (five) that will fail (LOS F) by 2035. This alternative includes the work required at failing intersections, in proximity to the bridges, to obtain a minimum LOS of D. The closure of the Memorial Bridge would reduce traffic and noise levels in the neighborhoods adjacent to the Memorial Bridge approaches. Traffic would increase in three neighborhoods cause by the diversion of traffic to the Sarah Mildred Long Bridge. With the Memorial Bridge closed, the Sarah Mildred Long Bridge would have a volume to capacity ratio of 1.09, indicating that the traffic volume would exceed the available bridge capacity in the peak hour by 2035.
- Multimodal Evaluation – This alternative would reduce bicycle/pedestrian facilities and limit use in the Study Area due to the closure of the Memorial Bridge. The lift span section of the Sarah Mildred Long Bridge would not provide adequate bicycle shoulder width, and would not provide pedestrian facilities. Removal of Memorial Bridge would improve the movement of marine traffic, particularly to the Port of Portsmouth. Rail would be maintained on the Sarah Mildred Long Bridge.
- Air Quality Analysis – The No-Build Alternative is not expected to increase air pollutants above the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels. Noise levels would likely decrease in the vicinity of the Memorial Bridge access points due to a reduction in traffic.

- Natural Resource Impact Analysis – The No Build Alternative would have beneficial long term effects on aquatic resources and floodplain areas due to the closure and removal of the Memorial Bridge and its piers in the Piscataqua River.
    - River Quality: Temporary impacts to river quality may occur during demolition of bridge piers in the Piscataqua River. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. Long term effects on aquatic habitat would be beneficial with the removal of the Memorial Bridge piers. Upon removal of the bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the development of environmental documentation, design and permitting phases of the project.
    - Wetlands: The removal of the Memorial Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type.
    - Floodplain/Floodway: There would be a beneficial effect by removal of the Memorial Bridge piers from the floodplain.
- Physical Resource Impacts – There would be no impacts to the physical resources due to no infrastructure construction occurring in either community. This alternative would not directly impact any publically owned, commercial or residential properties.
- Land Use Impacts –No direct impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determination indicates that closure and removal of the Memorial Bridge and subsequent change in traffic patterns would have an adverse effect on the following historic resources: U.S.S. Albacore, Moffatt-Ladd House, MacPhaedris-Warner House, Governor John Langdon House, Wentworth House, Memorial Bridge, Sarah Mildred Long Bridge, U.S. Route 1 Bypass Historic District, Memorial Bridge Historic District, Portsmouth Local Historic District, and Memorial Park.
- Archaeological Impacts – If the Scott Avenue Bridge in Portsmouth is removed as a part of the Memorial Bridge removal, the activity may impact an archaeological resource.
- Costs Analysis– This alternative yields the lowest capital costs ($18 to $22 million) because no new construction would occur. Total operations costs would be reduced due to the removal of the Memorial Bridge. Overall maintenance costs may be reduced due to the removal of the Memorial Bridge, but the maintenance costs would be expected to be higher on the unimproved Sarah Mildred Long Bridge due to its age (highest overall operation and maintenance costs ($126 to $154 million)). The life cycle cost is among

the lowest of all of the alternatives ($144 to $176 million) because operation and maintenance cost is only for the Sarah Mildred Long Bridge. This alternative provides the highest travel time delay cost ($22,970) due to having the highest congestion. It has the lowest benefit/cost ratio (0.00) because this alternative does not provide any transportation benefits. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental documentation phase.

- Business Impact Assessment – Closure of Memorial Bridge would have impact to adjacent local businesses that rely on customer traffic but would not affect the regional economy.
- Environmental Clearances – A bridge closure and removal does not require a Coast Guard permit. However, the Coast Guard must be notified to determine if the bridge closure and removal would have an effect on navigation so that waterway users may be notified. Under NEPA, FHWA is responsible for determining the Class of Action. A Categorical Exclusion (CE) would likely be the appropriate Class of Action for the removal of the Memorial Bridge. A U.S. Army Corps of Engineers permit likely would not be needed.

Figure 8-1 on the following page provides a plan and cross section of the No-Build alternative.

8.2 Alternative 1 - Memorial Bridge Rehabilitated and Sarah Mildred Long Bridge Rehabilitated

Per the findings summarized in Chapter 5 which states that the Memorial Bridge Rehabilitation is not prudent, Alternative 1 has been dismissed from further consideration. Figure 8-2 on the following pages provides a plan and cross section of Alternative 1 for reference only.

8.3 Alternative 2a - Memorial Bridge Rehabilitated and Sarah Mildred Long Bridge Replaced on Existing Alignment (two-lane), and Alternative 2b - Memorial Bridge Rehabilitated and Sarah Mildred Long Bridge Replaced on Existing Alignment (four-lane)

Per the findings summarized in Chapter 5 which states that the Memorial Bridge Rehabilitation is not prudent, Alternatives 2a and 2b have been dismissed from further consideration. Figures 8-3 and 8-4 on the following pages provide a plan and cross section of Alternatives 2a and 2b for reference only.

DRAFT

LIMIT OF WORK

PORTSMOUTH

MARKET ST EXT

MAPLEWOOD AVE

NORTHWEST ST

RETAINING WALL

LIMIT OF WORK

NEW HAMPSHIRE

MAINE

APPROXIMATE LOCATION OF NAVIGABLE CHANNEL

BRIDGE POSTED WEIGHT REDUCED

EXISTING 200' HORIZONTAL CLEARANCE

OAK TERRACE

OLD POST ROAD

KITTERY

BRIDGE ST

SARAH MILDRED LONG BRIDGE
NO BUILD - BRIDGE POSTED WEIGHT REDUCED

DANIEL ST

CHAPEL ST

BOW ST

STATE ST

WRIGHT AVE

HARBOR PL

ATKINSON ST

COURT ST

MARCY ST

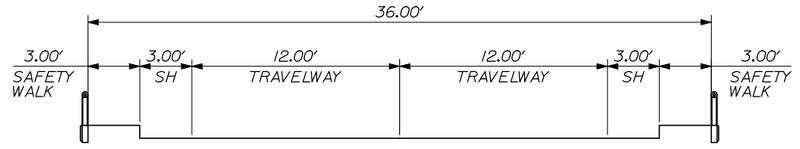
NEW HAMPSHIRE

MAINE

BADGER'S ISLAND

BRIDGE REMOVED

MEMORIAL BRIDGE
NO BUILD - BRIDGE CLOSED



SARAH MILDRED LONG BRIDGE
NO BUILD - 2 TRAVEL LANES

BRIDGE TYPICAL SECTION

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

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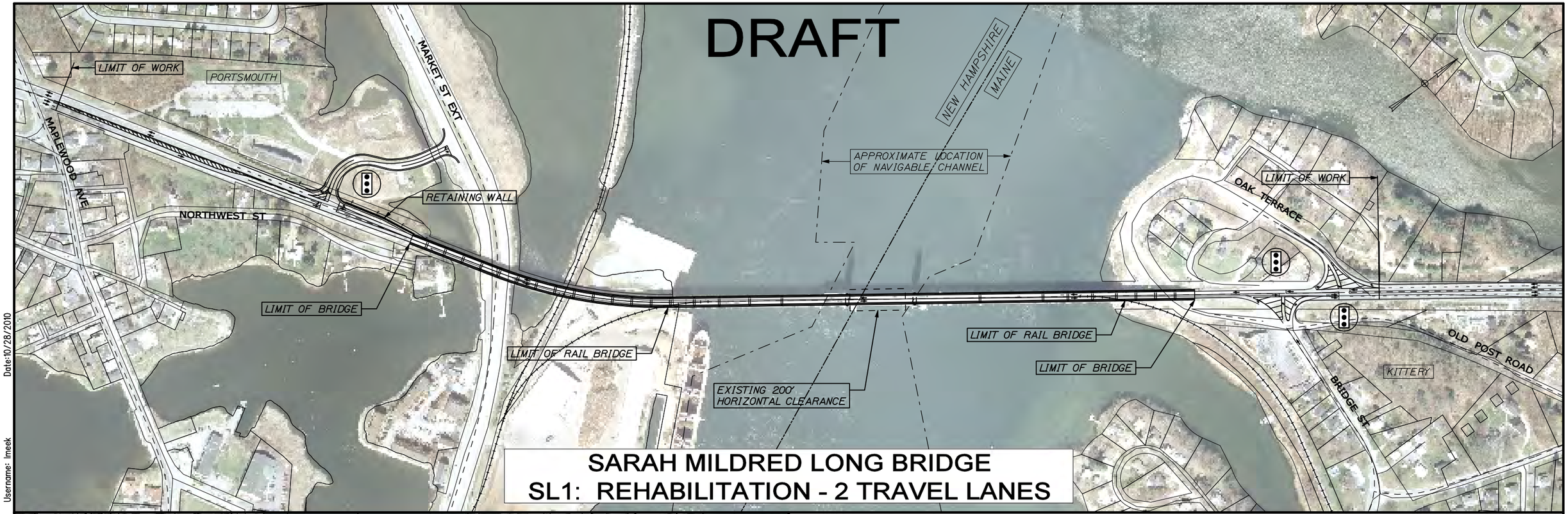
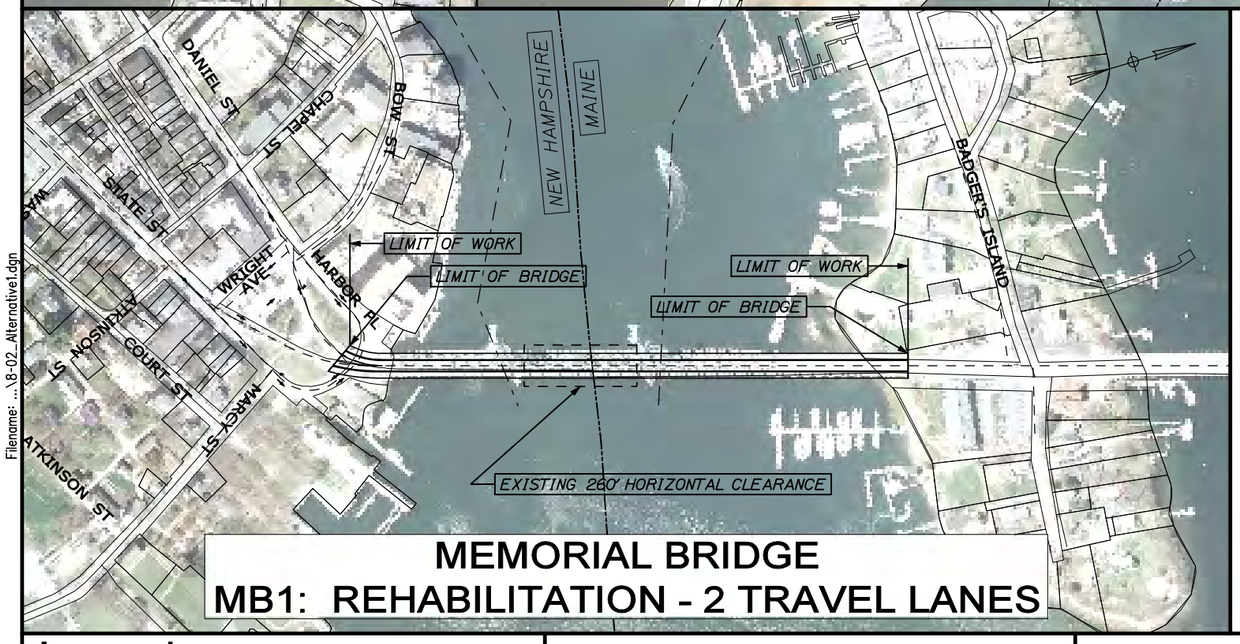
FIGURE 8-1
NO BUILD ALTERNATIVE

Date:10/28/2010
Username: lmeek
Filename: ...\8-01_NoBuildAlternative.dgn

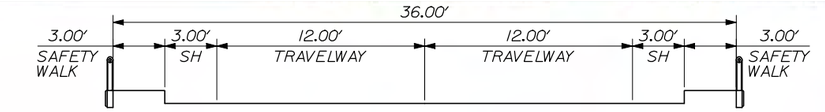
DRAFT



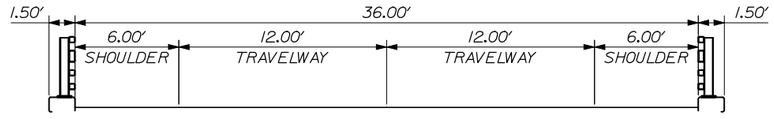
SARAH MILDRED LONG BRIDGE
SL1: REHABILITATION - 2 TRAVEL LANES



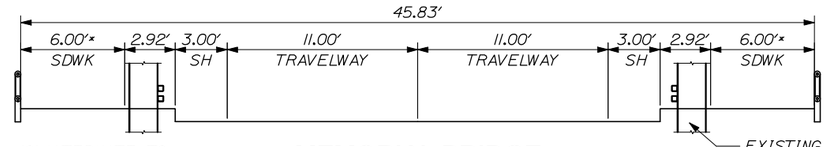
MEMORIAL BRIDGE
MB1: REHABILITATION - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REHABILITATION - 2 TRAVEL LANES (LIFT SPAN)



SARAH MILDRED LONG BRIDGE
REHABILITATION - 2 TRAVEL LANES (APPROACH SPANS)



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REHABILITATION - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

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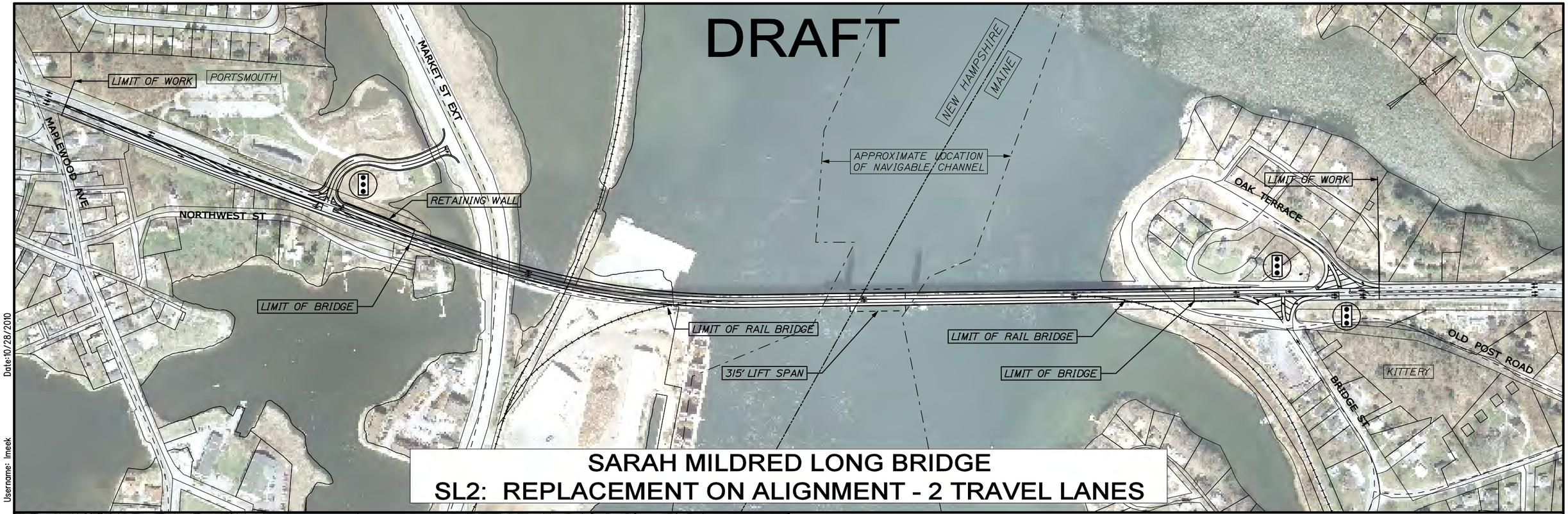
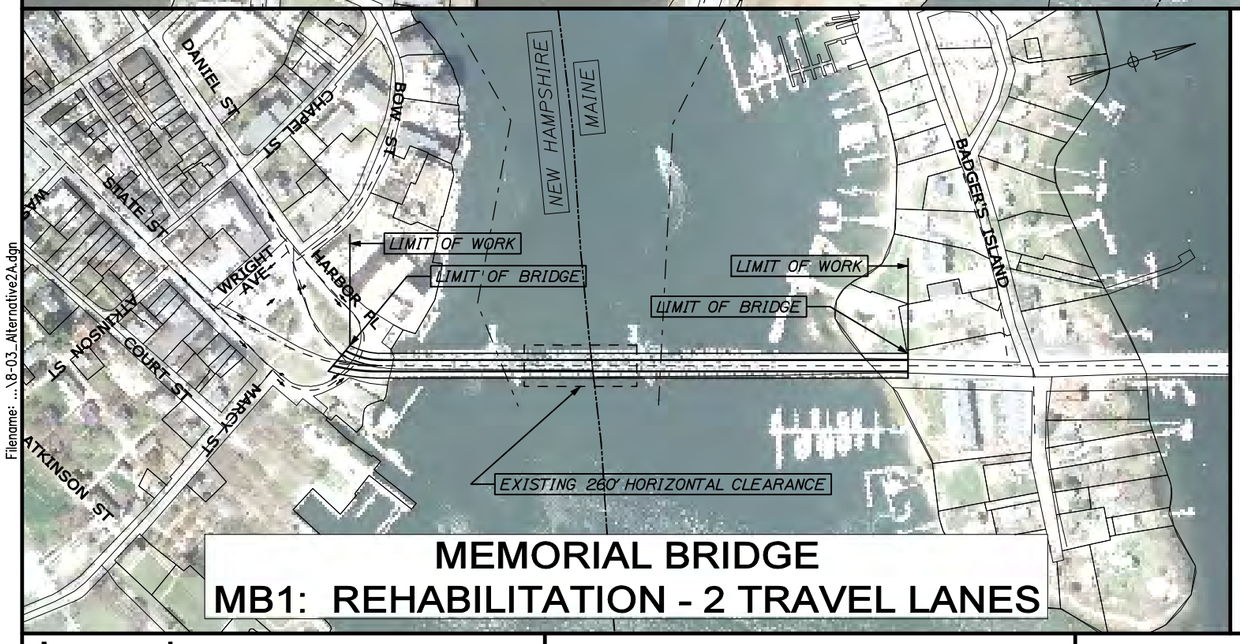
FIGURE 8-2
ALTERNATIVE 1

Date:10/28/2010
Username: lmeek
Filename: ...\8-02_Alternative1.dgn

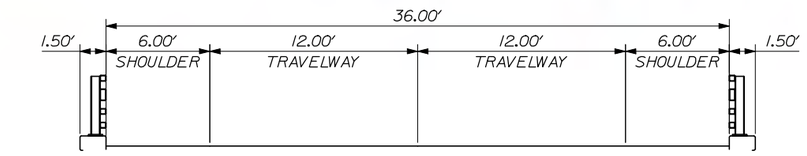
DRAFT



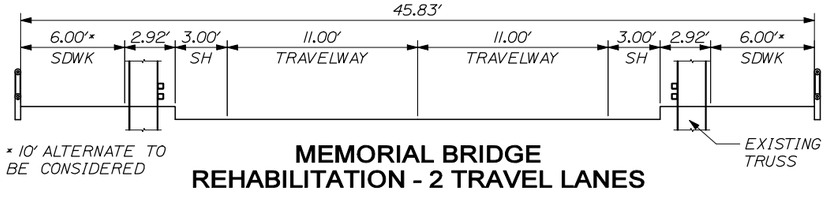
SARAH MILDRED LONG BRIDGE
SL2: REPLACEMENT ON ALIGNMENT - 2 TRAVEL LANES



MEMORIAL BRIDGE
MB1: REHABILITATION - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REHABILITATION - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

