Portland Area Mainline Needs Assessment
Final Alternatives Analysis Report

August 24, 2018

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EXECUTIVE SUMMARY

ES.1 Introduction

The Maine Turnpike mainline through the Greater Portland area is an essential component of the regional and state-wide transportation system. It provides safe and efficient mobility for regional through-traffic, as well as quick and convenient cross-town access to local businesses, municipalities, and other transportation modes.

The primary purpose of the Portland Area Mainline Needs Assessment Study (PAM Study) is to assess safety and mobility deficiencies on the Maine Turnpike between Scarborough and Falmouth, Maine and, as needed, recommend practicable solutions that preserve and improve long-term highway mobility for the region in a manner that is consistent with the Sensible Transportation Policy Act (STPA), enhances the regional transportation system, meets Maine Turnpike Authority (MTA) responsibilities, and reasonable customer expectations. MTA responsibilities include those defined by law and contract, such as the obligation to maintain and improve the Maine Turnpike to meet revenue projections pledged to MTA investors. Maine Turnpike customers reasonably expect that the tolls they pay will be used to provide a safe and reliable travel experience. Chronic congestion is not consistent with these responsibilities and expectations, and the MTA has an obligation to anticipate such conditions and attempt to avoid them with practicable solutions before they occur.

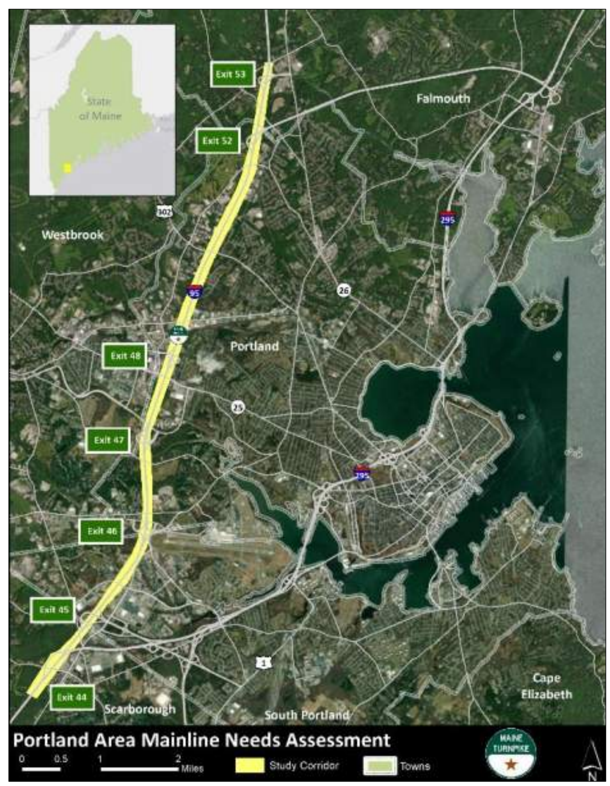

Figure ES-1: PAM Study Area

The Study Area includes the Maine Turnpike corridor from Exit 44 in Scarborough to Exit 53 in West Falmouth. The Maine Turnpike passes through five communities in this corridor – Scarborough, South Portland, Portland, Westbrook, and Falmouth. The Study Area is shown in Figure ES-1: PAM Study Area.

This PAM Study is the mechanism to meet MTA obligations for this section of the Turnpike. The Turnpike is part of a larger system and context, and the future of transportation in this region will be determined by a myriad of factors and efforts including population and economic growth, the price of land, highway capacity decisions, efforts to reduce traffic demand and provide reasonable transportation choices, land use decisions, and efforts to maintain quality of life and the livability of communities. Participants in these broader efforts necessarily include the public, businesses, transportation and planning agencies, and government officials. Consistent with MTA responsibilities, this PAM Study fits well into this larger context, and focuses on the identified safety and mobility deficiencies, a full range of reasonable alternatives, and the potential for each alternative or combination of selected alternatives to cost-effectively address the study purpose.

The PAM Study follows the direction and requirements identified by STPA and the MTA Enabling Act (see 23 M.R.S.A. §73 and §1965-B). These laws require that the MTA evaluate a full range of reasonable transportation strategies to address the transportation need before adding transportation capacity. To be considered reasonable, strategies need to address the study purpose, be cost effective, and be capable of being implemented within a reasonable time-period. The PAM Study was also designed to be consistent with alternatives analyses required by the Army Corps of Engineers (ACOE) and by the Maine Department of Environmental Protection (MaineDEP).

ES.2 Public Outreach Process

Although consideration of the needs of this section of the Maine Turnpike has been occurring for over a decade, the PAM Study began in the spring of 2017. The Study Team aided the MTA in developing an active public outreach process that was an integral part of the assessment. Because the development and analysis of alternatives would include much technical information, the MTA decided to center the public outreach process on a broad-based Public Advisory Committee (PAC). The PAC would guide the range of alternatives to be evaluated and help assess final recommendations. A broader public outreach effort was launched towards the end of the evaluation process to provide the public with a clear set of tools and choices for commentary.

During the course of the PAM Study, five PAC meetings were held. Dates and topics are noted below.

- Meeting #1: June 28, 2017 – Existing conditions, regional transportation and economic systems;
- Meeting #2: October 5, 2017 – Future transportation infrastructure, when it is appropriate to address highway safety and capacity issues, and what an STPA study looks like;
- Meeting #3: January 24, 2018 – Future No Action conditions, Alternatives Pros/Cons;
- Meeting #4: April 25, 2018 – Alternatives Evaluation and Measures of Effectiveness (MOE's); and
- Meeting #5: June 19, 2018 – Induced Demand, Additional Alternatives Evaluated, and PAC Recommendations

PAC meetings were open to the public and time was allotted at each meeting for public comment. The PAC meetings were publicized throughout the study process via traditional media, social media and the MTA website. Press releases were sent to more than 40 regional media outlets two weeks prior to each PAC meeting, and the meeting date was prominently featured on the MTA website.