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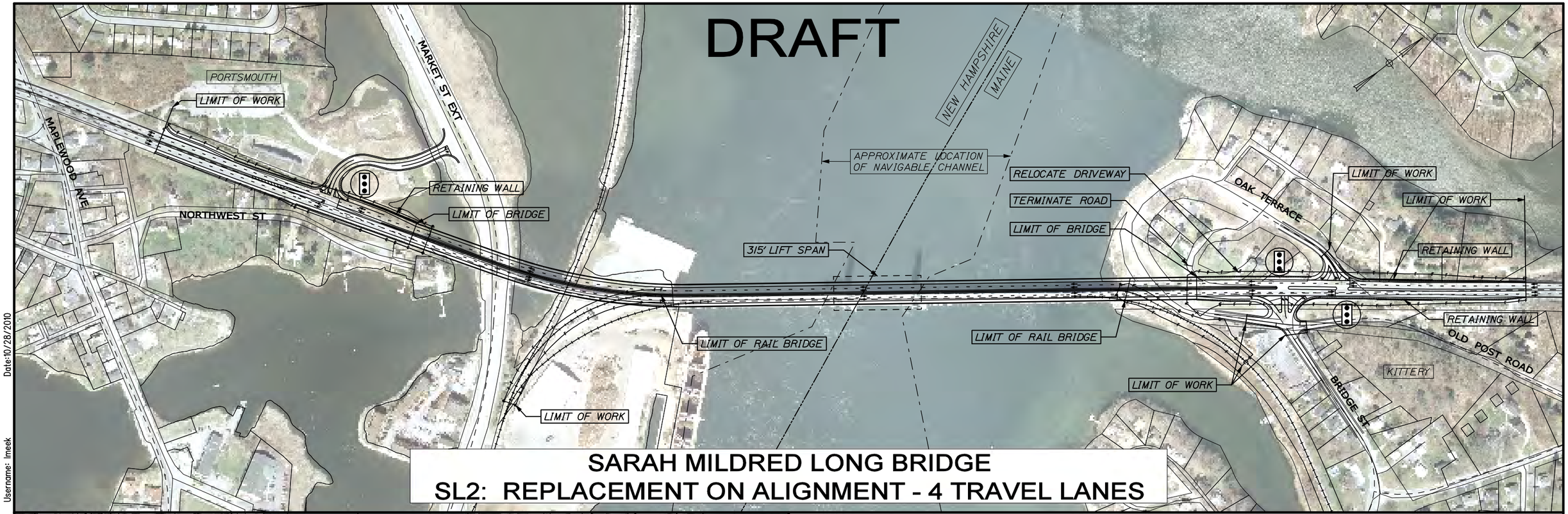
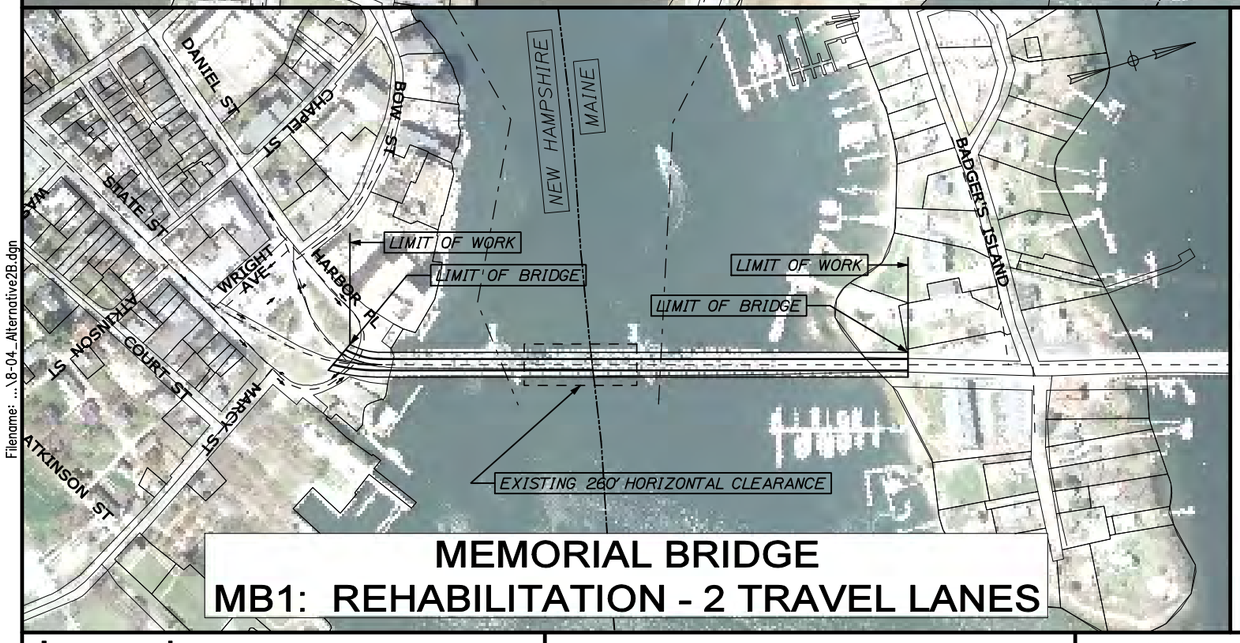
FIGURE 8-3
ALTERNATIVE 2A

Date:10/28/2010
Username: lmeek
Filename: ...\8-03_Alternative2A.dgn

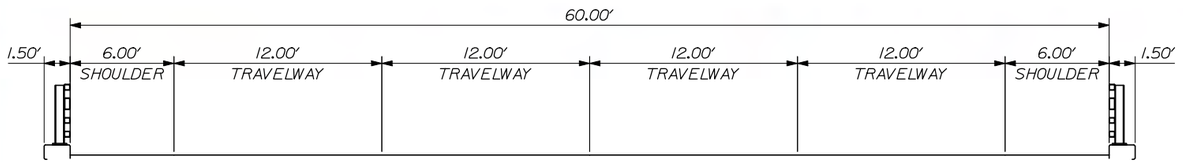
DRAFT



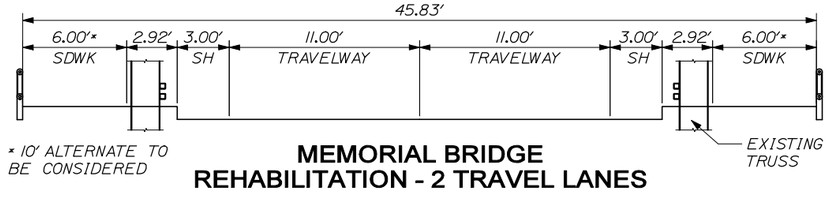
SARAH MILDRED LONG BRIDGE
SL2: REPLACEMENT ON ALIGNMENT - 4 TRAVEL LANES



MEMORIAL BRIDGE
MB1: REHABILITATION - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REHABILITATION - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

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FIGURE 8-4
ALTERNATIVE 2B

Date:10/28/2010
Username: lmeek
Filename: ...\8-04_Alternative2B.dgn

8.4 Alternative 3a - Memorial Bridge Rehabilitated and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane), and Alternative 3b - Memorial Bridge Rehabilitated and Sarah Mildred Long Bridge Replaced on Upstream Alignment (four-lane)

Per the findings summarized in Chapter 5 which states that the Memorial Bridge Rehabilitation is not prudent, Alternative 3a and 3b have been dismissed from further consideration. Figures 8-5 and 8-6 on the following pages provide a plan and cross section of Alternatives 3a and 3b for reference only.

8.5 Alternative 4 – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Rehabilitated

Alternative 4 would replace the Memorial Bridge and its abutments on existing alignment, retaining the existing piers and navigational clearances. Alternative 4 would rehabilitate the lift span and the four approach truss spans of the Sarah Mildred Long Bridge which maintains existing navigational clearances, and replaces the abutments, piers and spans to the truss spans (both super and sub-structure) including the rail component, all on the existing alignment. The results of the Alternative 4 evaluation are:

- Engineering Analysis – This alternative would not fully address the engineering issues or parameters necessary to accommodate the 2035 design year traffic. The replacement of the Memorial Bridge would improve roadway shoulder widths and bicycle/pedestrian facilities. The rehabilitation of the Sarah Mildred Long Bridge would not provide opportunities for improving the shoulder widths nor provide for bicycle/pedestrian facilities. The portion of the Sarah Mildred Long Bridge that would be rehabilitated would require a greater maintenance effort and increased maintenance costs, compared to a completely new bridge.
- Traffic Analysis – The Memorial Bridge superstructure replacement and the Sarah Mildred Long Bridge rehabilitation would improve vehicular cross river mobility. It has some of the lowest VMT (122,283) and VHT (4,062) of the build alternatives. Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) in downtown Portsmouth would increase along State Street/Daniel Street and on Badgers Island. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.

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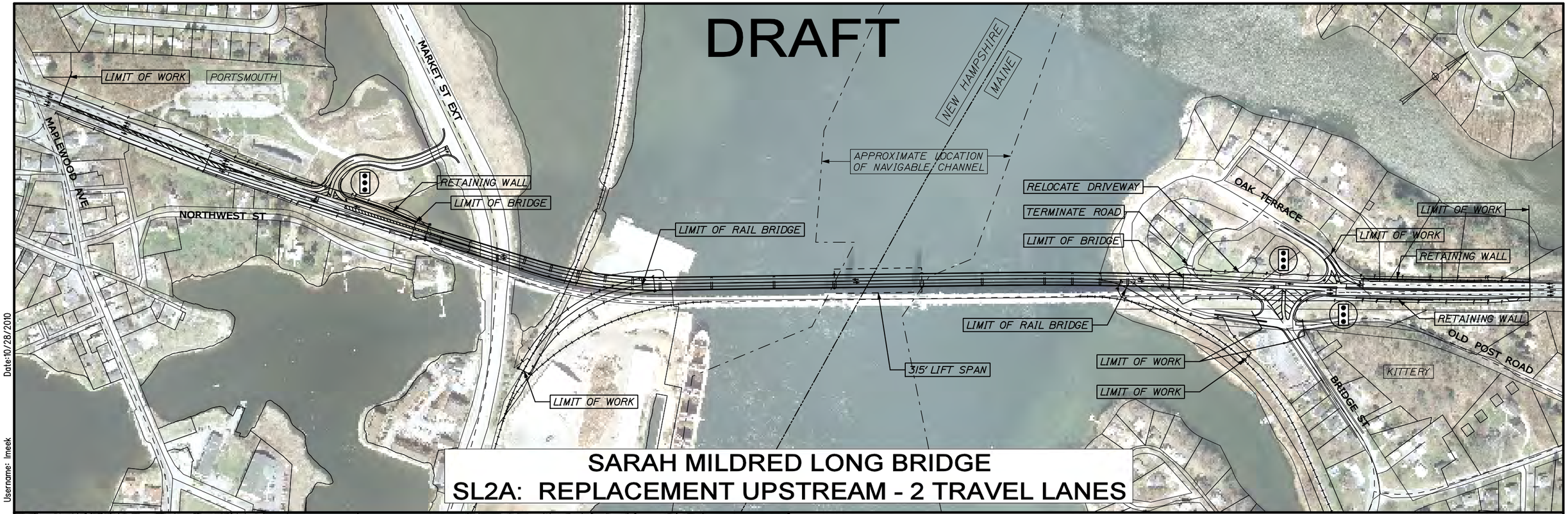
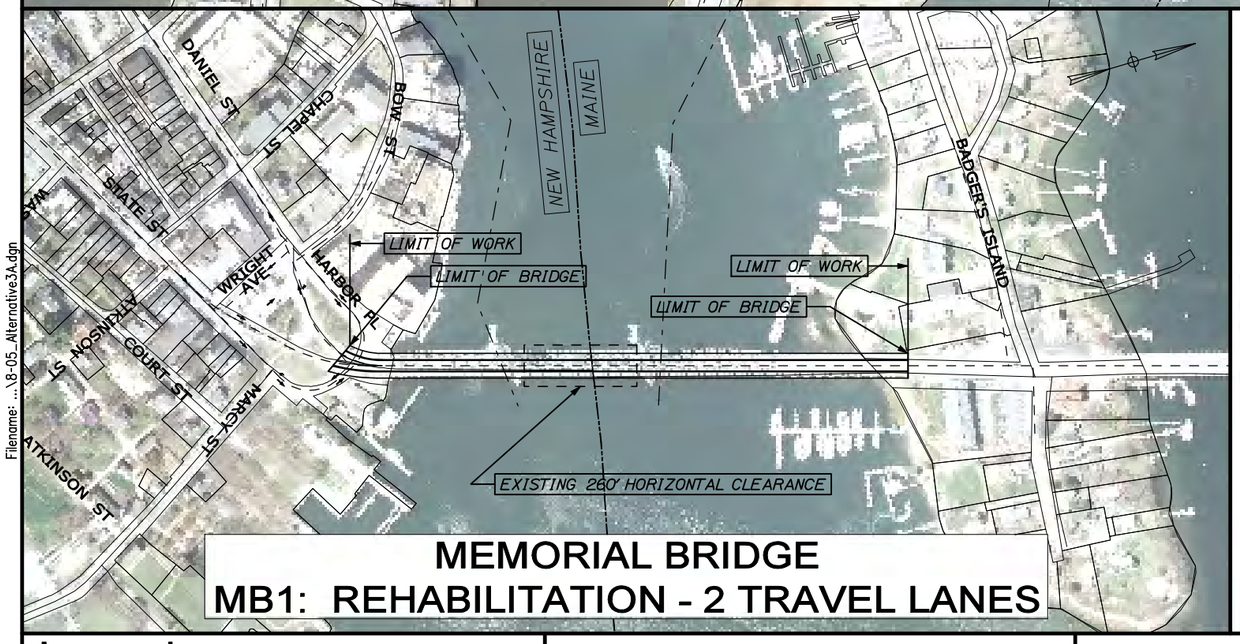
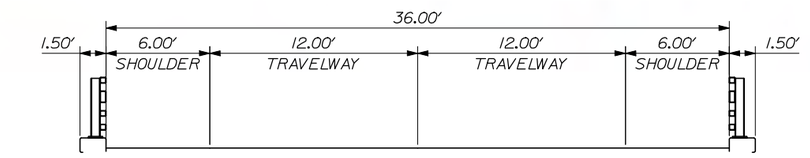


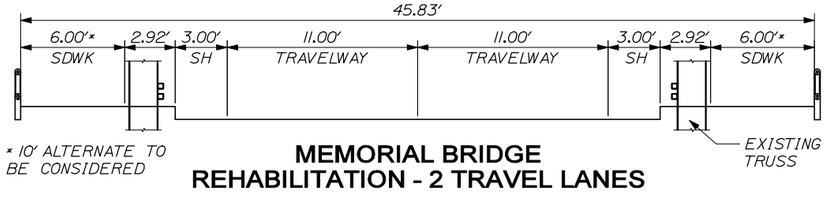
SARAH MILDRED LONG BRIDGE
SL2A: REPLACEMENT UPSTREAM - 2 TRAVEL LANES



MEMORIAL BRIDGE
MB1: REHABILITATION - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REHABILITATION - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

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FIGURE 8-5
ALTERNATIVE 3A

Date:10/28/2010
Username: lmeek
Filename: ...\8-05_Alternative3A.dgn

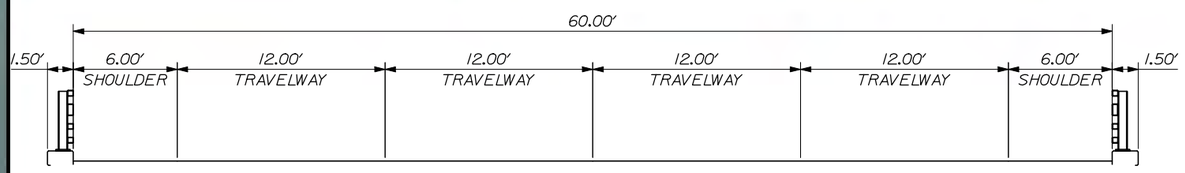
DRAFT

PORTSMOUTH
LIMIT OF WORK
MAPLEWOOD AVE
NORTHWEST ST
MARKET ST EXT
RETAINING WALL
LIMIT OF BRIDGE
NEW HAMPSHIRE
MAINE
APPROXIMATE LOCATION OF NAVIGABLE CHANNEL
315' LIFT SPAN
RELOCATE DRIVEWAY
TERMINATE ROAD
LIMIT OF BRIDGE
OAK TERRACE
LIMIT OF WORK
LIMIT OF WORK
LIMIT OF RAIL BRIDGE
LIMIT OF RAIL BRIDGE
OLD POST ROAD
KITTERY
LIMIT OF WORK
BRIDGE ST
LIMIT OF WORK
LIMIT OF WORK

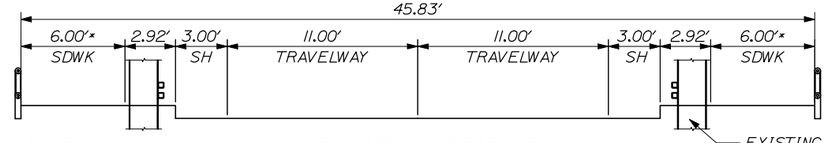
SARAH MILDRED LONG BRIDGE
SL2A: REPLACEMENT UPSTREAM - 4 TRAVEL LANES

DANIEL ST
CHAPEL ST
BOW ST
NEW HAMPSHIRE
MAINE
BADGER'S ISLAND
STATE ST
WRIGHT AVE
HARBOR PL
LIMIT OF WORK
LIMIT OF BRIDGE
LIMIT OF WORK
LIMIT OF BRIDGE
ATKINSON ST
COURT ST
MARCY ST
ATKINSON ST
EXISTING 260' HORIZONTAL CLEARANCE

MEMORIAL BRIDGE
MB1: REHABILITATION - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REHABILITATION - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

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FIGURE 8-6
ALTERNATIVE 3B

Date:10/28/2010
Username: kmeek
Filename: ...\8-06_Alternative3B.dgn

- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve accessibility to bicyclists and pedestrians to the downtowns of Portsmouth and Kittery and PNSY. The rehabilitation of the Sarah Mildred Long Bridge would continue to not provide bicycle/pedestrian accommodations on that bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic, and the rehabilitation of the Sarah Mildred Long Bridge would not improve marine deficiencies associated with the lift span channel constrictions at that location. Rail would be maintained on the existing Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis – With the rehabilitation of the Sarah Mildred Long Bridge (including all approach spans) three bridge piers in the river would be replaced. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal and replacement of three Sarah Mildred Long Bridge piers in the Piscataqua River. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be negligible with the removal and replacement of three Sarah Mildred Long Bridge piers. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the environmental documentation, design and permitting phases of the project.
    - Wetlands: The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In

addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.

  - Floodplain/Floodway: Permanent impact on floodplain areas would be negligible from replacement of bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur.