Additionally, a Public Open House was held on June 7, 2018 at the Maine Mall. This event provided detailed study information and the opportunity to comment.

Also, five municipal select board/city council meetings took place in May and June 2018 for communities in the study area: Portland, South Portland, Westbrook, Scarborough and Falmouth. All were televised via local cable channels. Most were informational only and therefore did not include commentary; those that did ranged from questions about how this study would affect a potential Gorham spur to concerns about potentials for additional traffic, air pollution, and induced demand.

Finally, the PAM Study is being considered by the Portland Area Comprehensive Transportation System (PACTS), the federally designated Metropolitan Planning Organization (MPO). Public comment is also invited at each monthly meeting of the Maine Turnpike Board of Directors.

ES.3 The Challenge: Existing and Future Conditions

Existing Conditions

Understanding the relationship between supply and demand is a fundamental consideration in evaluating how well a transportation facility fulfills its objective to serve the traveling public. For a highway facility, this is accomplished by conducting a level-of-service (LOS) analysis using the traffic engineering procedures outlined in the Highway Capacity Manual[1], which sets forth nationally and regionally accepted guidelines for the evaluation of freeways and other roadways.

Level-of-service describes the operating conditions of the highway using a scale of A-F, with LOS A being a free-flow open condition and LOS F being a heavily congested condition with frequent slowing or stops, representing where vehicular demand exceeds available capacity. The LOS analysis compares "peak" traffic demands with the available highway capacity. AASHTO and MaineDOT roadway guidelines suggest that roadways should be designed to operate at an LOS C or better. In accordance with common engineering practice, the peak demand utilized for this analysis is based on design hour volumes, or typically the 30th highest hour vehicular volumes. When practicable, it is the general policy of the MTA to begin developing solutions before existing conditions reach LOS E to account for the development process and to avoid unacceptable impacts on customers.

The LOS analysis of existing (2016) AM and PM peak hour traffic volumes on the mainline sections of the Maine Turnpike between Exits 44 and 53 are shown in Table ES-1: 2016 AM and PM Existing Traffic Analysis Results.

Table ES-1: 2016 AM and PM Existing Traffic Analysis Results

Location	Northbound PM Design Hour Volume		Southbound AM Design Hour Volume	
	Volume	LOS	Volume	LOS
44 to 45	2402	C	1,651	B
45 to 46	2776	D	2,253	C
46 to 47	3440	E	3194	E
47 to 48	3209	E	2951	D
48 to 52	2901	D	2751	D
52 to 53	2411	C	2436	C

[1] Transportation Research Board, *Highway Capacity Manual* (Transportation Research Board, 2010)

From this analysis using 2016 data, the Study Team found that several sections of the Maine Turnpike already meet or exceed roadway capacity, LOS (D or worse). These sections include the Northbound PM Peak from Exit 45 to 52 and the Southbound AM Peak from Exit 52 to 46.

Due to relatively high traffic volumes on the section of the Maine Turnpike between Exits 44 and 53, the annual number of crashes is significant. The annual crash total for this section has been increasing steadily since 2012. From 2012 to 2016, the annual number of crashes increased from a 10-year low of 67 crashes to 84 crashes – a 25% increase in four years. However, according to MaineDOT standards, no locations on the Maine Turnpike mainline in the study area are classified as a High Crash Location (HCL), although there are several HCLs immediately adjacent to the Maine Turnpike in the PAM study area.

Future Conditions

Projecting traffic conditions to a future year is a standard engineering practice to prevent the transportation facility from operating at or over capacity shortly after construction is completed. For roadway design projects in Maine, the typical forecast year is 20 years[2]. In this case, the forecast year of 2040 was selected to be consistent with the regional traffic model used by this study and by PACTS.

The next step to determine future traffic conditions is to establish an expected annual growth rate. Traffic growth on this section of the Maine Turnpike has been among the highest on the entire Turnpike in recent years (2014-2016) – ranging from 4.3 % to 6.2%. However, establishing a growth rate for a long-term forecast such as this requires a broader consideration of several sources of historic data and forecasts. The Study Team considered the following:

- Historic daily traffic growth on the Maine Turnpike between Exits 44-53
- Maine Turnpike Authority (MTA) Safety and Capacity Study[3]
- 2017 Toll Revenue Study[4]
- Dr. Charles Colgan Maine Turnpike Transaction Forecast[5]
- Total Gross Domestic Product for Maine[6]

From these sources, a range of long-term annual growth rates from 1.4% to 2.3% per year were identified. Following review of these sources with the MTA and the PAC, the Study Team found that although higher rates are possible, a growth rate of 1.5% per year was clearly supportable and conservative. This growth rate is consistent with the MTA's Safety and Capacity Study, another long-range transportation planning study, and exceeds the 0% - 0.9% growth rates used by MaineDOT in its analysis of I-295 entitled "I-295 Corridor Update Scarborough to Brunswick" dated June 2018.

Using the 2040 forecast year and the 1.5% annual growth rate, the design hour traffic volumes and the resulting levels-of-service for the northbound and southbound directions of the Maine Turnpike were grown to the levels shown in Table ES-2: 2040 AM and PM Future Traffic Analysis Results.

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[2] MaineDOT, *Highway Design Guide* (MaineDOT, February 2015)
[3] Maine Turnpike Authority, *Maine Turnpike Needs Assessment, Safety and Capacity Study* (HNTB Corp., May 2016)
[4] Maine Turnpike Authority, *Maine Turnpike 2017 Toll Revenue Study* (CDM Smith, December 2014)
[5] Charles S. Colgan PhD., 16 February 2015, memorandum, *Turnpike Transaction Forecast*
[6] https://fred.stlouisfed.org/series/MENGSP

Table ES-2: 2040 AM and PM Future Traffic Analysis Results

Location	Northbound PM Design Hour Volume		Southbound AM Design Hour Volume	
	Volume	LOS	Volume	LOS
44 to 45	3,434	E	3,482	E
45 to 46	3,969	F	3,932	F
46 to 47	4,919	F	4,219	F
47 to 48	4,588	F	4,566	F
48 to 52	4,147	F	3,222	E
52 to 53	3,446	E	2,363	C

From this analysis of future conditions, the Study Team finds that virtually all of the Maine Turnpike in the Study Area will be at an unacceptable LOS by 2040. Forecasted volumes are anticipated to be approximately 400 to 1,300 vehicles per hour over capacity. These are not far off, distant concerns. Traffic conditions were also forecasted for 2025, and substantial portions of the Maine Turnpike in the Study Area will be at undesirable and unacceptable LOS, especially in the area of Exits 46 to 48. To the Maine Turnpike traveler, this future will reveal itself in the form of more crashes, chronic congestion, stop and go traffic, queues at ramps, and unreliable travel, which will lead to a desire to look for alternative routes. In summary, this analysis confirms that action is required to keep the Maine Turnpike operating safety and reliably in accordance with MTA responsibilities and reasonable customer expectations.

ES.4 Solutions: The Alternatives Evaluation

The Alternatives Evaluation was conducted for the MTA to help identify possible solutions to address the safety and mobility deficiencies previously identified. This evaluation fully complies with Maine's STPA and Maine's Enabling Act by considering a full range of reasonable transportation strategies to address the transportation need before adding transportation capacity. This evaluation was also designed to be consistent with alternative analysis required by the ACOE and by the MaineDEP.

Alternatives analyzed fall into the following categories:

- No Action
- Travel Demand Management (TDM) Alternatives
- Transportation System Management (TSM) Alternatives
- Capacity Alternatives
- Combination Alternatives

The original scope of the PAM Study identified 10 alternatives for evaluation. Through the PAC and public outreach process, an additional nine alternatives were added, for a total of 19 alternatives. The alternatives evaluated are summarized in Table ES-3: Alternatives Evaluated, following.

Table ES-3: Alternatives Evaluated

Alternative Category	Alternative Number	Alternative Name	Alternative Source (Study Scope, PAC, Public)
No Action			
	Alternative 1	No Action	Study Scope
Travel Demand Management (TDM)			
	Alternative 2	Travel Demand Management (TDM)	Study Scope
	Alternative 3	Congestion Pricing	Study Scope
	Alternative 4	Intercity Bus	PAC
	Alternative 5a	Regional Bus	Study Scope
	Alternative 5b	Local Bus	Study Scope
	Alternative 5c	I-95 Corridor Regional Bus	PAC
	Alternative 6a	Commuter Rail	PAC, Public
	Alternative 6b	Local Commuter Rail	PAC
	Alternative 7	Freight Rail	PAC, Public
	Alternative 8	Land Use	Study Scope
Transportation System Management			
	Alternative 9a	Ramp Metering	PAC
	Alternative 9b	HOV/HOT Lanes	PAC
	Alternative 9c	Reversible Lanes	PAC
Capacity			
	Alternative 10	I-295 Widening	Study Scope
	Alternative 11	I-295 Widening with Tolls	Study Scope
	Alternative 12	I-95 Widening	Study Scope
Combined			
	Alternative 13	Alternatives 2, 4, 5a, 5b, and 8	PAC
	Alternative 14	Alternatives 2, 4, 5a, 5b, 8, and 12	PAC

The Study Team also produced working papers analyzing several other topics raised during the Study process including autonomous vehicles, congestion pricing, HOV/HOT lanes, ITS, part-time shoulder use, and induced demand.

Each alternative shown in Table ES-3 above was analyzed for the Year 2040, the future analysis year determined for the PAM Study and compared against the future No Action Alternative.

Alternatives were evaluated using evaluation criteria known as Measures of Effectiveness (MOE’s). MOE’s are used to compare the performance of the alternatives based on the issues, opportunities, and goals identified in the Study Purpose statement.

Twenty-two MOE’s were developed and divided into five groups:

- Transportation Measures
- Environmental Measures
- Cost/Funding Measures
- Implementation Measures

- Summary Measures

Results of the alternatives evaluation are shown in the Evaluation Summary Matrix included as Table 6-13 in this report. The Evaluation Summary Matrix identifies each of the 19 alternatives and provides information under each of the 22 MOE's.

ES.5 Study Team Findings

In accordance with the STPA and environmental and planning laws and guidance, the Study Team determined that an alternative was "reasonable" if it meets the study purpose (see second paragraph on page ES-1 above), is cost effective, and is capable of being implemented within a reasonable time period.

Using the extensive analysis documented in this report as summarized in the Evaluation Summary Matrix included as Table 6-13 ("the Matrix"), Table ES-4 below further refines the reasonableness of each alternative studied. The "Meets Study Purpose" column below is derived from Column Y of the Matrix, the "Implementable" column is a combination of Columns N, P, and S of the Matrix, and the "Cost Effective" column reflects whether the alternative had a Benefit / Cost ratio of greater than 1.0 as shown in Column U of the Matrix.