- Physical Resource Impacts – Since the proposed work associated with this alternative is located along the existing alignment, this alternative would have some of the lowest impacts to the physical resources (no publicly owned, no commercial and one residential) located at the Portsmouth approach to the Memorial Bridge.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace one bridge and rehabilitate one bridge are considered to have the lowest impact on these historic bridges, as compared to alternatives that would replace both bridges. This alternative would have an adverse effect on six other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.
- Archaeological Impacts – The replacement of the Memorial Bridge would require excavation in areas of moderate archaeological sensitivity in Portsmouth and Kittery.
- Costs Analysis – This alternative could have the lowest capital costs ($166 to $204 million) of all of the build alternatives because it would not replace the truss and lift span portions of the Sarah Mildred Long Bridge. Total operations costs would be similar to other build alternatives. Overall maintenance costs would be higher than other build alternatives because of the anticipated higher maintenance effort needed on the rehabilitated portion of the Sarah Mildred Long Bridge (highest operation and maintenance costs of the build alternatives ($121 to $149 million)). The life cycle cost is among the lowest of all the build alternatives ($287 to $353 million) because of the lower capital cost of the Sarah Mildred Long Bridge. This alternative has relatively the same travel time delay cost ($15,880) as all of the other build alternatives. It has the highest benefit/cost ratio (1.62) because of the low capital cost.
- Business Impact Assessment – There would not be any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period for each bridge are not estimated.

- Environmental Clearances - A replacement of the Memorial Bridge superstructure and its abutments would require a Coast Guard permit. The rehabilitation of the Sarah Mildred Long Bridge may not require a Coast Guard permit, but the rehabilitation work must adhere to the navigational conditions of the original permit. Under NEPA, FHWA is responsible for determining the Class of Action. A CE would likely be an appropriate Class of Action for the rehabilitation of the Sarah Mildred Long Bridge and a CE or Environmental Assessment (EA) would likely be an appropriate Class of Action for the replacement of the Memorial Bridge superstructure and its abutments. A U.S. Army Corps of Engineers permit likely would be needed for construction activities in Portsmouth impacting wetland areas.

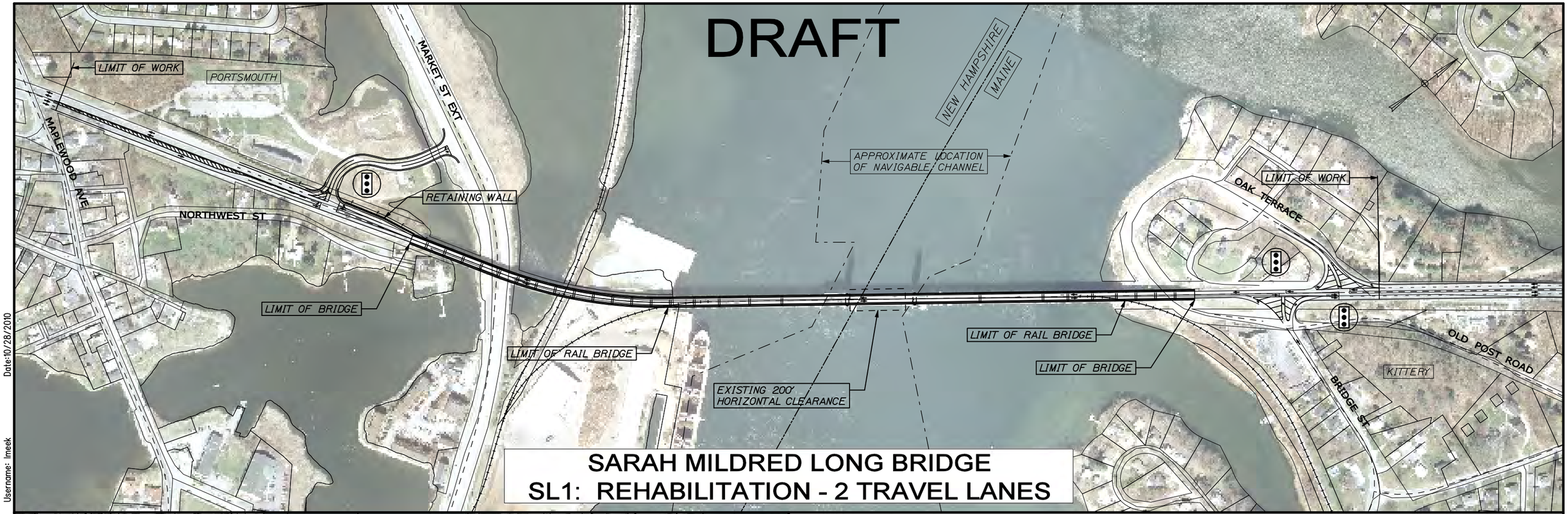
Figure 8-7 on the following page provides a plan and cross section of Alternative 4.

8.6 Alternative 5a – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Existing Alignment (two-lane)

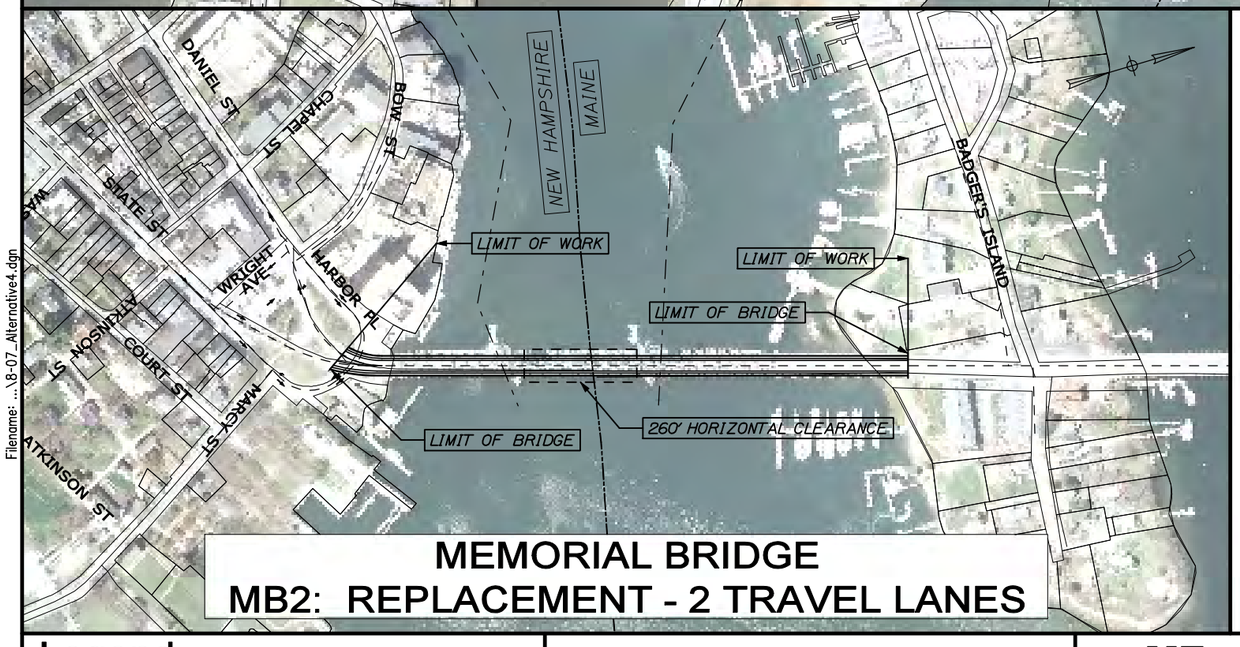
Alternative 5a would replace the Memorial Bridge and its abutments on existing alignment, retaining the existing piers, and navigational clearances. Alternative 5a would also replace the Sarah Mildred Long Bridge with a new two-lane bridge on existing alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 5a evaluation are:

- Engineering Analysis – This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The Memorial Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle/pedestrian facilities. The new Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as an appropriate shoulder for bicyclists. The new bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100-year life span.
- Traffic Analysis – The replacement of both bridges would improve cross river mobility by not limiting heavy loads and would improve efficiency in the local and regional transportation system by having lower VMT (122,283) and VHT (4,062). Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) in downtown Portsmouth would increase along State Street/Daniel Street and on Badgers Island. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.

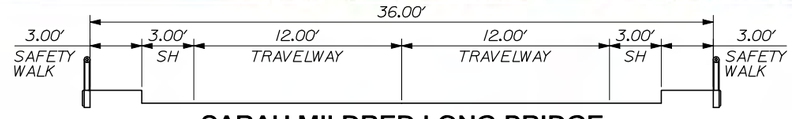
DRAFT



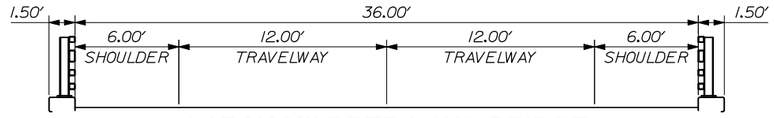
SARAH MILDRED LONG BRIDGE
SL1: REHABILITATION - 2 TRAVEL LANES



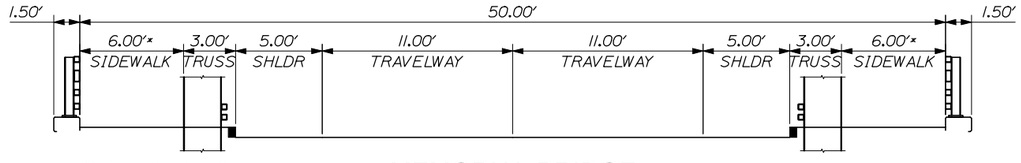
MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REHABILITATION - 2 TRAVEL LANES (LIFT SPAN)



SARAH MILDRED LONG BRIDGE
REHABILITATION - 2 TRAVEL LANES (APPROACH SPANS)



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

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FIGURE 8-7
ALTERNATIVE 4

Date:10/28/2010
Username: lmeek
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- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve bicycle and pedestrian access to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by providing a longer lift span (270 feet vs. 200 feet) over the existing marine channel. Rail would be included on the new Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis –The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
    - Wetlands: The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL

wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.

  - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary floodway impacts in work zones around the bridge piers and abutments would occur.

- Physical Resource Impacts – Since the proposed work associated with this alternative is located along the existing alignment, this alternative would have some of the lowest impacts to the physical resources (three publicly owned, no commercial and four residential properties) located at the approaches to both bridges in both communities.
- Land Use Impacts –No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on six other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.
- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative would have some of the highest capital costs ($229 to $281 million) of all of the build alternatives because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($94 to $116 million). The life cycle cost is among the highest of all the build alternatives ($323 to $397 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($15,880) as all of the other build alternatives. The benefit/cost ratio is 1.22.

- Business Impact Assessment – This alternative would not have any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances – The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge superstructure and its abutments would require a Coast Guard permit. Under NEPA, FHWA is responsible for determining the Class of Action. A CE or an EA would likely be the appropriate Class of Action for the replacement of the Memorial Bridge superstructure and its abutments and for the replacement of the Sarah Mildred Long Bridge. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth.

Figure 8-8 on the following page provides a plan and cross section of Alternative 5a.

8.7 Alternative 5b – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Existing Alignment (four-lane)

Alternative 5b would replace the Memorial Bridge and its abutments on existing alignment, retaining the existing piers, and navigational clearances. Alternative 5b also replaces the Sarah Mildred Long Bridge with a new four-lane bridge on existing alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 5b evaluation are:

- Engineering Analysis– This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The Memorial Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle/pedestrian facilities. The new four-lane Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle facilities. The new bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100-year life span.

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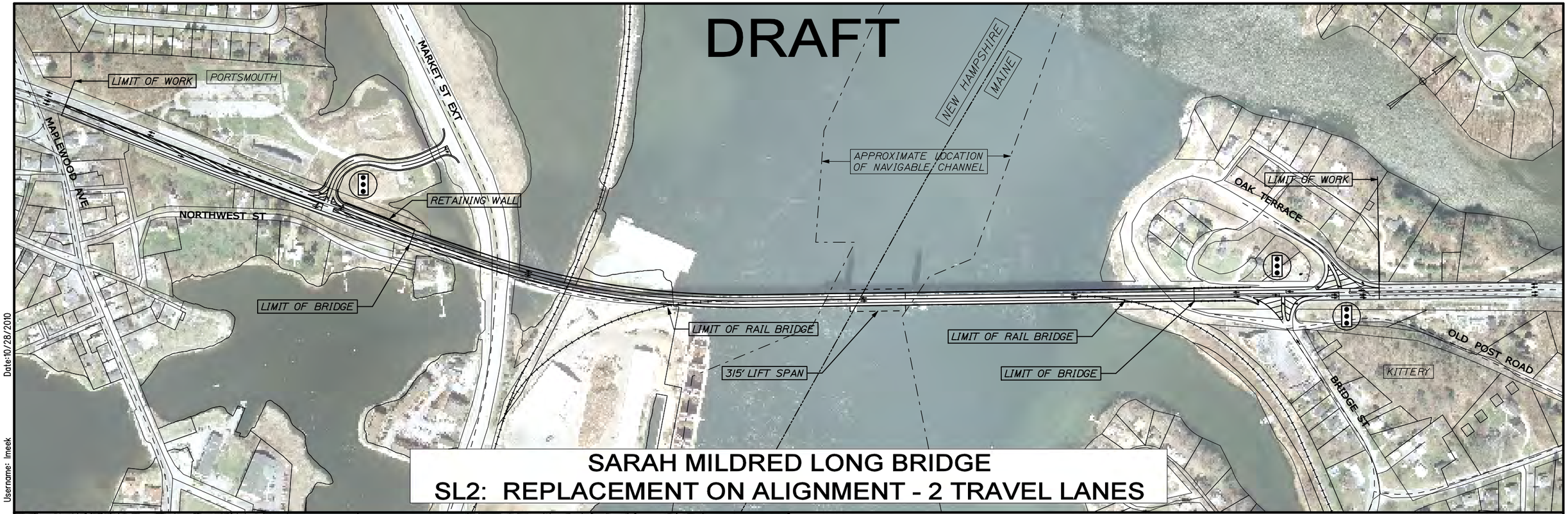
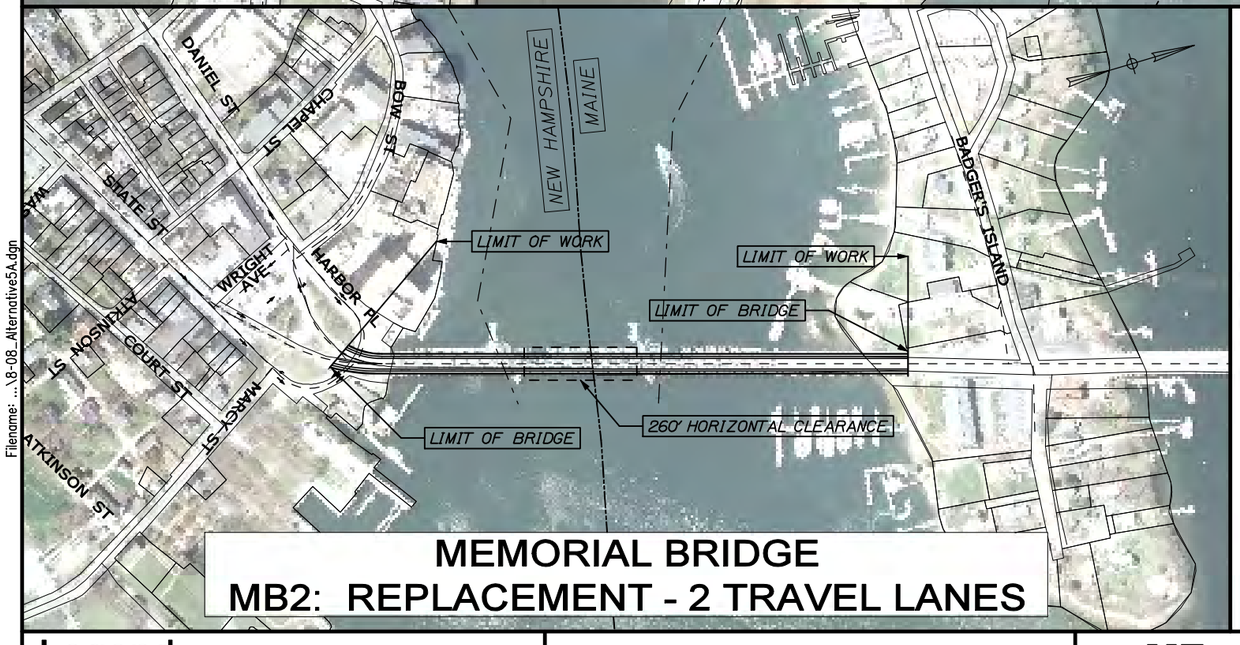
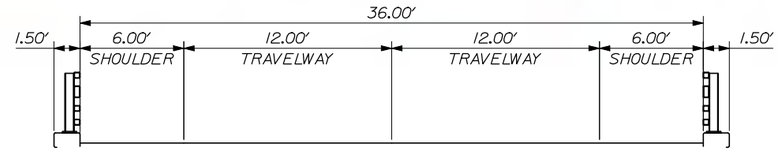


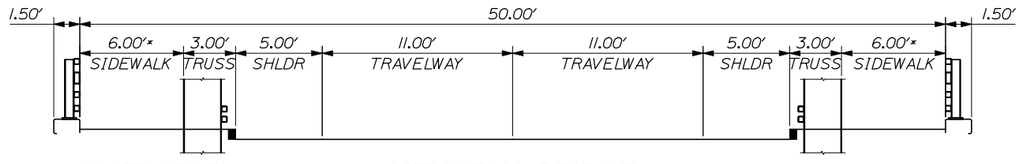
SARAH MILDRED LONG BRIDGE
SL2: REPLACEMENT ON ALIGNMENT - 2 TRAVEL LANES



MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

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FIGURE 8-8
ALTERNATIVE 5A

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Username: lmeek
Filename: ...\8-08_Alternative5A.dgn

- Traffic Analysis – The replacement of both bridges would improve cross river vehicular mobility by not limiting heavy loads and would improve local and regional transportation system efficiencies by having lower VMT (121,901) and VHT (4,049). Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) in downtown Portsmouth would increase along State Street/Daniel Street and on Badgers Island. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve bicycle and pedestrian access to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by providing a longer lift span (270 feet vs. 200 feet) over the existing marine channel. Rail would be included on the new Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. Although the substructure design has not advanced at this time, the substructure would be larger than the two-lane option and would have a greater impact on the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and

softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.

  - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design environmental documentation and permitting phases of the project.
  - Wetlands: This alternative would impact 1,300 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
  - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 25,400 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new four-lane bridge on existing alignment would require widening of the highway approaches in both communities. The widening of the approaches would have the highest impacts to publicly owned (four), commercial (one) and residential (14) property impacts as compared to the other build alternatives. This alternative would impact 5,163 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – There would no impact on zoning or activity centers.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in

accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on seven other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.

- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative has the highest capital costs ($265 to $325 million) of all of the build alternatives because it would replace both bridges with the new Sarah Mildred Long Bridge having four lanes. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($103 to $127 million). The life cycle cost is the highest of all the build alternatives ($368 to $452 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($15,620) as all of the other build alternatives. The benefit/cost ratio is 1.02.
- Business Impact Assessment – This alternative would not have any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances – The replacement of the Sarah Mildred Long Bridge will require a Coast Guard permit. The replacement of the Memorial Bridge superstructure and its abutments will require a Coast Guard permit. Under NEPA, FHWA is responsible for determining the Class of Action. A CE or an EA would likely be the appropriate Class of Action for the replacement of the Memorial Bridge superstructure and its abutments and for the replacement of the Sarah Mildred Long Bridge. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth.