Table ES-4: Evaluation of Reasonableness of Alternatives

	Alternative	**Meets Study Purpose?**	**Cost Effective?**	**Implementable?**		Reasonable
				Funding	Implementation Period	
1	Future No Action	No	Yes	Viable	--	No
2	Expanded TDM/Rideshare	Partially	Yes	Viable	<5 year	No
3	Congestion Pricing	Partially	No	Uncertain	Unknown/Long	No
4	New or Improved Interstate Bus	Partially	Yes	Uncertain	< 5 years	No
5a	Improved Regional Bus	Partially	Yes	Uncertain	< 5 years	No
5b	Improved Local Bus	Partially	No	Uncertain	< 5 years	No
5c	New I-95 Corridor Regional Bus	Partially	No	Uncertain	< 5 years	No
6a	New or Improved Commuter Rail	Partially	No	Uncertain	5-10 years	No
6b	New Local Commuter Rail	Partially	No	Uncertain	5-10 years	No
7	New or Improved Freight Rail	Partially	Yes	No	5-10 years	No
8	Land Use Scenario	Partially	Yes	Uncertain	Unknown/Long	No
9a	Ramp Metering	Partially	No	Viable	< 5 years	No
9b	High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT)	Fully	Yes	Viable	Unknown/Long	No
9c	Reversible Lane	Partially	Yes	Viable	<5 years	No
10	Widen I-295 to three lanes in each direction	Partially	No	No	5-10 years	No
11	Widen I-295 to three lanes in each direction	No	No	No	Unknown/Long	No
12	Widen I-95 to three lanes in each direction	Fully	Yes	Viable	<5 years	Yes
13	Alternatives 2, 4, 5a, 5b, and 8	Partially	Yes	Uncertain	Unknown/Long	No
14	Alternatives 2, 4, 5a, 5b, 8 and 12	Fully	Yes	Uncertain	Unknown/Long	No

As can be seen, the Study Team found that Alternative 12 – widening the Portland Area Mainline of the Turnpike to 3 lanes in each direction - is the only alternative that fully meets the Study Purpose, is cost effective, and is readily implementable.

ES.6 Study Team Recommendations

Based on the technical analysis and evaluation of existing and future conditions, feedback provided by the Public Advisory Committee and the public, and given the results of the Alternatives Analysis, the Study Team recommends that the MTA proceed as follows.

1. Implement Alternative 12 to Address Safety and Congestion Issues Using a Phased Approach. The Study Team recommends that the MTA implement Alternative 12 to improve safety and reduce congestion by developing a consistent 6-lane highway from Exit 44 to Exit 52 or 53 in a phased approach before levels of service reach unacceptable levels.

   The Study Team recommends that the first phase widen the mainline to three lanes in each direction from Exit 44 in Scarborough to a point just north of Exit 48 in Portland, and should begin as soon as possible. Using the conservative annual growth rate in the Study (1.5%), this first phase needs to be completed prior to 2025.

   The Study Team recommends that the second phase widen the mainline from just north of Exit 48 in Portland to a point near Exit 52 or Exit 53 in West Falmouth before levels of service reach unacceptable levels, to be determined based upon traffic levels and available funding. Using the 1.5% annual growth rate, this second phase should be completed prior to 2030. Actual traffic growth rates could alter the timing of these phases.

2. Turnpike Capacity Preservation Measures. Given the substantial financial investment necessary to widen as recommended above, it is reasonable to preserve this new capacity as long as possible to attempt to slow or avoid the need for a future widening. Accordingly, the Study Team also recommends that the MTA work with partner agencies to prudently pursue the following Turnpike capacity preservation measures that the MTA.

   a. Transportation Demand Management (TDM). Consistent with the STPA goals of managing transportation demand and system efficiency over the long term, the Study Team recommends that the MTA continue to support and potentially enhance TDM efforts. In particular, the MTA is encouraged to build upon its efforts in the areas of:

      - Employer TDM, including GoMaine;
      - Expansion of park & ride facilities;
      - Continued safety enforcement; and
      - Expansion of ITS initiatives.

   b. Transit. The Study Team recommends that the MTA consider partnering with other state and local agencies, municipalities, and other stakeholders to support a coordinated regional approach to bus and rail infrastructure and service which, pending further analysis, could include a new transit service along the Turnpike corridor, identification of smaller transportation hubs for local or regional buses, perhaps at existing or future MTA park & ride facilities, and assessing the need for additional parking at the Portland Transportation Center.

c. Land Use. The Study Team recommends that the MTA consider prudently supporting local and regional land use initiatives and policies designed to allow robust economic growth in a way that minimizes impacts on highway capacity, the environment and communities. Specifically, the Study Team recommends that the MTA support the efforts of regional planning organizations and the municipalities through which the Turnpike passes between Exits 44 and 53 to develop coordinated and consistent Transit Oriented Development (TOD) plans that promote higher density development in proximity to designated transportation hubs, which may include MTA park and ride facilities.

3. Continue Best Practices to Mitigate Impacts on Protected Resources. Finally, the Study Team recommends that the MTA continue to evaluate its deicing program in an attempt to minimize the impacts that salt and chlorides will place on the watersheds of the four urban impaired streams in the Exit 44 to 53 widening area. The design of the widened highway and vegetation should also consider impacts on protected resources.

1. Introduction

The Maine Turnpike mainline through the Greater Portland area is an essential component of the regional and state-wide transportation system. It provides safe and efficient mobility for regional through-traffic, as well as quick and convenient cross-town access to local businesses, municipalities, and other transportation modes.

The primary purpose of the Portland Area Mainline Needs Assessment Study (PAM Study) as agreed by the Public Advisory Committee (PAC) is to assess safety and mobility deficiencies on the Maine Turnpike between Exit 44 in Scarborough and Exit 53 in West Falmouth. The study's goal is to recommend practicable solutions that preserve and improve long-term highway mobility for the region in a manner that is consistent with the Sensible Transportation Policy Act (STPA), enhance the regional transportation system, and meet Maine Turnpike Authority (MTA) responsibilities and reasonable customer expectations.

MTA responsibilities include those defined by law and contract. They include the responsibility to maintain and improve the Turnpike to meet revenue projections pledged to MTA investors. Turnpike customers reasonably expect that the tolls they pay will be used to provide a safe and reliable travel experience on the Turnpike. Chronic congestion is not consistent with these responsibilities and expectations, and the MTA has an obligation to anticipate such conditions, and avoid them with practicable solutions before they become persistent.

This PAM Study is a critical component of a process that will identify the future of the Maine Turnpike in the Greater Portland region. That process includes analysis of adding additional highway capacity, reducing vehicular demands, promoting economic development, providing reasonable transportation choices, and maintaining quality of life. Participants include the public, businesses, transportation agencies, and government officials. Consistent with MTA responsibilities, the PAM Study focuses on identified safety and mobility deficiencies, the range of reasonable alternatives, and the potential for each alternative or combination of selected alternatives to cost effectively address the PAM Study purpose.

The Study Area (see Figure 1-1) includes the Maine Turnpike corridor from Exit 44 in Scarborough to Exit 53 in West Falmouth. The Maine Turnpike passes through five communities in this corridor – Scarborough, South Portland, Portland, Westbrook, and Falmouth.

Figure 1-1: Portland Area Mainline Needs Assessment Study Area

This report summarizes the findings of the PAM Study and is prepared in the following seven chapters as follows:

- Introduction
- Public Outreach Process
- Existing Traffic Conditions
- Existing Safety Conditions
- Future Traffic Conditions
- Alternatives Evaluation
- Summary of Findings and Recommendations

The MTA has previously identified the safety and mobility deficiencies along this section of the Maine Turnpike corridor between Exits 44 and 53 as part of an MTA Safety and Capacity Analysis Study. The most recent MTA Safety and Capacity Analysis Study was completed in May 2016. Based on the findings of this study, the MTA included the need to address the safety and capacity deficiencies in this corridor in their 10-year and 4-year Capital Investment Plans.

Following these findings, the PAM Study began to pursue fulfilling the direction and requirements identified by Maine's STPA and the MTA Enabling Act (see 23 M.R.S.A. §73 and section §1965-B). These laws require that the MTA evaluate a full range of reasonable transportation strategies to address transportation needs before adding transportation capacity. To be considered reasonable, strategies need to address the Study purpose, be cost effective, and be capable of being implemented within a reasonable time period. The PAM Study was also designed to be consistent with alternative analyses required by the Section 404(b)(1) Guidelines of the Army Corps of Engineers and by the Maine Department of Environmental Protection.

The strategies to be considered[7] will include:

(1) No Action;

(2) Transportation demand management alternatives;

(3) Transportation system management alternatives;

(4) Capacity alternatives; and

(5) Combination alternatives

Also consistent with STPA, the PAM Study involved an extensive public outreach process. This process, including formation of a Public Advisory Committee (PAC), is outlined in Chapter 2.

[7] List of reasonable strategies listed are as identified in 17-229, Chapter 103: Rule for the Sensible Transportation Policy Act

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2. Public Outreach Process

2.1 Overview

The Portland Area Mainline Needs Assessment Study (PAM Study) began in the spring of 2017. The Study Team aided the MTA in developing an active public outreach process that was an integral part of the assessment. Because the development and analysis of alternatives would include much technical information, the MTA elected to center the public outreach process on a broad-based Public Advisory Committee (PAC). The PAC would guide the range of alternatives to be evaluated and help assess final recommendations. A broader public outreach effort was launched towards the end of the evaluation process to provide the public with a clear set of tools and choices for commentary.

As background, Maine's Sensible Transportation Policy Act (STPA) directs that any transportation planning decisions must include the public in the following manner: "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 investment decisions and project decisions. The department and the Maine Turnpike Authority (MTA) shall take the comments and concerns of local citizens into account and must be responsive to them." This study was conducted specifically to fulfill this directive, as well as adhere to legislation relating specifically to the widening of the Turnpike between mile marker 44 and 53, which directs the Turnpike Authority to provide a similar level of public participation as the STPA.

2.2 Public Advisory Committee

The PAC was formed in April 2017 to assist the MTA in the process of identifying and analyzing a range of alternatives to be considered in addressing capacity issues. Toward this end, the roster of PAC members invited to serve on the PAC were chosen to reflect a variety of regional and local transportation needs and values. Invitations were sent to the following organizations.

- Greater Portland Council of Governments (GPCOG) / Portland Area Comprehensive Transportation System (PACTS): Kristina Egan
- City of Portland: Chris Branch
- City of South Portland: Scott Morelli
- Town of Scarborough: Mike Shaw
- City of Westbrook: Ann Peoples
- Town of Falmouth: Nathan Poore

- MaineDOT: Ed Hanscom
- Portland Jetport: Paul Bradbury
- Northern New England Passenger Rail Authority (NNEPRA): John Melrose
- Portland Metro: Greg Jordan
- Portland Trails: Kara Wooldrik
- Maine Motor Transport: Brian Parke
- Portland Regional Chamber: James Cohen
- Maine State Legislature: Mark Dion
- State Police: Lt. Eric Baker
- Long Creek Watershed Management District: Peter Carney
- Maine Better Transportation Assn.: Steve Sawyer
- Maine Bicycle Coalition: Nancy Grant
- At Large: Josh Benthien

The invitation letter proposed four three-hour meetings over the course of the year, with the final meeting in the spring of 2018. All invitees accepted; the Bicycle Coalition of Maine withdrew after two meetings due to a change in leadership.

2.2.1 PAC Meeting #1

Agenda: June 28, 2018

1. Welcome & Introductions
2. Housekeeping / Roles and Responsibilities of the PAC
3. Schedule and Process
4. Regional Transportation Systems: The Study in Context
5. Regional Economic Systems: An Economic Outlook for Greater Portland – Dr. Charles Colgan
6. How the Road Works Now (Existing Conditions)
7. Next Meeting: Date, Time, Agenda
8. Public Comment

This first meeting was focused on giving the PAC an overview of existing traffic and economic conditions. The PAC had a number of clarifying questions and comments on the trends presented. See Appendix A for details: PAC Meeting #1 Minutes.