Figure 8-9 on the following page provides a plan and cross section of Alternative 5b.

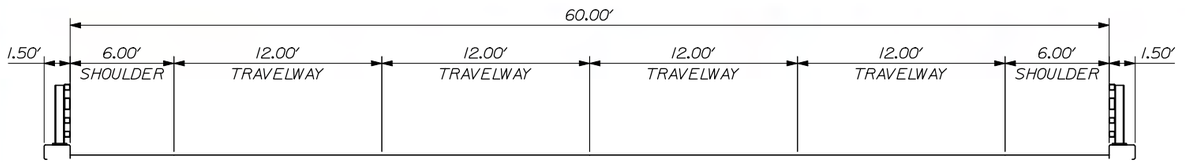
DRAFT

PORTSMOUTH
LIMIT OF WORK
MAPLEWOOD AVE
MARKET ST EXT
NORTHWEST ST
RETAINING WALL
LIMIT OF BRIDGE
NEW HAMPSHIRE
MAINE
APPROXIMATE LOCATION OF NAVIGABLE CHANNEL
315' LIFT SPAN
LIMIT OF RAIL BRIDGE
LIMIT OF WORK
RELOCATE DRIVEWAY
TERMINATE ROAD
LIMIT OF BRIDGE
LIMIT OF RAIL BRIDGE
OAK TERRACE
LIMIT OF WORK
LIMIT OF WORK
RETAINING WALL
RETAINING WALL
OLD POST ROAD
KITTERY
LIMIT OF WORK
BRIDGE ST

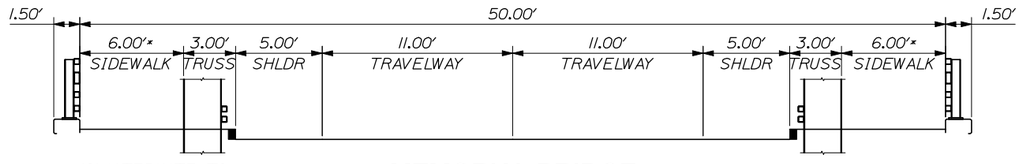
SARAH MILDRED LONG BRIDGE
SL2: REPLACEMENT ON ALIGNMENT - 4 TRAVEL LANES

DANIEL ST
CHAPEL ST
BOW ST
NEW HAMPSHIRE
MAINE
BADGER'S ISLAND
STATE ST
WRIGHT AVE
HARBOR PL
ATKINSON ST
COURT ST
MARCY ST
LIMIT OF WORK
LIMIT OF WORK
LIMIT OF BRIDGE
LIMIT OF BRIDGE
260' HORIZONTAL CLEARANCE

MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

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FIGURE 8-9
ALTERNATIVE 5B

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Filename: ...\8-09_Alternative5B.dgn

8.8 Alternative 6a – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane)

Alternative 6a would replace the Memorial Bridge on existing alignment, retaining the existing piers, and navigational clearances. Alternative 6a also replaces the Sarah Mildred Long Bridge with a new two-lane bridge on an upstream alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 6a evaluation are:

- Engineering Analysis – This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The Memorial Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle/pedestrian facilities. The new Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as an appropriate shoulder for bicyclists. The new bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100 year life span.
- Traffic Analysis – The replacement of both bridges would improve cross river mobility by not limiting heavy loads and improving local and regional transportation system efficiencies by having lower VMT (122,283) and VHT (4,062). Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) in downtown Portsmouth would increase along State Street/Daniel Street and on Badgers Island. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve bicycle and pedestrian access to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by including a longer lift span (270 feet vs. 200 feet) over the existing marine channel. Rail would be included on the new Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.

- River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
- Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
- Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
- Wetlands: This alternative would impact 1,100 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
- Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,000 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 29,000 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new two-lane bridge on new alignment would require modifying the highway approaches in both communities. The modified highway approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (14) property impacts as compared to the other build alternatives. This alternative would impact 3,633 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts –The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on six other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.
- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative would have some of the highest capital costs ($233 to $287 million) of all of the build alternatives because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($94 to $116 million). The life cycle cost is among the highest of all the build alternatives ($327 to $403 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($15,880) as all of the other build alternatives. The benefit/cost ratio is 1.18.
- Business Impact Assessment – This alternative would not yield any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge superstructure and its abutments would require a Coast Guard permit. Under NEPA, FHWA is responsible for determining the Class of Action. A CE or an EA would likely be the

appropriate Class of Action for the replacement of the Memorial Bridge superstructure and its abutments and for the replacement of the Sarah Mildred Long Bridge. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth.

Figure 8-10 on the following page provides a plan and cross section of Alternative 6a.

8.9 Alternative 6b – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Upstream Alignment (four-lane)

Alternative 6b would replace the Memorial Bridge and its abutments on existing alignment, retaining the existing piers, and navigational clearances. Alternative 6b also replaces the Sarah Mildred Long Bridge with a new four-lane bridge on an upstream alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 6b evaluation are:

- Engineering Analysis– This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The Memorial Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle/pedestrian facilities. The new four-lane Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle facilities. The new bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100 year life span.
- Traffic Analysis – The replacement of both bridges would improve cross river mobility by not limiting heavy loads and improving the local and regional transportation system efficiencies by having lower VMT (121,901) and VHT (4,049). Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) in downtown Portsmouth would increase along State Street/Daniel Street and on Badgers Island. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.

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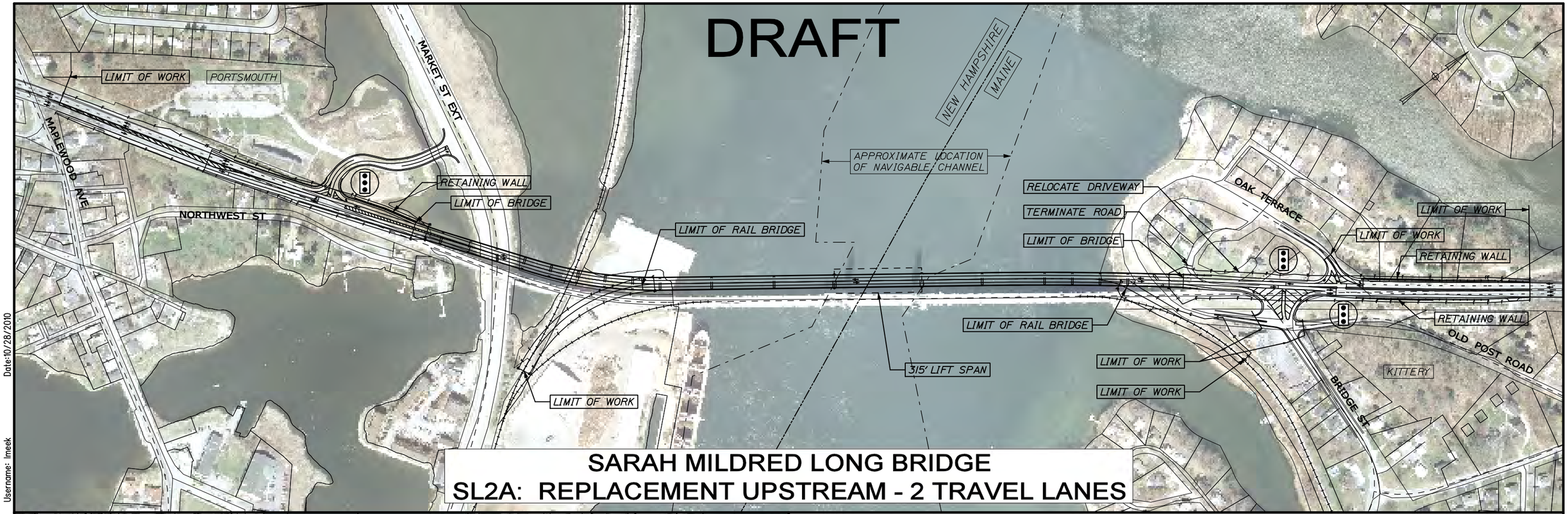
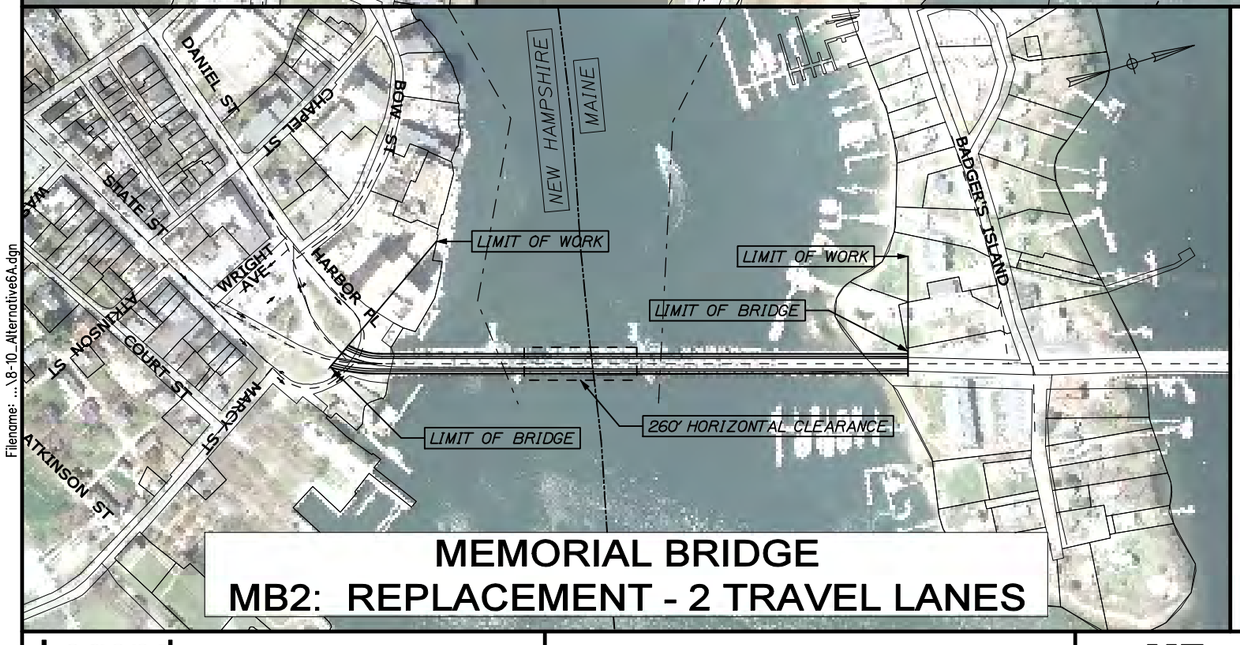
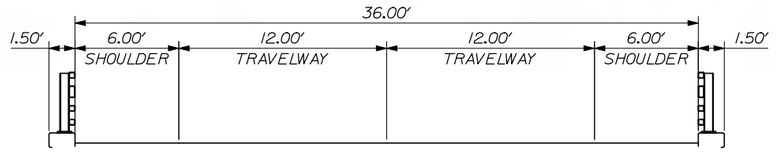


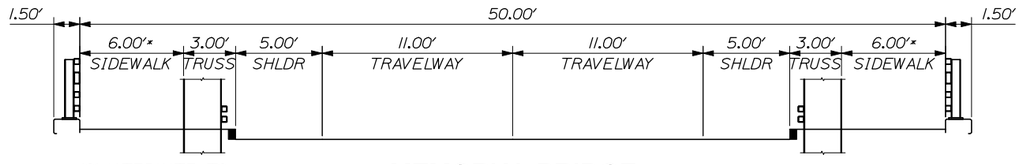
SARAH MILDRED LONG BRIDGE
SL2A: REPLACEMENT UPSTREAM - 2 TRAVEL LANES



MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

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FIGURE 8-10
ALTERNATIVE 6A

Date:10/28/2010
Username: lmeek
Filename: ...\8-10_Alternative6A.dgn

- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve bicycle and pedestrian access to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by including a longer lift span (270 foot vs. 200 foot) over the existing marine channel. Rail would be included on the new Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. Although the substructure design has not advanced at this time, the substructure would be larger than the 2-lane option and would have a greater impact on the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design environmental documentation and permitting phases of the project.

  - Wetlands: This alternative would impact 1,250 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
  - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 34,700 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.
- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new four-lane bridge on new alignment would require modifying the highway approaches in both communities. The modified highway approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (13) property impacts as compared to the other build alternatives. This alternative would impact 2,496 square feet of commercial real estate including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on seven other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.

- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative has the highest capital costs ($265 to $325 million) of all of the build alternatives because it would replace both bridges with the new Sarah Mildred Long Bridge having four lanes. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($103 to $127 million). The life cycle cost is the highest of all the build alternatives ($368 to $452 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($15,620) as all of the other build alternatives. The benefit/cost ratio is 1.02.
- Business Impact Assessment – There would not be any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge superstructure and its abutments would require a Coast Guard permit. Under NEPA, FHWA is responsible for determining the Class of Action. A CE or an EA would likely be the appropriate Class of Action for the replacement of the Memorial Bridge superstructure and its abutments and for the replacement of the Sarah Mildred Long Bridge. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth.

Figure 8-11 on the following page provides a plan and cross section of Alternative 6b.

8.10 Alternative 7 – Memorial Bridge Replaced on Existing Alignment with a Bicycle/Pedestrian Bridge Only and Sarah Mildred Long Bridge Replaced on Existing Alignment (four-lane)

Alternative 7 replaces the Memorial Bridge with a bicycle/pedestrian only lift bridge on existing alignment with similar navigational clearances. Alternative 7 also replaces the Sarah Mildred Long Bridge with a new four-lane bridge on existing alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 7 evaluation are:

DRAFT

PORTSMOUTH

LIMIT OF WORK

MAPLEWOOD AVE

NORTHWEST ST

MARKET ST EXT

RETAINING WALL

LIMIT OF BRIDGE

NEW HAMPSHIRE

MAINE

APPROXIMATE LOCATION OF NAVIGABLE CHANNEL

315' LIFT SPAN

LIMIT OF RAIL BRIDGE

LIMIT OF WORK

RELOCATE DRIVEWAY

TERMINATE ROAD

LIMIT OF BRIDGE

LIMIT OF RAIL BRIDGE

OAK TERRACE

LIMIT OF WORK

LIMIT OF WORK

OLD POST ROAD

KITTERY

BRIDGE ST

LIMIT OF WORK

LIMIT OF WORK

SARAH MILDRED LONG BRIDGE
SL2A: REPLACEMENT UPSTREAM - 4 TRAVEL LANES

DANIEL ST

CHAPEL ST

BOW ST

NEW HAMPSHIRE

MAINE

BADGER'S ISLAND

STATE ST

WRIGHT AVE

HARBOR PL

ATKINSON ST

COURT ST

MARCY ST

LIMIT OF WORK

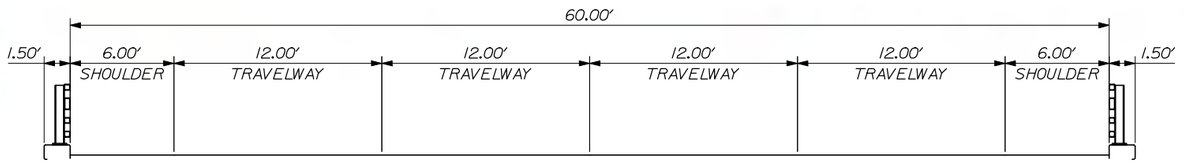
LIMIT OF WORK

LIMIT OF BRIDGE

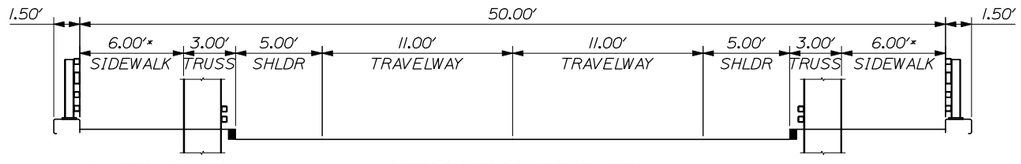
LIMIT OF BRIDGE

260' HORIZONTAL CLEARANCE

MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

FIGURE 8-11
ALTERNATIVE 6B

Date:10/28/2010
Username: kmeek
Filename: ...\8-11_Alternative6B.dgn

- Engineering Analysis – This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The new four-lane Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle facilities. The new Memorial Bridge would provide appropriate bicycle/pedestrian facilities only. Both bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100 year life span.
- Traffic Analysis – With the Memorial Bridge no longer available for vehicular traffic, cross river vehicle mobility and efficiencies would be similar to the No-Build alternative with some of the highest design year VMT (123,345) and VHT (4,107). Three intersections would fail (LOS F) by 2035, two less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) would increase along Newmarch Street/Government Street in Kittery, Bridge Street/Cook Street in Kittery, and Maplewood Avenue in Portsmouth. Traffic on Badgers Island would be reduced substantially due to vehicles no longer being allowed on the Memorial Bridge. A four-lane Sarah Mildred Long Bridge would have volume to capacity ratio less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of the bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – The replacement of the Memorial Bridge with an exclusive bicycle/pedestrian bridge would improve accessibility to bicyclists and pedestrians to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by including a longer lift span (270 feet vs. 200 feet) over the existing marine channel. Rail would be included on the new Sarah Mildred Long.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels. Noise levels would be reduced in the vicinity of Badgers Island due to the elimination of vehicle access to the Memorial Bridge.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. Although the substructure design has not advanced at this time, the substructure would be larger than the 2-lane option and would have a greater impact on the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for

the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.

- Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
- Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
- Wetlands: This alternative would impact 1,300 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
- Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 25,400 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new four-lane bridge on existing alignment would require modifying the highway approaches in both communities. The modification of the highway approaches would

have the highest publicly owned (four), commercial (one) and residential (14) property impacts as compared to the other build alternatives. This alternative would impact 5,163 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.

- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on 13 other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, Richard Jackson House, Moffatt-Ladd House, MacPhaedris-Warner House, Governor John Langdon House, Wentworth House, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, Portsmouth Local Historic District, and Memorial Park.
- Archeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative would have some of the highest capital costs ($238 to $292 million) of all of the build alternatives because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($103 to $127 million). The life cycle cost is among the highest of all the build alternatives ($341 to $419 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($17,580) as all of the other build alternatives. The benefit/cost ratio is 0.77.
- Business Impact Assessment – This alternative would have an economic impact to local businesses. The closure of the Memorial Bridge to vehicles would have a negative impact to businesses located near the Memorial Bridge approaches, but not as substantial if bicycle/pedestrian access remains. This alternative would have no regional economic impact. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge with a bicycle/pedestrian only bridge would require a Coast Guard permit. A U.S. Army Corps

of Engineers permit likely would be needed for potential construction activities in Portsmouth. Under NEPA, FHWA is responsible for determining the Class of Action. It is likely that the appropriate Class of Action for the Sarah Mildred Long Bridge replacement and for the Memorial Bridge bicycle/pedestrian replacement will be individual CE's or EA's.

Figure 8-12 on the following page provides a plan and cross section of Alternative 7.