Committee Members present: Paul Bradbury, *Chair*, Portland Jetport; Lt. Eric Baker, State Police; Chris Branch, City of Portland; Peter Carney, Long Creek Watershed Management District; Jim Cohen, Portland Regional Chamber; Kristina Egan, GPCOG/PACTS; Nancy Grant, Bicycle Coalition of Maine; Ed Hanscom, MaineDOT; Greg Jordan, Greater Portland Transit; Ann Peoples, City of Westbrook; Nathan Poore, Town of Falmouth; Steve Sawyer, MBTA; Mike Shaw, Town of Scarborough; Kara Wooldrik, Portland Trails

2.2.2 PAC Meeting #2

Agenda: October 5, 2017

1. In planning for the future of the Turnpike, what assumptions should we make with respect to region-wide new or expanded transportation infrastructure and other factors impacting travel demand?
    a. Review and revise proposed transportation and land use changes
    b. To what degree could they affect how and where people travel?
    c. What other factors could affect travel patterns?
2. When is it appropriate to address highway capacity and safety issues?
    a. MTA Financial Obligations and Funding Model
    b. MaineDOT Funding Model
    c. Turnpike's transportation role/growth data
3. What would an STPA study for a limited-access roadway look like**?**
    a. Review STPA and MTA enabling legislation
    b. Create list of reasonable Alternatives for limited-access road
    c. Discuss Alternatives' pros and cons
    d. Discuss tools/methodology to evaluate Alternatives

At this meeting, the MTA asked the PAC to brainstorm any upcoming regional transportation or land use changes that should be included in the Travel Demand Model for the study. The model will project out to 2040. An explanation of MTA's funding model was provided. A list of the alternatives included in the study scope was presented and the PAC was asked for their ideas on appropriate additional alternatives to analyze, based on Maine's STPA legislation. Multiple new alternatives were suggested. See Appendix A for details: PAC Meeting #2 Minutes.

*Committee Members present***:** Paul Bradbury, *Chair*, Portland Jetport; Lt. Eric Baker, State Police**;** Josh Benthien, Northland**;** Chris Branch, City of Portland**;** Peter Carney, Long Creek Watershed Management District; Jim Cohen, Portland Regional Chamber**;** Kristina Egan, GPCOG**;** Ed Hanscom, MaineDOT**;** Greg Jordan, Greater Portland Transit**;** John Melrose, NNEPRA**;** Ann Peoples, City of Westbrook**;** Nathan Poore, Town of Falmouth**;** Steve Sawyer, MBTA**;** Mike Shaw, Town of Scarborough**;** Kara Wooldrik, Portland Trails
Also Attending: John Duncan, PACTS

2.2.3 PAC Meeting #3

Agenda: January 24, 2018

1. Welcome, Introductions, Meeting Guidelines

2. Future No Action conditions (with and without Gorham)
3. Discussion: Pros/cons of each alternative
4. Public Comment

At this meeting, the Study Team presented the results of the Travel Demand Model. The PAC had multiple questions. The model projections were accepted by the PAC. The PAC was then asked to do a pro and con exercise on the twelve alternatives under consideration. During this exercise, additional alternatives were suggested by the PAC. See Appendix A for details: PAC Meeting #3 Minutes.

Committee Members present: Josh Benthien, Northland; Kristina Egan, GPCOG/PACTS; Mike Shaw, Scarborough; Ed Hanscom, MaineDOT; John Melrose, NNEPRA; Chris Branch, Portland; Paul Bradbury, Jetport; Nathan Poore, Falmouth; Greg Jordan, Greater Portland Metro; Kara Wooldrik, Portland Trails; Peter Carney; Long Creek Watershed Management; Eric Baker, State Police

2.2.4 PAC Meeting #4

Agenda: April 25, 2018

1. Welcome and Introductions
2. Review of Alternatives and Measures of Effectiveness (MOEs)
3. PAC discussion
4. PAC recommendations
5. Public Comment (about 30 minutes)
6. Next Steps

At this meeting, the Study Team reviewed the technical criteria for analyzing the alternatives, now totaling 19. Additional MOE criteria were added by the PAC to total the current 22. A simplified guideline to evaluate alternatives was also provided: a) Does this alternative solve the problem? b) Does this alternative create other unfixable problems? And, c) Can this alternative be implemented? The PAC then discussed the in-depth technical analysis of the alternatives, presented in matrix format. Finally, each PAC member provided comments and suggestions. These suggestions for follow up work by MTA were:

- Effects of Induced demand
- Regional I-95 bus route with stops/connections to downtown
- Break out commuter rail into separate pieces
- Create a combined alternative*
- Phase short, medium and long-term alternatives
- Add transit enhancements to congestion pricing
- Look at synergy of HOV and rapid bus
- Adapt cost/benefit ratio to beyond turnpike geographic area

- Enhance reduced price congestion pricing for Spur

See Appendix A for details: PAC Meeting #4 Minutes.

*To determine PAC members' suggestions on what to include in a combined alternative, each member was polled via email after the meeting, and asked to provide their top five alternatives. The results are shown in Table 2-1.

Table 2-1: PAC Members' Recommended Combined Alternatives

Combined Alternative	**# Responses**
New/Expanded Transportation Demand Management Programs (TDM)	47
Widen Turnpike to three lanes in each direction	46
Land Use Scenario	33
Public Transportation: New or Improved Local Bus Service	25
Public Transportation: New or Improved Regional Bus Service	22
Public Transportation: New or Improved Interstate Bus Service	19
High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Lanes	15
Public Transportation: New or Expanded Commuter Rail	12
Ramp Metering	9
Widen I-295 to three lanes in each direction	8
Reversible Lanes	7
Congestion Pricing on Maine Turnpike	7
Freight Transportation: New or Improved Intermodal Freight	6
Widen I-295 to three lanes in each direction with tolls	0

Committee Members present: Paul Bradbury, chair, Portland Jetport; Lt. Eric Baker, State Police; Josh Benthien, Northland; Chris Branch, City of Portland; Peter Carney, Long Creek Management; Tim Doyle, MMTA; Kristina Egan, GPCOG/PACTS; Ed Hanscom, MaineDOT; Greg Jordan, Greater Portland Transit; John Melrose, NNEPRA; Ann Peoples, City of Westbrook; Nathan Poore, Town of Falmouth; Mike Shaw, Town of Scarborough; Kara Wooldrik, Portland Trails; Guest: Herb Thompson, MaineDOT

2.2.5 PAC Meeting #5

Agenda: June 19, 2018

1. Welcome and Introductions
2. Response to PAC questions from Meeting #4
3. Induced Demand Discussion: Dr. Charles Colgan
4. Discussion of New Alternatives requested by PAC
5. Public Comment – (includes overview of MTA-received public comments)
6. Discussion

At this meeting, the Study Team began by answering the series of questions that had surfaced at the April PAC meeting, and then asked Dr. Charles Colgan to provide insight as to whether induced demand would be a factor in a potential Turnpike widening. The Study Team then presented analysis on four new alternatives that the PAC had requested at the April meeting. The PAC then commenced an open discussion on all the alternatives and next steps by the MTA and the region. In general, most saw the widening as inevitable, either now or in the future, but there was general agreement that several other alternatives also had merit in terms of regional transportation improvements and that the MTA and the agencies represented by PAC members should partner in creating implementation plans. See Appendix A for details: PAC Meeting #5 Minutes.

Committee Members present: Paul Bradbury, *Chair*, Portland Jetport; Lt. Eric Baker, State Police**;** Josh Benthien, Northland**;** Chris Branch, City of Portland**;** Peter Carney, Long Creek Management**;** Kristina Egan, GPCOG/PACTS**;** Ed Hanscom, MaineDOT**;** Greg Jordan, Greater Portland Transit**;** John Melrose, NNEPRA**,** Brian Parke, MMTA**;** Ann Peoples, City of Westbrook**;** Nathan Poore, Town of Falmouth**;** Mike Shaw, Town of Scarborough**;** Steve Sawyer, MBTA**. Guest:** Herb Thompson, MaineDOT

2.2.6 Publicity and Outreach for PAC Meetings

The PAC meetings were publicized throughout the study process via traditional media, social media and the MTA website. Press releases were sent to more than 40 regional media outlets two weeks prior to each PAC meeting, and the meeting date was prominently featured on the MTA site.

Email alerts were sent from the Study Team to a list of organizations and individuals in Greater Portland that had a history of interest in transportation studies. This list included the Conservation Law Foundation, a representative of which attended all but the final PAC meeting and provided two sets of comment. A handful of other citizens were also in attendance at PAC Meetings 1-4. All correspondence from members of the public who attended the PAC Meetings can be seen in Appendix B.

A half hour at the end of each meeting was set aside for public comment. The public comment period was placed at the end of each meeting to allow the public to hear the same information as the PAC and consequently provide more informed comment.

2.3 Public Information Campaign

In May 2018, the MTA launched a public information campaign to alert the public to initial findings of the study. The objective of the campaign was to solicit specific feedback on the 19 alternatives under consideration. The timing of the public information campaign was based on the generally accepted understanding that the public can provide more, and more useful, feedback when they are provided with specific items on which to comment.

2.3.1 Social, Paid and Earned Media

The public information campaign was launched with a focus on a June 7 open house event at the Maine Mall, coupled with a link to the MTA website, which provided detailed study information and the opportunity to comment. In addition, purchased media included print, digital and radio and the event and online commentary were promoted through press releases and notifications on the MTA's social media pages. A significant amount of earned media resulted from these. Details of the media buy and earned media can be found in Appendix B.

2.4 Municipal Council Meetings

Five municipal select board/city council meetings took place in May and June 2018 for communities in the study area: Portland, South Portland, Westbrook, Scarborough and Falmouth; all were televised via local cable channels. Most were informational only and so did not include commentary; those that did ranged from questions about how this study would affect a potential Gorham spur to concerns about potential additional traffic, potential additional air pollution, and potential induced demand.

2.4.1 Public Open House

The June 7 open house took place from 4:30 to 6:30 at South Portland's Maine Mall, designed as an informal event that allowed participants to drop in and view details on the 19 alternatives, ask questions, or make comments to staff. The displays also encouraged written comments via sticky notes and a comment sheet. A summary of the comments made is shown in Table 2-2 below.

Table 2-2: Summary of Public Open House Comments

Alternative	Comments	Red Dot: No	Green Dot: Yes
Alt 1 - No Action		**3**	
Alt 2 - TDM	Combine with widening	**1**	**3**
Alt 3 - Congestion Pricing	I can't change my commute time-will cost me more-no thanks	**2**	**1**
Alt 4 - Interstate Bus			**2**
Alt 5a - Regional Bus	Breez should go Portland, Falmouth, Yarmouth, Augusta		**2**
Alt 5b - Local Bus	I commute to Lewiston – won't help	**1**	**1**
Alt 6a - Commuter Rail	I love trains but far too costly – cheaper in long run to widen pike	**1**	**1**
Alt 6b - Corridor Commuter Rail	Too expensive for commuters and taxpayers		
Alt 7 - Freight Rail			**2**
Alt 8 - Land Use			**2**
Alt 9a - Ramp Meter		**2**	
Alt 9b - HOV/HOT		**3**	
Alt 9c - Reversible		**2**	**1**
Alt 10 - Widen 295	What about Hadlock Field?	**1**	**2**
Alt 11 - Widen + Tolls		**1**	**1**
Alt 12 - Widening 95	So far, this one makes the most sense to me		**4**
Alt 14 - Combined Alts w/ Widening			**1**

2.5 Quantitative Summary of Online Comments

The MTA received 15 written comments on their social media pages (Facebook and Twitter); 28 commenters posted via the *Make a Comment* section of the MTA website's study page. A summary of social media comments is shown in Table 3-3 and a summary of website comments is shown in Table 2-4. Verbatim comments can be found in Appendix B.