8.11 Alternative 8 – Memorial Bridge Replaced on Existing Alignment with a Bicycle/Pedestrian Bridge Only and Sarah Mildred Long Bridge Replaced on Upstream Alignment (four-lane)

Alternative 8 replaces the Memorial Bridge with a bicycle/pedestrian only lift bridge on existing alignment with similar navigational clearances. Alternative 8 also replaces the Sarah Mildred Long Bridge with a new four-lane bridge on an upstream alignment, with a new 270 foot horizontal lift span and rail components. The results of the Alternative 8 evaluation are:

- Engineering Analysis – This alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The new four-lane Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle facilities. The new Memorial Bridge would provide appropriate bicycle/pedestrian facilities only. Both bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100 year life span.
- Traffic Analysis – With the Memorial Bridge no longer available for vehicular traffic, cross river vehicle mobility and efficiencies would be similar to the No-Build alternative with some of the highest design year VMT (123,345) and VHT (4,107). Three intersections would fail (LOS F) by 2035, two less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) would increase along Newmarch Street/Government Street in Kittery, Bridge Street/Cook Street in Kittery, and Maplewood Avenue in Portsmouth. Traffic on Badgers Island would be reduced substantially due to vehicles no longer being allowed on the Memorial Bridge. A four-lane Sarah Mildred Long Bridge would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of the bridge. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.

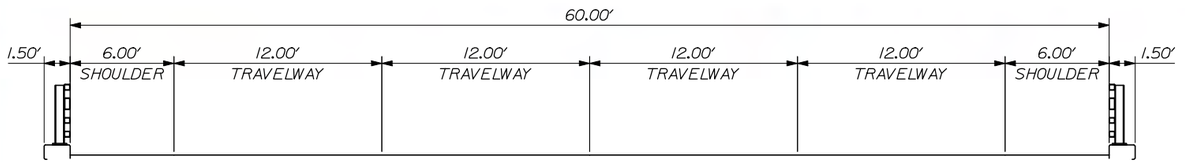
DRAFT

PORTSMOUTH
LIMIT OF WORK
MAPLEWOOD AVE
MARKET ST EXT
NORTHWEST ST
RETAINING WALL
LIMIT OF BRIDGE
NEW HAMPSHIRE
MAINE
APPROXIMATE LOCATION OF NAVIGABLE CHANNEL
315' LIFT SPAN
RELOCATE DRIVEWAY
TERMINATE ROAD
LIMIT OF BRIDGE
LIMIT OF RAIL BRIDGE
LIMIT OF RAIL BRIDGE
LIMIT OF WORK
OAK TERRACE
LIMIT OF WORK
LIMIT OF WORK
RETAINING WALL
RETAINING WALL
OLD POST ROAD
KITTERY
BRIDGE ST
LIMIT OF WORK

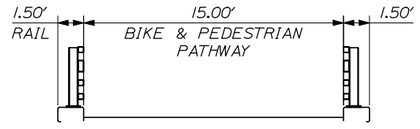
SARAH MILDRED LONG BRIDGE
SL2: REPLACEMENT ON ALIGNMENT - 4 TRAVEL LANES

DANIEL ST
CHAPEL ST
BOW ST
NEW HAMPSHIRE
MAINE
BADGER'S ISLAND
STATE ST
WRIGHT AVE
HARBOR PL
LIMIT OF WORK
LIMIT OF BRIDGE
LIMIT OF WORK
LIMIT OF BRIDGE
TERMINATE ROAD
PARKING
EXISTING 260' HORIZONTAL CLEARANCE
ATKINSON ST
COURT ST
MARCY ST

MEMORIAL BRIDGE
MB6: REPLACEMENT - BIKE & PEDESTRIAN PATH



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES



MEMORIAL BRIDGE
REPLACEMENT - BIKE & PEDESTRIAN PATHWAY

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

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NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

FIGURE 8-12
ALTERNATIVE 7

Date:10/28/2010
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Filename: ...\8-12_Alternative7.dgn

- Multimodal Evaluation – The replacement of the Memorial Bridge with an exclusive bicycle/pedestrian bridge would improve accessibility to bicyclists and pedestrians to the downtowns of Portsmouth and Kittery and PNSY. Bicycle facilities would be provided on the Sarah Mildred Long Bridge. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be improved by the replacement of the Sarah Mildred Long Bridge by including a longer lift span (270 feet vs. 200 feet) over the existing marine channel. Rail would be included on the new Sarah Mildred Long Bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels. Noise levels would be reduced in the vicinity of Badgers Island due to the elimination of vehicle access to the Memorial Bridge.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. Although the substructure design has not advanced at this time, the substructure would be larger than the 2-lane option and would have a greater impact on the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination

with resource agencies will be required during the design, environmental documentation and permitting phases of the project.

  - Wetlands: This alternative would impact 1,250 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
  - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 34,700 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new four-lane bridge on new alignment would require modifying the highway approaches in both communities. The modified highway approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (13) property impacts as compared to the other build alternatives. This alternative would impact 2,496 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on 13 other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, Richard Jackson House, Moffatt-Ladd House, MacPhaedris-Warner House, Governor John Langdon House, Wentworth House, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian

Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, Portsmouth Local Historic District, and Memorial Park.

- Archeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative would have some of the highest capital costs ($238 to $292 million) of all of the build alternatives because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($103 to $127 million). The life cycle cost is among the highest of all the build alternatives ($341 to $419 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($17,580) as all of the other build alternatives. The benefit/cost ratio is 0.77.
- Business Impact Assessment – This alternative would have an economic impact to local businesses. The closure of the Memorial Bridge to vehicles would have a negative impact to businesses located near the Memorial Bridge approaches, but not as substantial if bicycle/pedestrian access remains. This alternative would have no regional economic impact. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge with a bicycle/pedestrian only bridge would require a Coast Guard permit. The U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth. Under NEPA, FHWA is responsible for determining the Class of Action. It is likely that the appropriate Class of Action for the Sarah Mildred Long Bridge replacement and for the Memorial Bridge bicycle/pedestrian replacement will be individual CE's or EA's.

Figure 8-13 on the following page provides a plan and cross section of Alternative 8.

8.12 Alternative 9 – Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane) with Hybrid Bridge with 6 percent grade

Alternative 9 would replace the Memorial Bridge and its abutments on existing alignment, retaining the existing piers, and navigational clearances. Alternative 9 also replaces the Sarah Mildred Long Bridge with a new mid-level (86 foot± vertical clearance), two-lane hybrid bridge on an upstream alignment with new lift span and rail components. The results of the Alternative 9 evaluation are:

DRAFT

PORTSMOUTH

LIMIT OF WORK

MAPLEWOOD AVE

NORTHWEST ST

MARKET ST EXT

RETAINING WALL

LIMIT OF BRIDGE

NEW HAMPSHIRE

MAINE

APPROXIMATE LOCATION OF NAVIGABLE CHANNEL

315' LIFT SPAN

RELOCATE DRIVEWAY

TERMINATE ROAD

LIMIT OF BRIDGE

OAK TERRACE

LIMIT OF WORK

LIMIT OF WORK

LIMIT OF RAIL BRIDGE

LIMIT OF RAIL BRIDGE

OLD POST ROAD

KITTERY

LIMIT OF WORK

BRIDGE ST

LIMIT OF WORK

LIMIT OF WORK

SARAH MILDRED LONG BRIDGE
SL2A: REPLACEMENT UPSTREAM - 4 TRAVEL LANES

DANIEL ST

CHAPEL ST

66M ST

NEW HAMPSHIRE

MAINE

BADGER'S ISLAND

STATE ST

WRIGHT AVE

HARBOR PL

LIMIT OF WORK

LIMIT OF BRIDGE

LIMIT OF WORK

LIMIT OF BRIDGE

TERMINATE ROAD

PARKING

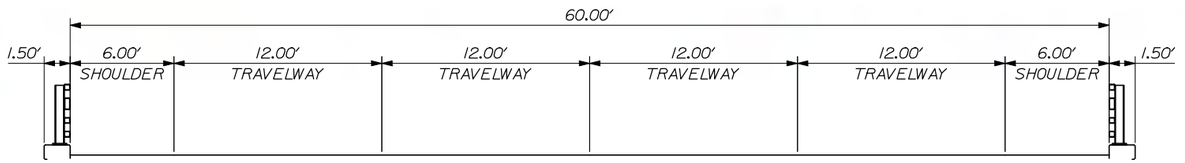
EXISTING 260' HORIZONTAL CLEARANCE

ATKINSON ST

COURT ST

MARCY ST

MEMORIAL BRIDGE
MB6: REPLACEMENT - BIKE & PEDESTRIAN PATH



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 4 TRAVEL LANES

MEMORIAL BRIDGE
REPLACEMENT - BIKE & PEDESTRIAN PATHWAY

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700

Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

FIGURE 8-13
ALTERNATIVE 8

Date:10/28/2010
Username: lmeek
Filename: ...\8-13_Alternative8.dgn

- Engineering Analysis – This Alternative would fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The Memorial Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle/pedestrian facilities. The new hybrid Sarah Mildred Long Bridge would provide desirable lane and shoulder widths as well as appropriate bicycle facilities. The new bridges would also address the needs of long-term maintenance by providing new bridges with an expected 100 year life span. Additionally, the 86 foot± vertical clearance at the lift portion of the Sarah Mildred Long Bridge would provide a reduction in the number of required bridge lifts for marine vessel passage.
- Traffic Analysis – The replacement of both bridges would improve cross river mobility by not limiting heavy loads and improve efficiency in the local and regional transportation system by having lower VMT (122,032) and VHT (4,041). Four intersections would fail (LOS F) by 2035, one less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) would increase along, Newmarch Street/Government Street in Kittery, Bridge Street/Cook Street in Kittery, and Maplewood Avenue in Portsmouth. Both bridges would have volume to capacity ratios less than 1.0 indicating that the 2035 peak hour vehicular traffic would not exceed the available capacity of each bridge. The 80 percent± reduction in required bridge lifts would provide increased river crossing capacity and reduced travel delays. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – The replacement of the Memorial Bridge would maintain/improve accessibility to bicyclists and pedestrians to the downtowns of Portsmouth and Kittery and PNSY. The replacement of the Sarah Mildred Long Bridge would provide a marginally (one foot) wider travelway and shoulder width on the hybrid lift span than is currently provided on the existing bridge for bicycle accommodations and would not include any pedestrian (sidewalk) facilities. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be greatly improved by the replacement of this Sarah Mildred Long Bridge Option. It would include a longer lift span (270 feet vs. 200 feet) over the existing marine channel, similar to the other replacement Sarah Mildred Long Bridge Options, as well as a greater vertical opening of lift span (86 feet± vs. the current 10 feet) resulting from a higher roadway grade with this bridge option. This would result in an 80 percent± reduction in the required Sarah Mildred Long Bridge lifts, which would not be provided with other low level replacement Sarah Mildred Long Bridge Options. Rail would be included on the new hybrid Sarah Mildred Long Bridge. The lift portion of the rail bridge would be in the road surface and the existing retractable rail bridge would be eliminated. Only one mode at a time, highway or rail, could be accommodated with the hybrid lift bridge.

- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
    - Wetlands: This alternative would impact 1,250 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
    - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for

the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 34,700 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new two-lane hybrid bridge on new alignment would require modifying the highway approaches in both communities. The modified highway approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (13) property impacts as compared to the other build alternatives. Would impact 2,496 square feet of commercial real estate including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on seven other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, and Memorial Park.
- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – This alternative would have some of the highest capital costs ($251 to $309 million) of all of the build alternatives because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($94 to $116 million). The life cycle cost is among the highest of all the build alternatives ($345 to $425 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($15,880) as all of the other build alternatives, excluding the reduced travel delays resulting from the 80 percent± reduction in bridge lifts at the Sarah Mildred Long Bridge. The benefit/cost ratio is 1.15.

- Business Impact Assessment – This alternative would not have any permanent local business or regional economic impacts. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge with a bicycle/pedestrian only bridge would require a Coast Guard permit. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth. Under NEPA, FHWA is responsible for determining the Class of Action. It is likely that the appropriate Class of Action for the Sarah Mildred Long Bridge replacement and for the Memorial Bridge bicycle/pedestrian replacement will be individual CE's or EA's.

Figure 8-14 on the following page provides a plan and cross section of Alternative 9.

8.13 Alternative 10 – Memorial Bridge Replaced on Existing Alignment with a bicycle/pedestrian bridge only and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane) with Hybrid Bridge with 6 percent grade

Alternative 10 replaces the Memorial Bridge with a bicycle/pedestrian only lift bridge on existing alignment with similar navigational clearances. Alternative 10 also replaces the Sarah Mildred Long Bridge with a new mid-level (86 foot± vertical clearance), two-lane hybrid bridge on an upstream alignment with new lift span and rail components. The results of the Alternative 10 evaluation are:

- Engineering Analysis – This alternative would not fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The new Sarah Mildred Long Bridge would provide desirable lane widths and minimal shoulder widths on the moveable lift span, though the recommended minimum shoulder widths for bicycle use would not be met on the moveable lift span. Pedestrian facilities would not provide on the Sarah Mildred Long Bridge. The new two-lane Sarah Mildred Long Bridge would not provide the necessary capacity to accommodate the 2035 design year river crossing traffic. The new Memorial Bridge would provide appropriate bicycle/pedestrian facilities only. Both bridges would address the needs of the long-term maintenance by providing new bridges with an expected 100 year life span. The 86 foot± vertical clearance at the lift portion of the Sarah Mildred Long Bridge would provide a reduction in the number of required bridge lifts for marine vessel passage.

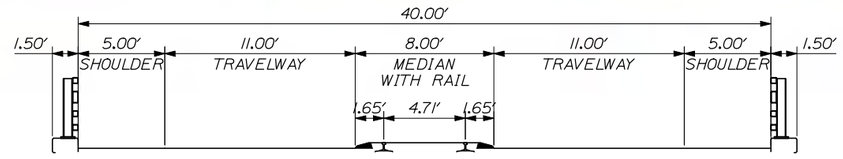
DRAFT

PORTSMOUTH
LIMIT OF WORK
MAPLEWOOD AVE
MARKET ST EXT
NORTHWEST ST
RETAINING WALL
LIMIT OF BRIDGE
NEW HAMPSHIRE
MAINE
APPROXIMATE LOCATION OF NAVIGABLE CHANNEL
LIMIT OF RAIL BRIDGE
315' LIFT SPAN
RELOCATE DRIVEWAY
TERMINATE ROAD
LIMIT OF BRIDGE
LIMIT OF WORK
OAK TERRACE
LIMIT OF WORK
LIMIT OF RAIL BRIDGE
LIMIT OF WORK
LIMIT OF WORK
OLD POST ROAD
KITTERY
BRIDGE ST

SARAH MILDRED LONG BRIDGE
SL2B: HYBRID REPLACEMENT UPSTREAM - 2 TRAVEL LANES

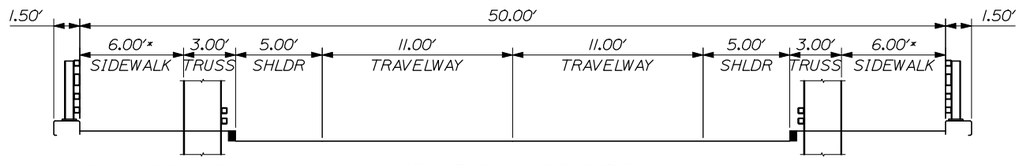
DANIEL ST
CHAPEL ST
BOW ST
NEW HAMPSHIRE
MAINE
STATE ST
WRIGHT AVE
HARBOR PL
BADGER'S ISLAND
LIMIT OF WORK
LIMIT OF WORK
LIMIT OF BRIDGE
COURT ST
ATKINSON ST
MARCY ST
LIMIT OF BRIDGE
260' HORIZONTAL CLEARANCE
ATKINSON ST

MEMORIAL BRIDGE
MB2: REPLACEMENT - 2 TRAVEL LANES



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES WITH RAIL IN RAISED MEDIAN

NOTE: TYPICAL SECTION OF THE HYBRID LIFT SPAN IS SHOWN. THE TYPICAL SECTION FOR THE APPROACH SPANS WILL BE CONSISTENT WITH THE TYPICAL SECTION OF THE OTHER 2 LANE REPLACEMENT OPTIONS SL2 & SL2A.



* 10' ALTERNATE TO BE CONSIDERED

MEMORIAL BRIDGE
REPLACEMENT - 2 TRAVEL LANES

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

FIGURE 8-14
ALTERNATIVE 9

Date:10/28/2010
Username: lmeek
Filename: ...\8-14_Alternative9.dgn

- Traffic Analysis – With the Memorial Bridge no longer available for vehicular traffic, cross river vehicle mobility and efficiencies are anticipated to be similar to the No-Build alternative with some of the highest design year VMT (123,372) and VHT (4,096). Three intersections would fail (LOS F) by 2035, two less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) would increase in the following three neighborhoods, Newmarch Street/Government Street in Kittery, Bridge Street/Cook Street in Kittery, and Maplewood Avenue in Portsmouth. Traffic on Badgers Island would be reduced substantially due to the vehicles no longer being allowed on the Memorial Bridge. Additional widening of the U.S. Route 1 Bypass intersections at Bridge Street and the Albacore Connector would be required to achieve an acceptable LOS due to the increased traffic with the Memorial Bridge closed. With the Memorial Bridge closed, and only a 2-lane Sarah Mildred Long Bridge, the 2-lane Sarah Mildred Long Bridge would have a volume to capacity ratio of 1.06, indicating that the traffic volume would exceed the available bridge capacity in the peak hour by 2035. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – The replacement of the Memorial Bridge with an exclusive bicycle/pedestrian bridge would improve accessibility to bicyclists and pedestrians to the downtowns of Portsmouth and Kittery and PNSY. The new Sarah Mildred Long Bridge would provide a one foot wider travelway and shoulder width on the hybrid lift span than is currently provided on the existing bridge for bicycle accommodations and would not include any pedestrian (sidewalk) facilities. Replacement of the Memorial Bridge would have no effect on the movement of marine traffic (except during construction). Marine traffic would be greatly improved by the replacement of the Sarah Mildred Long Bridge Option. It would include a longer lift span (270 feet vs. 200 feet) over the existing marine channel, similar to the other replacement Sarah Mildred Long Bridge Options, as well as a greater vertical opening of lift span (86 feet± vs. the current 10 feet today) resulting from a higher roadway grade with this bridge option. This would result in an 80percent± reduction in Sarah Mildred Long Bridge lifts, which would not be provided with other low level replacement Sarah Mildred Long Bridge Options. Rail would be included on the new hybrid Sarah Mildred Long Bridge. The lift portion of the rail bridge would be in the surface of the road and the existing retractable rail bridge would be eliminated. Only one mode at a time, highway or rail, could be accommodated with the hybrid lift bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels. Noise levels would be reduced in the vicinity of Badgers Island due to the elimination of vehicle access to the Memorial Bridge.

- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. No substructure work is anticipated for the Memorial Bridge other than replacement of its abutments.
    - River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers.
    - Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
    - Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
    - Wetlands: This alternative would impact 1,250 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. In addition, an area of mapped eelgrass habitat exists south of the Sarah Mildred Long Bridge which may be temporarily impacted during construction.
    - Floodplain/Floodway: Permanent impact on floodplain areas would be small from removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge and replacement of abutments for the Memorial Bridge. Temporary impacts in work zones around the bridge piers and abutments would occur. This alternative would permanently impact 2,100 sf of special flood

hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 34,700 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new two-lane bridge on new alignment would require relocating the bridge approaches in both communities. The relocated bridge approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (13) property impacts as compared to the other build alternatives. Would impact 2,496 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.
- Land Use Impacts – No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative and other alternatives that replace both bridges are considered to have the highest impact on these historic bridges, as compared to alternatives that would replace only one bridge. This alternative would have an adverse effect on 13 other historic resources located adjacent to the highway approaches to the bridges including: U.S.S. Albacore, Richard Jackson House, Moffatt-Ladd House, MacPhaedris-Warner House, Governor John Langdon House, Wentworth House, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, Portsmouth Local Historic District, and Memorial Park.
- Archeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- This alternative would have high capital costs ($224 to $276 million) because it would replace both bridges. Total operations costs would be similar to other build alternatives. Overall maintenance and operation costs would be among the lowest because both bridges would be replaced ($94 to $116 million). The life cycle cost is among the highest of all the build alternatives ($318 to $392 million) due to the high capital costs. This alternative has relatively the same travel time delay cost ($17,580) as all of the other build alternatives, excluding the reduced travel delays resulting from the 80 percent± reduction in lifts at the Sarah Mildred Long Bridge. It has a good benefit/cost ratio of 0.92.

- Business Impact Assessment – This alternative would have an economic impact to local businesses. The closure of the Memorial Bridge to vehicles would have a negative impact to businesses located near the Memorial Bridge approaches, but not as substantial if bicycle/pedestrian access remains. Would have no regional economic impact. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. The replacement of the Memorial Bridge with a bicycle/pedestrian only bridge would require a Coast Guard permit. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth. Under NEPA, FHWA is responsible for determining the Class of Action. It is likely that the appropriate Class of Action for the Sarah Mildred Long Bridge replacement and for the Memorial Bridge bicycle/pedestrian replacement will be individual CE's or EA's.

Figure 8-15 on the following page provides a plan and cross section of Alternative 10.

8.14 Alternative 11 – Memorial Bridge Removed and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane) with Hybrid Bridge with 5 percent grade and Provide Transit Service

Alternative 11 would close and completely remove the Memorial Bridge. Bicycle/pedestrian river crossing accommodations would be provided with a zero-fare, year round bus transit system between the two communities. The Sarah Mildred Long Bridge would be replaced with a new mid-level (74 foot± vertical clearance with 5 percent grade), two-lane hybrid bridge on an upstream alignment with new lift span and rail components. The results of the Alternative 11 evaluation are:

- Engineering Analysis – This alternative would not fully satisfy the design parameters necessary to accommodate the 2035 design year traffic. The new Sarah Mildred Long Bridge would provide adequate shoulder widths (five feet) to accommodate bicycle use and would provide an adequate pedestrian facility (a six foot wide sidewalk attached to bridge structure). The new Sarah Mildred Long Bridge would also address the needs of long term maintenance by providing a new bridge with an expected 100 year life span. The new 2-lane Sarah Mildred Long Bridge would not provide the necessary capacity to accommodate the 2035 design year river crossing traffic. The 74 foot± vertical clearance at the lift portion of the Sarah Mildred Long Bridge would provide a reduction in the number of required bridge lifts for marine vessel passage.

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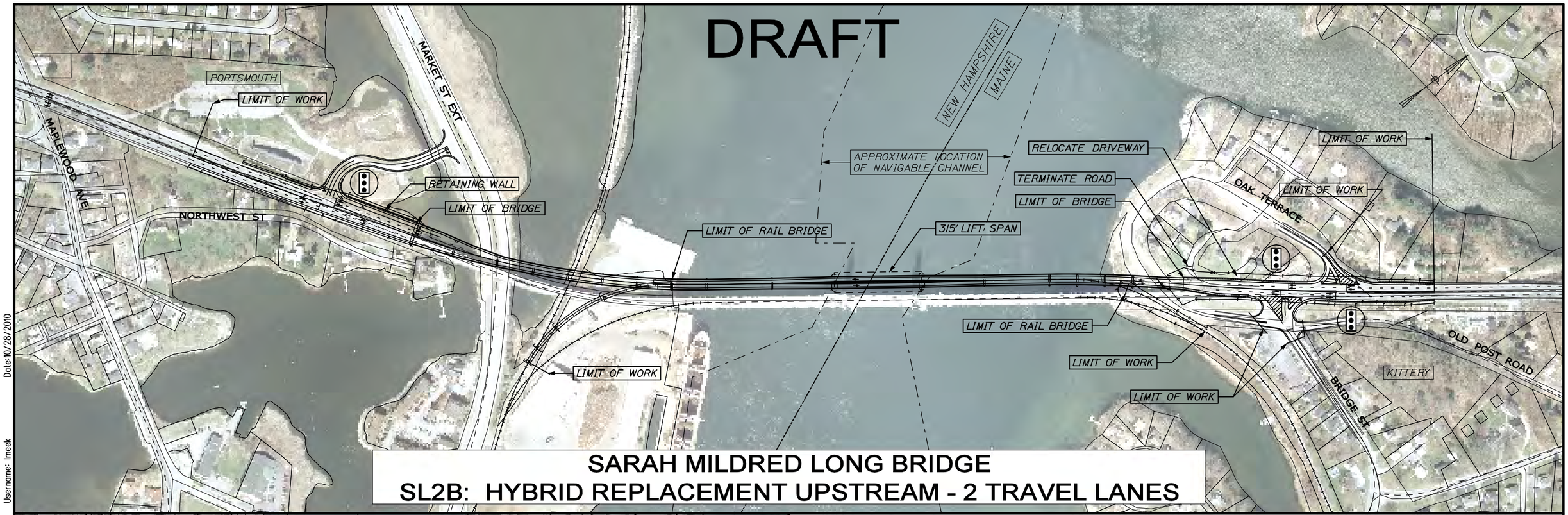
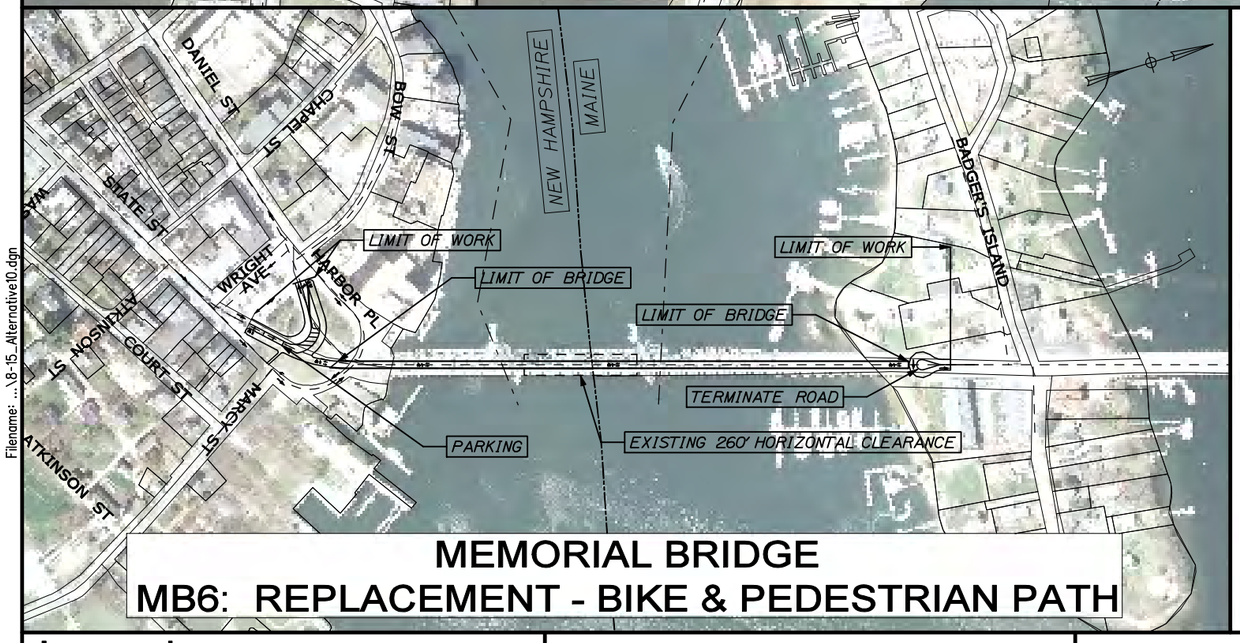
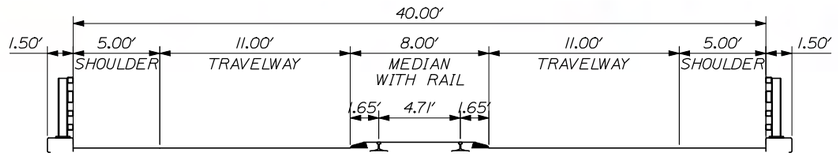


SARAH MILDRED LONG BRIDGE
SL2B: HYBRID REPLACEMENT UPSTREAM - 2 TRAVEL LANES

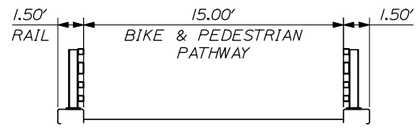


MEMORIAL BRIDGE
MB6: REPLACEMENT - BIKE & PEDESTRIAN PATH



SARAH MILDRED LONG BRIDGE
REPLACEMENT - 2 TRAVEL LANES WITH RAIL IN RAISED MEDIAN

NOTE: TYPICAL SECTION OF THE HYBRID LIFT SPAN IS SHOWN. THE TYPICAL SECTION FOR THE APPROACH SPANS WILL BE CONSISTENT WITH THE TYPICAL SECTION OF THE OTHER 2 LANE REPLACEMENT OPTIONS SL2 & SL2A.



MEMORIAL BRIDGE
REPLACEMENT - BIKE & PEDESTRIAN PATHWAY

BRIDGE TYPICAL SECTIONS

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

ME - NH CONNECTIONS STUDY
NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

FIGURE 8-15
ALTERNATIVE 10

Date:10/28/2010
Username: lmeek
Filename: ...\8-15_Alternative10.dgn

- Traffic Analysis – With the Memorial Bridge no longer available for vehicular traffic, cross river vehicle mobility and efficiencies are anticipated to be similar to the No-Build alternative with some of the highest design year VMT (123,375) and VHT (4,099). Three intersections would fail (LOS F) by 2035, two less than the No-Build Alternative. The alternative includes the work required at failing intersections to obtain a minimum LOS of D. Traffic volumes (relative to the No-Build Alternative) would increase in the following three neighborhoods, Newmarch Street/Government Street in Kittery, Bridge Street/Cook Street in Kittery, and Maplewood Avenue in Portsmouth. Traffic on Badgers Island would be reduced substantially due to no longer being allowed on Memorial Bridge. Additional widening of the U.S. Route 1 Bypass intersections at Bridge Street and the Albacore Connector would be required to achieve an acceptable LOS due to the increased traffic with the Memorial Bridge closed. With the Memorial Bridge closed, and only a two-lane Sarah Mildred Long Bridge, the two-lane Sarah Mildred Long Bridge would provide a volume to capacity ratio of 1.06, indicating that the traffic volume would exceed the available bridge capacity in the peak hour by 2035. It should be noted that delays caused by bridge openings have not been factored into the calculations. This will be done during the environmental evaluation phase.
- Multimodal Evaluation – This alternative provides transit service access to the Portsmouth and Kittery downtowns and PNSY to individuals who currently bicycle or walk to cross the Piscataqua River via the Memorial Bridge. This alternative would include a free bus transit service to be operated seven days per week, 365 days per year, from 5:00 AM to 11:00 PM to transport pedestrians and bicyclists between the Portsmouth and Kittery approaches of the demolished Memorial Bridge. Marine traffic would be greatly improved by the replacement of the Sarah Mildred Long Bridge with a hybrid bridge. It would include a longer lift span (270 feet vs. 200 feet) over the existing marine channel, similar to the other replacement Sarah Mildred Long Bridge Options, as well as a greater vertical opening of lift span (74 feet± vs. the current 10 feet today) resulting from a higher roadway grade with this bridge option. This would result in an 80 percent± reduction in Sarah Mildred Long lifts, which would not be provided with other low level replacement Sarah Mildred Long Bridge Options. Rail would be included on the new hybrid Sarah Mildred Long Bridge. Only one mode at a time, highway or rail, can be accommodated with this hybrid lift bridge.
- Air Quality Analysis – Air pollutants would remain below the NAAQS standard.
- Noise Analysis – There would not be any noticeable (less than three dbA) increase in noise levels. Noise levels would be reduced in the vicinity of Badgers Island due to the removal of the Memorial Bridge.
- Natural Resource Impact Analysis – The replacement of the Sarah Mildred Long Bridge includes the removal of 15 existing piers in the river and construction of 17 new piers in the river. The closure and removal of the Memorial Bridge and its piers in the Piscataqua River would have beneficial long term effects on aquatic resources and floodplain areas.

- River Quality: Temporary impacts to river quality may occur during removal of 15 existing piers and replacement with 17 new piers in the Piscataqua River for the Sarah Mildred Long Bridge. These temporary impacts to river (water) quality include increased turbidity and sedimentation during demolition and construction of bridge piers. Temporary impacts to river quality may also occur during demolition of Memorial Bridge piers in the Piscataqua River.
- Aquatic Habitat: Potential temporary impacts associated with work in the river include increased turbidity, sedimentation, noise, and temporary loss of habitat. Time of year restrictions for work in the water may be required to avoid spawning periods of fisheries. There are areas of tidal waterfowl and wading bird habitat adjacent to the north side of the Sarah Mildred Long Bridge at both the Kittery and Portsmouth shorelines that may be temporarily impacted during replacement of the piers. There are areas of tidal waterfowl and wading bird habitat and softshell clam beds along the Kittery shoreline south of the Sarah Mildred Long Bridge that may be temporarily impacted during replacement of the piers and bridge abutment. Long term effects on aquatic habitat would be small with the removal of 15 existing bridge piers and replacement with 17 new bridge piers for the Sarah Mildred Long Bridge. Long term effects of removal of the Memorial Bridge piers would be beneficial. Upon removal of the existing bridge piers, the impacted area would be naturally restored to the condition of the adjacent river bottom.
- Threatened and Endangered Species: No federally-listed threatened or endangered species are known to exist in the Piscataqua River, however further coordination with resource agencies will be required during the design, environmental documentation and permitting phases of the project.
- Wetlands: This alternative would impact 1,250 sf of wetlands (type PUBHx) adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector. The replacement of the Sarah Mildred Long Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type. There is a small area of NH mapped salt marsh northeast of the Albacore Connector that may be temporarily impacted during construction. The removal of the Memorial Bridge piers would have a temporary impact to the Piscataqua River which is classified as an E1UBL wetland type.
- Floodplain/Floodway: This alternative would impact 2,100 sf of special flood hazard area Zone AE adjacent to the intersection of the U.S. Route 1 Bypass and the Albacore Connector and 34,700 sf of special flood hazard area Zone AE along the PNSY rail spur in Kittery. There would be a beneficial effect by removal of the Memorial Bridge piers from the floodplain.

- Physical Resource Impacts – Replacing the existing two-lane Sarah Mildred Long Bridge with a new two-lane bridge on new alignment would require modifying the highway

approaches in both communities. The modified highway approaches would have close to the highest publicly owned property impacts (three), and the highest commercial (one) and residential (13) property impacts as compared to the other build alternatives. Would impact 2,496 square feet of commercial real estate (among the highest) including one commercial business displacement. The assessed value of this displaced property is $166,900.

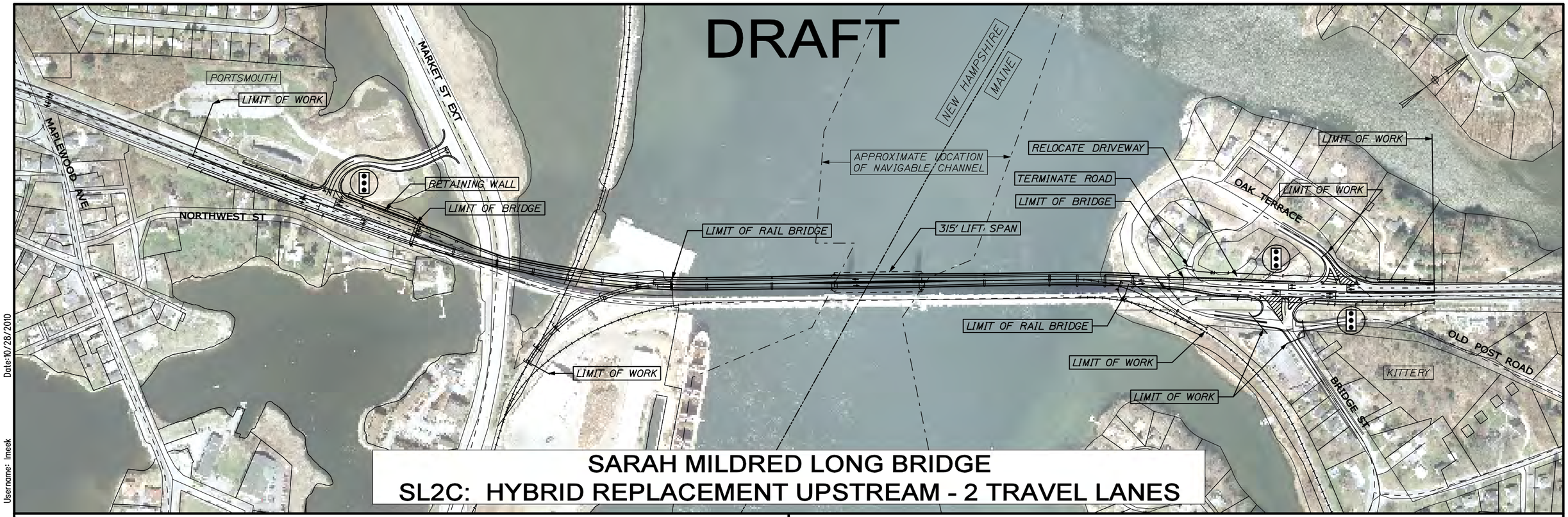
- Land Use Impacts –No impact on zoning or activity centers would occur.
- Historic Impacts – The preliminary Section 106 effects determinations indicate that either replacement or rehabilitation of the Memorial Bridge and the Sarah Mildred Long Bridge would be an adverse effect on the individual bridges. Removal of the Memorial Bridge also would be an adverse effect on that bridge. From a historic perspective, rehabilitation is generally preferred over replacement if the rehabilitation can be done in accordance with the Secretary Standards to preserve key elements of the structure that contribute to its historic significance. For this reason, as well as with consideration of Section 4(f) avoidance and mitigation requirements, this alternative, which removes the Memorial Bridge and replaces the Sarah Mildred Long Bridge, is considered to have the highest impact on these historic bridges, as compared to alternatives that would replace or remove only one bridge including: U.S.S. Albacore, Richard Jackson House, Moffatt-Ladd House, MacPhaedris-Warner House, Governor John Langdon House, Wentworth House, U.S. Route 1 Bypass, U.S. Route 1 Bypass Historic District, Christian Shore Historic District, Eastern Railroad Historic District, Memorial Bridge Historic District, Portsmouth Local Historic District, and Memorial Park.
- Archaeological Impacts – This alternative would require excavation in areas of moderate to high archaeological sensitivity along the Portsmouth and Kittery shorelines at the Sarah Mildred Long Bridge and the Memorial Bridge.
- Costs Analysis – Capital costs would be in the low-range ($197 to $243 million) of all the build alternatives because this alternative does not replace the Memorial Bridge. This alternative would have the lowest operation and maintenance cost ($89 to $111 million) and life cycle cost ($286 to $354 million). Has relatively the same travel time delay cost ($17,580) as all of the other build alternatives, excluding the reduced travel delays resulting from the 80 percent± reduction in bridge lifts at the Sarah Mildred Ling Bridge. The benefit/cost ratio is (1.07).
- Business Impact Assessment – This alternative would have an economic impact on local businesses located near the Memorial Bridge approaches due to removal of the Memorial Bridge. The new transit service could offset some of the local business impacts. This alternative would have no regional economic impact. Temporary impacts during the two to three year construction period are not estimated.
- Environmental clearances - The replacement of the Sarah Mildred Long Bridge would require a Coast Guard permit. A removal of the Memorial Bridge would not require a Coast Guard permit. However, the Coast Guard must be notified to determine if the

bridge removal would have an effect on navigation for notifying waterway users. A U.S. Army Corps of Engineers permit likely would be needed for potential construction activities in Portsmouth. Under NEPA, FHWA is responsible for determining the Class of Action. It is anticipated that all bridge work (Sarah Mildred Long Bridge replacement and Memorial Bridge removal) may be satisfied by the preparation of individual Categorical Exclusions or Environmental Assessments. It is likely that the appropriate Class of Action for the Sarah Mildred Long Bridge replacement and for the Memorial Bridge removal will be individual CE's or EA's.

Figure 8-16 on the following page provides a plan and cross section of Alternative 11. Figure 8-17 on the following page provides profiles for the three bridge deck positions for the hybrid bridge.

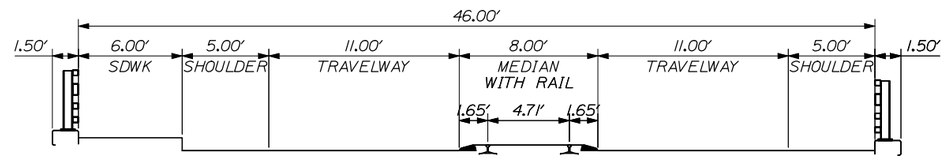
The Alternatives Evaluation Matrix summarizing the results of the Evaluation Criteria Rating for the MOEs is shown in Figure 8-18 on the following page.

DRAFT

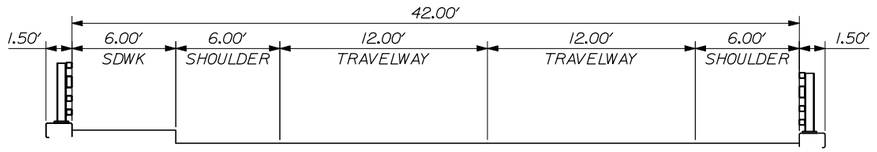


SARAH MILDRED LONG BRIDGE
SL2C: HYBRID REPLACEMENT UPSTREAM - 2 TRAVEL LANES

TRANSIT ALTERNATIVE



SARAH MILDRED LONG BRIDGE
REPLACEMENT LIFT SPAN- 2 TRAVEL LANES WITH RAIL IN RAISED MEDIAN



SARAH MILDRED LONG BRIDGE
REPLACEMENT APPROACH SPANS- 2 TRAVEL LANES

BRIDGE TYPICAL SECTION

Legend

- Approximate Property Lines
- Approximate Cut / Fill Lines
- Existing Roadway Centerline
- Existing or Proposed Signal
- Traffic Flow Arrows

350 0 350 700
Scale of Feet

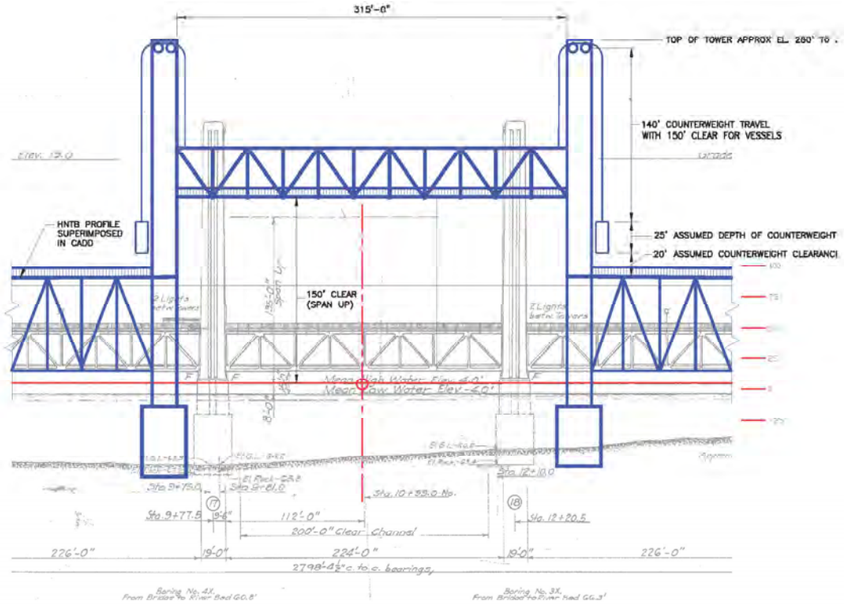
ME - NH CONNECTIONS STUDY
NOVEMBER 2010

New Hampshire DOT · MaineDOT · HNTB

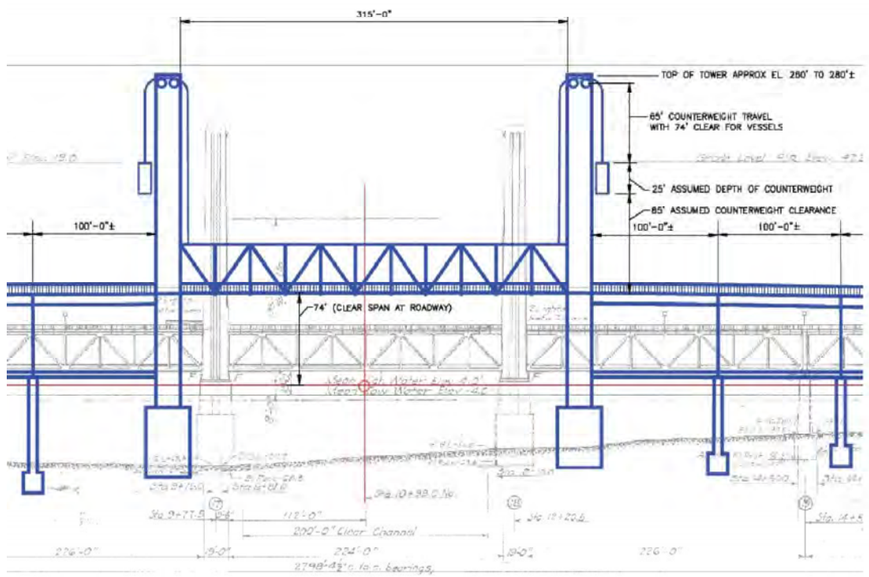
FIGURE 8-16
ALTERNATIVE 11

Date:10/28/2010
Username: lmeek
Filename: ...\8-16_Alternative11.dgn

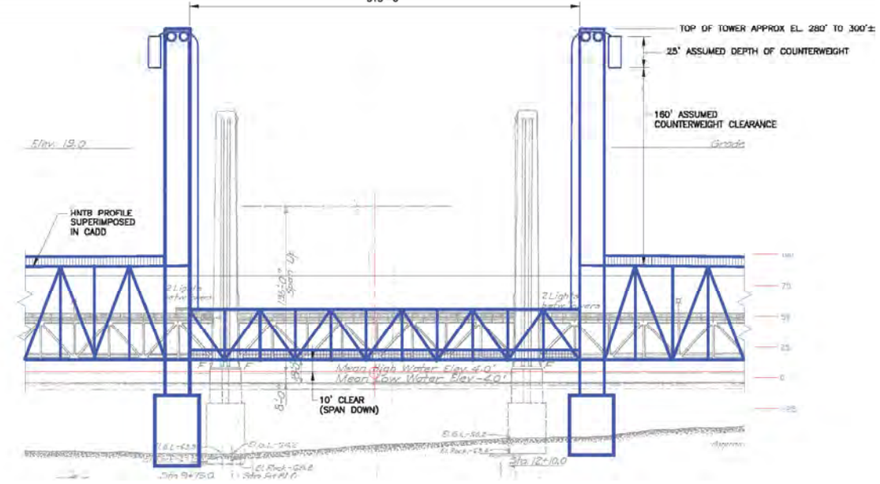
DRAFT



MAXIMUM OPEN POSITION



ROADWAY OPERATION POSITION



RAIL OPERATION POSITION

	Not to Scale	**ME - NH CONNECTIONS STUDY** **JULY 2010** New Hampshire DOT · MaineDOT · HNTB	FIGURE 8-17 SARAH MILDRED LONG BRIDGE HYBRID LIFT SPAN ELEVATIONS

Filename: $file$ Username: $user$ Date: $date$

ME-NH Connections Study
Draft Report - Feasible Alternatives Evaluation Matrix
November 9, 2010

Needs/Goals Addressed	Evaluation Criteria Category	Description of Evaluation Criteria/Measures of Effectiveness (MOE's)[1]		No-Build Alternative	Alt #4 (MB Replace + SL Rehab)	Alt #5a (MB Replace +SL 2-lane on line)	Alt #5b (MB Replace +SL 4-lane on line)	Alt #6a (MB Replace +SL 2-lane off line)	Alt #6b (MB Replace + SL 4-lane off line)	Alt #7 (MB Bike-Ped + SL 4-lane on line)	Alt #8 (MB Bike-Ped + SL 4-lane off line)	Alt #9 (MB Replace + SL 2-lane hybrid)	Alt #10 (MB Bike-Ped + SL 2-lane hybrid)	Alt #11 (MB Removed + Bike-Ped Tunnel Option + SL 2-lane hybrid)
1,2	Structural Improvement	Improve structural deficiencies and increase reliability of lift spans												
		Satisfy Structural and Functional Needs	MB	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	N/A[3]
			SL	NO	Rehab	YES	YES	YES	YES	YES	YES	YES	YES	YES
		Lift Span Reliability	MB	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	N/A[3]
			SL	NO	Rehab	YES	YES	YES	YES	YES	YES	YES	YES	YES
1, 5, 17	Mobility for the year **2035**	Providing adequate mobility supports local and regional economic growth and stability, tourism and recreational opportunities and emergency evacuation efficiency												
		Vehicle Miles Traveled (VMT)		123,982	122,283	122,283	121,901	122,283	121,901	123,345	123,345	122,032	123,372	123,375
		Vehicle Hours Traveled (VHT)		4,148	4,062	4,062	4,049	4,062	4,049	4,107	4,107	4,041	4,096	4,099
		Intersection Level of Service (indicates # of intersections @ LOS F)		(5)	(4)	(4)	(4)	(4)	(4)	(3)	(3)	(4)	(3)	(3)
		Available Bridge Vehicular Capacity (V/C)	MB	N/A[3]	0.62	0.62	0.78	0.62	0.78	N/A	N/A	0.52	N/A	N/A[3]
			SL	1.09	0.86	0.86	0.59	0.86	0.59	0.79	0.79	0.79	1.06	1.06
		Local Road Traffic Impacts (increases traffic on 1, 2,or 3 local rds)		3	0	0	3	0	3	3	3	0	3	3
		Mobility During Construction (exist SL open or closed)		N/A	closed	closed	closed	open	open	closed	open	open	open	open
		Emergency Access		2-lane	4-lane	4-lane	6-lane	4-lane	6-lane	4-lane	4-lane	4-lane	2-lane	2-lane
		Evacuation Access		2-lane	4-lane	4-lane	6-lane	4-lane	6-lane	4-lane	4-lane	4-lane	2-lane	2-lane
3, 4, 5, 6, 7, 9, 18	Accessibility	Maintain or improve access to Portsmouth and Kittery downtowns and Portsmouth Naval Shipyard, connections to other transportation modes and potential future connection opportunities												
		Accessibility To Portsmouth/Kittery Downtowns		Doesn't satisfy	Satisfies	Satisfies	Satisfies	Satisfies	Satisfies	Partially satisfies	Partially satisfies	Satisfies	Partially satisfies	Partially satisfies
		Accessibility To Portsmouth Naval Shipyard (PNSY)		Doesn't satisfy	Satisfies	Satisfies	Satisfies	Satisfies	Satisfies	Doesn't satisfy	Doesn't satisfy	Satisfies	Doesn't satisfy	Doesn't satisfy
		Bridge Design Features/Vehicle	MB	N/A[3]	Meets	Meets	Meets	Meets	Meets	N/A	N/A	Meets	N/A	N/A[3]
			SL	Doesn't meet	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
		Bridge Design Features/Marine	MB	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
			SL	Doesn't Improve	Doesn't Improve	Improves Horizontal Only[8]	Improves Horizontal Only[8]	Improves Horizontal Only[8]	Improves Horizontal Only[8]	Improves Horizontal Only[8]	Improves Horizontal Only[8]	Improves Vertical & Horizontal[8]	Improves Vertical & Horizontal[8]	Improves Vertical & Horizontal[8]
		Bridge Design Features/Bicycle	MB	Doesn't meet	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	N/A[3]
			SL	Doesn't meet	Partially meets[4]	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets
		Bridge Design Features/Pedestrian	MB	Doesn't meet	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	Meets [2]	N/A[3]
			SL	Doesn't meet	Doesn't Meet	Doesn't Meet	Doesn't Meet	Doesn't Meet	Doesn't Meet	Doesn't Meet	Doesn't Meet	Doesn't meet	Doesn't meet	Meets [5]
		Bridge Design/Rail Line		Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets	Meets[9]	Meets[9]	Meets[9]
8, 10	Cost in 2010 dollars	Minimize long-term costs for the regional transportation system												
		Range of Capital Cost (Millions)		$18 - $22	$166 - $204	$229 - $281	$265 - $325	$233 - $287	$265 - $325	$238 - $292	$238 - $292	$251 - $309	$224 - $276	$197 - $243
		Range of Operation and Maintenance Costs (Millions)		$126 - $154	$121 - $149	$94 - $116	$103 - $127	$94 - $116	$103 - $127	$103 - $127	$103 - $127	$94 - $116	$94 - $116	$89 - $111
		Range of Life Cycle Costs (Millions)		$144 - $176	$287 - $353	$323 - $397	$368 - $452	$327 - $403	$368 - $452	$341 - $419	$341 - $419	$345 - $425	$318 - $392	$286 - $354
		Travel Time Delay Cost		$22,970	$15,880	$15,880	$15,620	$15,880	$15,620	$17,580	$17,580	$15,880	$17,580	$17,580
		Benefit/Cost Ratio		0	1.62	1.22	1.02	1.18	1.02	0.77	0.77	1.15	0.92	1.07
		Business Survey Impacts												
		Regional Economic Impacts												
11	Historic Evaluation	Avoid or minimize detrimental impacts to the historic significance and integrity of the Kittery-Portsmouth area												
		Impacts to National Register-Listed or Eligible Historic Bridges[10]		1 bridge	1 bridge	2 bridges	2 bridges	2 bridges	2 bridges	2 bridges	2 bridges	2 bridges	2 bridges	2 bridges
		Other Historic Adverse Resource Impacts		0	6	6	7	6	7	13	13	7	13	13
		Archeological Resource Impacts	MB	None	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod	Low to Mod
			SL	None	High	High	High	High	High	High	High	High	High	High
12, 13, 15	Natural Environment	Conserve the aesthetic setting of the Piscataqua River												
		River Quality Impacts (# of piers replaced and/or removed in river during construction)		12	6	32	32	32	32	32	32	32	32	44
		Air Quality												
		Aquatic Habitat Loss (# of permanent piers in river)		15	29	29	29	29	29	29	29	29	29	17
		Access to River												
		Threatened and Endangered Species (T&E) [6]		Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
		Wetlands		0	0	0	1,300	1,100	1,250	1,300	1,250	1,250	1,250	1,250
		Floodplain/Floodway [7]		0	0	0	27,500	31,000	36,800	27,500	36,800	36,800	36,800	36,800
5, 14	Physical Environment	Avoid or minimize detrimental impacts to residential neighborhoods												
		Neighborhood Traffic Impacts (5 total neighborhoods)		3	1	1	1	1	1	3	3	3	3	3
		Square Foot of Publicly Owned Property Impacts (Indicates # impacted)		0 (0)	0 (0)	8,486 (3)	19,984 (4)	20,228 (3)	26,402 (3)	19,984 (4)	26,402 (3)	26,402 (3)	26,402 (3)	26,402 (3)
		Square Foot of Commercial Property Impacts (Indicates # impacted)		0 (0)	0 (0)	0 (0)	5,163 (1)	3,633 (1)	2,496 (1)	5,163 (1)	2,496 (1)	2,496 (1)	2,496 (1)	2,496 (1)
		Square Foot of Residential Property Impacts (Indicates # impacted)		0 (0)	823 (1)	1,654 (4)	26,223 (14)	23,875 (14)	26,294 (13)	26,073 (14)	26,144 (13)	26,294 (13)	26,144 (13)	26,144 (13)
		Business or Residential Displacements		0	0	0	1	1	1	1	1	1	1	1
		Noise												
16	Environmental Clearances	Comply with applicable federal and state regulations												
		US Coast Guard Permitability		No permit needed	1 permit	2 permits	2 permits	2 permits	2 permits	2 permits	2 permits	2 permits	2 permits	1 permit
		Potential Level of NEPA Documentation		CE	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA	CE/EA
5, 11, 16	Use of Section 4(f) Properties	Comply with Section 4(f) of the USDOT Act of 1966												
		Section 4(f) Historic Properties		1 use	7 use	7 use	8 use	7 use	8 use	8 use	8 use	8 use	8 use	8 use
		Other Section 4(f) Properties		1 use	3 use	3 use	3 use	3 use	3 use	3 use	3 use	3 use	3 use	3 use

NOTES:
1. The Alternatives that included the Memorial Bridge rehab options (Alternative #1, 2a, 2b, 3a, and 3b) have been dismissed from further consideration based on the recent Memorial Bridge Inspection Report and are not included in this matrix.
2. Alternatives with "MB Replace" and "MB Bike-Ped" include opportunity to better integrate East Coast Greenway with wider path.
3. Category is N/A because the Memorial Bridge has been removed and does not exist.
4. Approach spans provide a 6 foot wide shoulder with the existing lift span providing only a 3 foot wide shoulder.
5. Alternative has a 5% grade and a 5 foot wide sidewalk meeting ADA requirements.
6. Several T&E species are identified in the study area but specific locations are not known at this time.
7. The Floodplain/Floodway square foot impacts within this tidal area will have no noticable effect on water levels during high tidal events.
8. Vertical improvements for accommodating marine traffic are based on the vertical bridge clearances of the lift span in its closed position for accomodating vehicular traffic.
9. Hybrid lift span cannot accommodate roadway and rail traffic simultaneously.
10. Denotes number of historic bridges replaced and/or removed.

LEGEND

	Color assigned to worse performing alternatives
	Color assigned to alternatives performing in the middle
	Color assigned to best performing alternatives

MB	Memorial Bridge
SL	Sarah Mildred Long Bridge
N/A	Not Applicable

FIGURE 8-18

9.0 Study Results and Recommendations

This chapter identifies a) the environmental approvals likely required based on Study results, b) preliminary Section 4(f) evaluation findings, c) the alternatives dismissed from further consideration, d) alternatives recommended to be carried forward and, e) next steps.

9.1. ENVIRONMENTAL APPROVALS

All of the build alternatives considered in the Maine-NH Connections Study require environmental approvals and permits. The specific approvals and permits depend on the alternative chosen to be advanced as the proposed action. A summary of the environmental clearance considerations is included in the Alternatives Evaluation Matrix (Figure 8-18).

Further evaluation of alternatives and documentation of impacts of the proposed action are required under NEPA. Section 4(f) of the U.S. DOT Act of 1966 also applies to all alternatives. See Paragraph 9.2 below for further details regarding Section 4(f) analysis. Under NEPA, FHWA determines the appropriate class of action, either as a Categorical Exclusion, an Environmental Assessment or an Environmental Impact Statement. Preparation of individual Section 4(f) Evaluations are necessary for the alternatives being considered for the Memorial Bridge and the Sarah Mildred Long Bridge.

The USCG has jurisdiction over navigable waters. A Bridge Permit is required for work on the Memorial Bridge and/or the Sarah Mildred Long Bridge if the work would construct a new bridge or reconstruct or modify an existing bridge across navigable waters of the United States. Coordination with the USCG has been ongoing during the course of the Study, and USCG has provided input on the alternatives being considered. As design is advanced, continued coordination with the USCG would occur and filing for a USCG permit could occur with design at approximately a 25 percent level.

A permit from the USACOE is required for discharge of dredge or fill material in waters of the U.S., including wetlands, vernal pools, streams and navigable rivers. Some of these resources are present in the study area. No impact is expected for the No Build alternative. Due to the small areas impacted by the other alternatives, these alternatives likely qualify under a Corps Programmatic General Permit, though this has yet to be confirmed with the USACOE.

Similar approvals by New Hampshire Department of Environmental Service (DES) and Maine Department of Environmental Protection (DEP) may be required.

9.2. PRELIMINARY SECTION 4(F) EVALUATION

Section 4(f) of the Department of Transportation Act of 1966, requires that special effort be made to preserve publicly owned parks, recreation areas, wildlife and waterfowl refuges, as well as historic sites, whether publicly or privately owned.

Before an alternative involving the use of a Section 4(f) property can be selected, avoidance alternatives and minimization measures must be considered. Avoidance alternatives are those

that avoid the use of Section 4(f) property; minimization measures are efforts to minimize the impacts of a Section 4(f) use where it is not prudent or feasible to avoid the Section 4(f) property.

Minimization measures may include mitigation, which is compensation for Section 4(f) impacts that cannot be avoided. Mitigation may entail replacement of Section 4(f) property or facilities. The cost of mitigation should be a reasonable public expenditure in light of the severity of the impact on the Section 4(f) resource.

In this study, both the Memorial Bridge and the Sarah Mildred Long Bridge are Section 4(f) properties and are part of either a federal-aid highway system or a state or local highway system that has continued to evolve over the years. Even though these structures are on or are eligible for inclusion on the National Register of Historic Places, they must perform as an integral part of a modern transportation system. When they do not or cannot, they must be rehabilitated or replaced in order to assure public safety while maintaining system continuity and integrity. If alternatives exist that do not cause impacts, or minimize impacts, they must be considered first.

In addition to the two bridges, numerous parcels at the approaches of both bridges in Portsmouth and Kittery also are or may be eligible for protection under Section 4(f). If there is no feasible or prudent alternative that avoids use to all Section 4(f) properties, FHWA may only approve the alternative that causes the least overall harm. In the Fatal Flaw Analysis phase of this study, a preliminary least harm analysis was performed. None of the alternatives, including the No-Build Alternative, completely avoid all Section 4(f) properties.

The information developed in this study will form the basis for the continuation of the Section 4(f) evaluation and formal Section 4(f) documentation that will be prepared as a part of the subsequent NEPA process.

9.3. ALTERNATIVES DISMISSED FROM FURTHER CONSIDERATION

The remaining ten build alternatives have been evaluated collectively and, where possible, comparatively. Based on findings documented in this report and in supporting Technical Memoranda and Reports provided in the Appendices, and the ratings summarized in the Alternative Evaluation Matrix (Figure 8-18), the following alternatives are recommended to be dismissed from further consideration.

Dismissal #1: Six-lane River Crossing Bridge Alternatives. Appendix #45, Bridge Capacity Analysis Summary Report, evaluated future Piscataqua River crossing volumes for determining needed river crossing capacity. This Technical Report determined that six lanes (a four-lane Sarah Mildred Long Bridge plus a two-lane Memorial Bridge), besides the I-95 High-Level Bridge, were not needed for accommodating future river crossing traffic needs within the Study timeframe (2035). Therefore, it was recommended that alternatives that provide six lanes of river crossing capacity at the Memorial Bridge and Sarah Mildred Long Bridge combined be

dismissed from further consideration. This dismisses Alternative 5b and Alternative 6b from further consideration. This reduces the number of build alternatives from ten to eight.

Dismissal #2: On-line Sarah Mildred Long Bridge Replacement Alternatives. Two of the remaining eight alternatives would replace the Sarah Mildred Long Bridge on existing alignment. The duration of the Sarah Mildred Long Bridge closure during construction for these alternatives (estimated to be greater than two years) would:

- Require temporary maintenance of traffic during construction for traffic along the U.S. 1 Bypass which would reroute traffic to either the I-95 High Level Bridge or the Memorial Bridge;
- Have long term impacts to vehicle mobility and result in reduced level of traffic operations within the Study Area;
- Require coordination with Pan Am Railways and the PNSY relative to timing of closures and duration of rail line closures for current rail materials shipped to and from PNSY;
- Have adverse impacts to certain businesses located at the approaches to the Sarah Mildred Long Bridge due to the temporary loss of vehicular traffic; and
- Would have temporary impacts to emergency and evacuation access routes during the construction duration.

A summary of construction impacts relative to vehicle mobility and traffic operations associated with these alternatives can be found in Appendix 28, 2015 Construction Impacts.

As opposed to these two alternatives, the upstream Sarah Mildred Long Bridge replacement alternatives were carried forward during the Fatal Flaw Process and evaluated further. The upstream bridge replacement alternatives provide the same long term benefits as the on-line replacement alternatives, have minimal to no short-term impact to local businesses and to emergency and evacuation access routing during construction, and have minimal increase in resource and property impacts (noted below).

In reviewing the Alternatives Evaluation Matrix (Figure 8-18), information provided in six of the nine "Evaluation Criteria Category's" are essentially the same for all of the alternatives. The six "Evaluation Criteria Category's" in which there is no substantial difference in identified benefits or impacts are:

- The Structural Improvement Category;
- The Historic Evaluation Category;
- The Natural Environment Category;
- The Physical Environment Category;
- The Environmental Clearances Category; and
- The Use of Section 4(f) Properties Category.

It is recommended that the two remaining Sarah Mildred Long Bridge alternatives that replace the bridge on existing alignment (Alternative 5a and Alternative 7) be dismissed from further consideration. This reduces the number of build alternatives from eight to six.

Dismissal #3: One Four-Lane Vehicle Bridge as Compared to One Two-Lane Hybrid Vehicle Bridge. In comparing Alternative 8 to Alternative 10, the principal comparison is a four-lane, low level Sarah Mildred Long Bridge to a two-lane hybrid, mid-level Sarah Mildred Long Bridge. Both provide the necessary bridge traffic capacity required with the Memorial Bicycle/Pedestrian only bridge, and are similar in rating for mobility and accessibility [17] criteria, and have the same rating for the categories identified above under Dismissal #2.

Comparing the four-lane low level and the two-lane hybrid bridge designs (shown in Figures 8-11 and 8-14 respectively), two key benefits for Alternative 10 (two-lane hybrid bridge design) are identified that separate these two alternatives. These key benefits are:

- Improves both horizontal and closed position vertical marine clearance (86'± clearance over mean high water, a reduction of approx. 87 percent of bridge openings as noted in Appendix 3) providing reductions in travel time delays; and
- Has reduced capital and life cycle costs.

Based on these two key benefits for Alternative 10, Alternative 8 is dismissed from further consideration. This reduces the number of build alternatives from six to five.

Dismissal #4: Alternative 10 - Memorial Bridge Bicycle/Pedestrian Replacement with Sarah Mildred Long Bridge Replacement Hybrid upstream with 6 percent grade and Alternative 11 - Transit Alternative, Memorial Bridge Closed with Sarah Mildred Long Bridge Replacement Hybrid upstream with 5 percent grade.

After further analysis measured against the goals of the study, two alternatives were determined to be inferior to the remaining five. For the reasons set forth below, Alternative 10 (a pedestrian/bicycle replacement for the Memorial Bridge) and Alternative 11 (transit service in place of the Memorial Bridge) will not be analyzed further.

- Alternatives 10 and 11 do not adequately meet the goals established by the Study process. Specifically, these alternatives (a) would not maintain or improve access to Portsmouth and Kittery downtowns and the Portsmouth Naval Shipyard, (b) would not improve bicycle and pedestrian access across the Piscataqua River, (c) would not maintain or improve emergency evacuation efficiency across the Piscataqua River, and (d) could preclude future transportation alternatives.
- NH DOT indicates it has no funding sources for pedestrian/bicycle bridges or transit services.

[17] Modifications from current design could be readily incorporated to meet ADA accessibility requirements, current design standards, and maintain mid-level marine clearance benefits.

- There is virtually no community support, as evidenced by Stakeholder and local public meetings, for any option that does not include a highway Memorial Bridge replacement.

Therefore, three alternatives (4, 6a and 9) will immediately proceed to further environmental documentation, permitting, conceptual design, estimated cost refinement, funding feasibility and project delivery.

9.4. ALTERNATIVES RECOMMENDED TO BE CARRIED FORWARD

The following three alternatives are recommended to be carried forward:

- Alternative 4: Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Rehabilitated;
- Alternative 6a: Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane); and
- Alternative 9: Memorial Bridge Replaced on Existing Alignment and Sarah Mildred Long Bridge Replaced on Upstream Alignment (two-lane) with Hybrid Bridge with 6 percent grade.

A summary of the key advantages and disadvantages of each Alternative is noted below:

Alternative 4: Memorial Bridge Replacement with Sarah Mildred Long Bridge Rehabilitation	
Advantages	Disadvantages
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Rehabilitated Sarah Mildred Long does not fully address lift span reliability
• Improvements to Memorial Bridge: vehicle, bicycle, pedestrian	• No improvement to Sarah Mildred Long Bridge marine vessel clearances in the open or closed position
• Limited resource impacts	• Removal of Memorial Bridge – National Register eligible bridge
• No impacts to local businesses, except during construction	• Traffic impacts from both bridges being closed separately during construction
• Low Life Cycle cost	• No sidewalk on Sarah Mildred Long Bridge
• Maintains current emergency and evacuation access, and bridge redundancy, except during construction	• Does not accommodate bicycles on lift span section of Sarah Mildred Long Bridge (3 foot shoulder)

• Maintains Sarah Mildred Long Bridge – National Register eligible bridge	• Rehabilitation of Sarah Mildred Long Bridge will require additional operation and maintenance investment compared to a new structure

Alternative 6a: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement upstream	
Advantages	Disadvantages
• Fully addresses structural deficiencies	• Removal of Memorial and Sarah Mildred Long Bridges – National Register Eligible Bridges
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Greater natural and physical environment impacts
• Improvements to Memorial Bridge (vehicle, bicycle/pedestrian) and Sarah Mildred Long Bridge (vehicle, bicycle)	• Memorial Bridge closed to traffic during construction of new Memorial Bridge
• Improves Sarah Mildred Long Bridge marine vessel clearances – horizontal only	• No sidewalk on Sarah Mildred Long Bridge
• Traffic maintained on existing Sarah Mildred Long Bridge during construction and on new Memorial Bridge	• High Life Cycle Cost
• No impacts to local businesses, except during construction	• No vertical clearance improvement for marine vessels in closed position
• Maintain current emergency and evacuation access and bridge redundancy, except during construction	

Alternative 9: Memorial Bridge Replacement with Sarah Mildred Long Bridge Replacement Hybrid upstream with 6 percent grade	
Advantages	Disadvantages
• Fully addresses structural deficiencies	• Removal of Memorial and Sarah Mildred Long Bridges – National Register Eligible Bridges
• Maintains/improves mobility to Portsmouth, Kittery, and PNSY	• Greater natural and physical environmental impacts

• Improvements to Memorial Bridge (vehicle, bicycle/pedestrian) and Sarah Mildred Long Bridge (vehicle, bicycle)	• Sarah Mildred Long Bridge can only accommodate one mode at a time (rail or road)
• Improves Sarah Mildred Long Bridge marine vessel clearances – vertical (closed) and horizontal	• Rail in road at Sarah Mildred Long Bridge
• Reduction in # of Sarah Mildred Long Bridge openings vs. low level two-lane Sarah Mildred Long	• Memorial Bridge closed to traffic during construction of new Memorial Bridge
• Increases bridge vehicle capacity compared to low-level options	• No sidewalk on Sarah Mildred Long Bridge
• Traffic maintained on Sarah Mildred Long Bridge during construction and on new Memorial Bridge	• High Life Cycle Cost
• No impacts to local businesses, except during construction	
• Maintain current emergency and evacuation access and bridge redundancy, except during construction	

Discussions and recommendations regarding proposed bicycle/pedestrian facilities should be considered during the development of final design plans for each bridge.

9.5. DOCUMENTATION FOR REMAINING ALTERNATIVES

Documentation is an essential component of the NEPA project development process, which supports and complements public involvement and interagency coordination. It is understood that FHWA will determine the level of documentation required for the remaining alternatives.

The following describes the levels of NEPA documentation for Transportation Projects. Transportation project effects can vary from very minor to significant impacts on the human environment. To account for the variability of project impacts, three basic "classes of action" are allowed and determine how compliance with NEPA is carried out and documented:

- An Environmental Impact Statement (EIS) is prepared for projects where it is known that the action will have a significant effect on the environment.
- An Environmental Assessment (EA) is prepared for actions in which the significance of the environmental impact is not clearly established. Should environmental analysis and interagency review during the EA process find a project to have no significant impacts on the quality of the environment, a Finding of No Significant Impact (FONSI) is issued.
- Categorical Exclusions (CE) are issued for actions that do not individually or cumulatively have a significant effect on the environment.

Each bridge serves a different purpose (Memorial Bridge – local, Sarah Mildred Long Bridge - Regional) and due to the documented mobility issues with having both bridges out of service at the same time, it is recommended that the remaining alternatives be separated following acceptance of the study findings so that each bridge project may proceed on a separate NEPA schedule. Each of the remaining bridge options appear to have both logical termini and independent utility and may be classified as Categorical Exclusions if the appropriate studies substantiate this classification.

9.6. CONCLUSION/RECOMMENDATION

It is recommended that the remaining alternatives be separated for independent Section 106, Section 4(f), and NEPA analyses. Each of the remaining bridge options appear to have both logical termini and independent utility and may be classified as Categorical Exclusions if the appropriate studies substantiate this classification.

The Maine-New Hampshire Connections Study is a feasibility planning study with no direct FHWA approval or action.

9.7. NEXT STEPS

This Report culminates the feasibility analysis phase of the Maine-New Hampshire Connections Study. A joint Executive Order was issued on October 5, 2010 by the Governors of Maine and New Hampshire to form a Bi-State Bridge Funding Task Force to address the financial challenges involving the Memorial and Sarah Mildred Long Bridge, as well as future work on the I-95 High Level Piscataqua River Bridge (see Appendix 57). The duties of the Task Force are:

- Identify mechanisms that would allow the two states to jointly identify and maximize funding for the replacement, rehabilitation, repair, maintenance, and operations of the three bridges;
- Identify methods to jointly structure financing for the replacement of Memorial Bridge, the replacement or rehabilitation of Sarah Mildred Long Bridge and the repair of the I-95 High Level Bridge;
- Propose such legislation that may be necessary in each state to facilitate the funding structure and other contractual authority for state agencies or authorities consistent with each state's laws; and
- Deliver a report to the Governors of the States of Maine and New Hampshire no later than December 15, 2010 with the proposals and recommended legislation required by the Order.
    - On December 15, 2010, the Task Force delivered a report with the following recommendations:
        - Construct the Memorial Bridge replacement beginning in 2011 using a combination of TIGER II Grant funds, FHWA funds, and MaineDOT and NHDOT Bridge funds;

- Construct the recommended Sarah Mildred Long Bridge option beginning in 2016 using a combination of FHWA funds, NH Bureau of Turnpike funds, Maine Turnpike Authority funds, MaineDOT and NHDOT funds, and Department of Defense funds;
- Create a sinking fund that would be contributed to equally by each state to be used for the continued Capital Repair and Rehabilitation (R&R) of the Sarah Mildred Long and I-95 High Level Bridges, using state and federal funding when necessary to address short falls;
- No recommendation is being made by the Task Force on tolling, which if thought to be necessary would be considered by future Legislatures of the two States;
- Continue to share Operation and Maintenance (O&M) costs for all three bridges equally between the two states. Combine bridge operator duties to significantly reduce operator costs; and
- Revitalize the Interstate Bridge Authority (IBA) to oversee all three bridges and to serve as Funds' Administrator of Sinking Fund. This includes a re-establishment of the IBA, extending its charter to include the High Level Bridge, use the IBA to oversee and manage the Sarah Mildred Long and High Level bridges, and to act as an entity to oversee, manage and distribute monies from the sinking fund. IBA members will be selected from each state.

While the Task Force conducted its work, the Connections Study Report was being finalized. Additionally:

- NH DOT is taking the lead on the Memorial Bridge to:
  - Work with a consultant to conduct environmental documentation to satisfy National Environmental Policy Act, Section 106 (historic) and Section 4(f) (public lands) analyses and documentation.
  - Work with a consultant on a design-build approach to replace the Memorial Bridge.
  - Continue these activities with full public involvement, including Steering and Stakeholder Committees and Section 106 Consulting Parties, similar to what has been done on the Maine-New Hampshire Connections Study.

- MaineDOT is taking the lead on the Sarah Mildred Long Bridge to:
  - Work with a consultant to develop 30 percent design plans and detailed cost estimates for the rehabilitation option and mid-level Hybrid two-lane replacement bridge option immediately upstream. The Connections Report costs prepared by HDR are being used for the upstream low-level, two-lane bridge replacement option.

- Conduct environmental documentation to satisfy National Environmental Policy Act, Section 106 (historic) and Section 4(f) (public lands) analyses and documentation.
- Continue these activities with full public involvement, including Steering and Stakeholder Committees and Section 106 Consulting Parties, similar to what has been done on the Maine – New Hampshire Connections Study.

All of the activities noted above will occur concurrently so as to expedite delivery of the Memorial Bridge construction and determination of final recommended actions regarding the Sarah Mildred Long Bridge. The work is expected to begin immediately.