Table 2-3: Social Media Comments

Social Media Comment	**# Responses**	**Notes**
Widen	4	
Don't Raise Tolls	2	
Try Other Options	3	One commenter was a reporter, one CLF
Other Suggestions	3	(1)-Trucks should use all lanes (2)-295 too busy
Whimsical/Unrelated	3	

Table 2-4: Website Comments

Website Comment	**# Responses**	**Notes**
Widen	12	
Don't Raise Tolls	4	
Use Other Options		
• HOV/HOT	1	
• Light Rail	2	
• Use a Mix of Options	5	
Other Suggestions	6	Examples: adding Exits and EZ pass lanes

** There were 28 commenters, some of whom posted multiple messages for a total of 30 messages.*

3. Existing Traffic Conditions

3.1 Maine Turnpike

The Maine Turnpike is Maine's primary major north-south economic corridor connecting points south of Maine to the nation. It extends from the Piscataqua River Bridge in Kittery to Exit 109 in Augusta. From Kittery to Portland at Exit 44, the Maine Turnpike operates as a six-lane divided highway (three general purpose lanes in each direction). The remainder from Portland to Augusta operates as a four-lane divided highway (two general purpose lanes in each direction). Popular summer destinations such as York, Ogunquit, and Old Orchard Beach and major cities such as Portland, Lewiston/Auburn and Augusta, are all accessed via the Maine Turnpike.

There are two other major routes that serve the region, including Route 1 and Interstate I-295. Route 1 is a generally single lane arterial that runs parallel to the Maine Turnpike from Kittery to Portland and connects to the eastern communities along the Maine coast. Route 1 connects directly to the Maine Turnpike interchanges from Kittery to South Portland but has no direct connections to the Maine Turnpike north of Portland. Interstate I-295 is a four-lane divided highway that has three major connections to the Maine Turnpike: Exit 44, Exit 52 (connected by the Falmouth Spur) and Exit 103. Exit 44 is the southernmost access point to Interstate I-295 which runs through downtown Portland. The Falmouth spur, Exit 52 on the Maine Turnpike and Exit 11 on Interstate I-295, grants access to Interstate I-295 just north of Portland. Exit 103 is the northernmost access point to Interstate I-295 and converges back onto the Maine Turnpike near Augusta. These three routes provide visitors and residents access to the economic hub of Maine. Figure 3-1 is a regional map of Maine illustrating where Route 1, Interstate I-295 and the Maine Turnpike connect. The PAM Study Area is highlighted in yellow.

The Maine Turnpike is classified as an Interstate Freeway by the Federal Highway Administration (FHWA) Highway Classification System. The FHWA defines an interstate as: *"'limited access' or 'controlled access' roadways. Access to these roadways is controlled or limited to maximize mobility by eliminating conflicts with driveways and at-grade intersections that would otherwise hinder travel speed. Access to these roadways is limited to a set of controlled locations at entrance and exit ramps."*.[8]

3.2 Study Area

The PAM Study Area encompasses several surrounding communities including Portland, South Portland, Scarborough, Westbrook, and Falmouth between Exits 44 and 53. The 8.1 miles of Maine Turnpike within the PAM Study Area sits in a 300' wide corridor with two lanes in each direction. Except for the roadway section between exits 46 and 47 that is characterized as rolling terrain, the roadway is relatively flat. The entire roadway has a posted speed limit of 60 miles per hour and contains 7 interchanges, 5 of which are concentrated in the southerly 4.2 miles of interstate.

[8] Federal Highway Administration's (FHWA) "Highway Functional Classification Concepts, Criteria and Procedures" (2017), 14.

Figure 3-1: Regional Map

3.3 Data Collection

In addition to reviewing resources such as census data, the PAM Study utilizes data collected from a variety of sources. Below is a list summarizing the primary data sources.

- MTA:
    - Hourly vehicular volumes from a combination of permanent radar and toll plaza stations. Hourly vehicular volumes from 2016 are utilized for this study. These volumes are used to determine traffic operation parameters such as design hour volumes, level of service and volume to capacity ratio; and
    - EZ-Pass/Cash toll data counted at all barrier and interchange toll plazas. EZ Pass/Cash data is used to determine interchange origin and destination patterns as well as EZ-Pass utilization.
    - Origin & Destination Survey – This survey was conducted in 2010 to study trips taken on the Maine Turnpike[9]. Survey cards were given out at different locations and respondents were asked to provide origin and destination information. The data is used in conjunction with EZ-Pass Toll data to determine trip types (i.e. commuter, recreational, shopping, etc.) trip destinations and length of travel (regional, local, and through trips) relating to the PAM Study Area.
- MaineDOT:
    - Traffic Data for off turnpike roadways published online through MaineDOT's public map viewer[10] are utilized for this study. This traffic data is used to determine the effect of traffic going to and from the Maine Turnpike.

This combination of data helped engineers determine the traffic operations of the existing roadway network as well as travel behavior and types of trips utilizing the Maine Turnpike.

3.4 Existing Traffic Characteristics

Part of understanding the study corridor includes looking for patterns of when users travel and how traffic conditions fluctuate over time. This section presents existing conditions related to traffic volumes and traffic composition. Included in this section are:

- Annual Average Daily Traffic (AADT) volumes;
- Traffic volume growth;
- Monthly, day of the week and hourly traffic volume variation;
- Peak hour volumes;
- Vehicle class & type;
- Tolling characteristics;

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[9] Maine Turnpike Authority, *2010 Origin - Destination Survey Summary Report* (HNTB Corp., June 2011)
[10] MaineDOT. June 2nd, 2018. https://www1.maine.gov/mdot/mapviewer/

- Interchange origin & destination patterns; and
- Travel Time

3.4.1 Maine Turnpike Average Annual Daily Traffic volumes

Figure 3-2 represents the two-way AADT from 1960 to 2016 for the entire Maine Turnpike. As you can see, the AADT on the Maine Turnpike has grown steadily since the 1960's with large increases in the 1980's, late 1990's to early 2000's and as recently as 2014. A few declines have also occurred: one in the early 1990's due to a mild recession, and one from 2008 to 2013, when the housing market crashed and gas prices reached record highs. However, since 2014 on, traffic has recovered and continued to grow on the Maine Turnpike at record highs. The current AADT for the Maine Turnpike is approximately 190,000 vehicles.

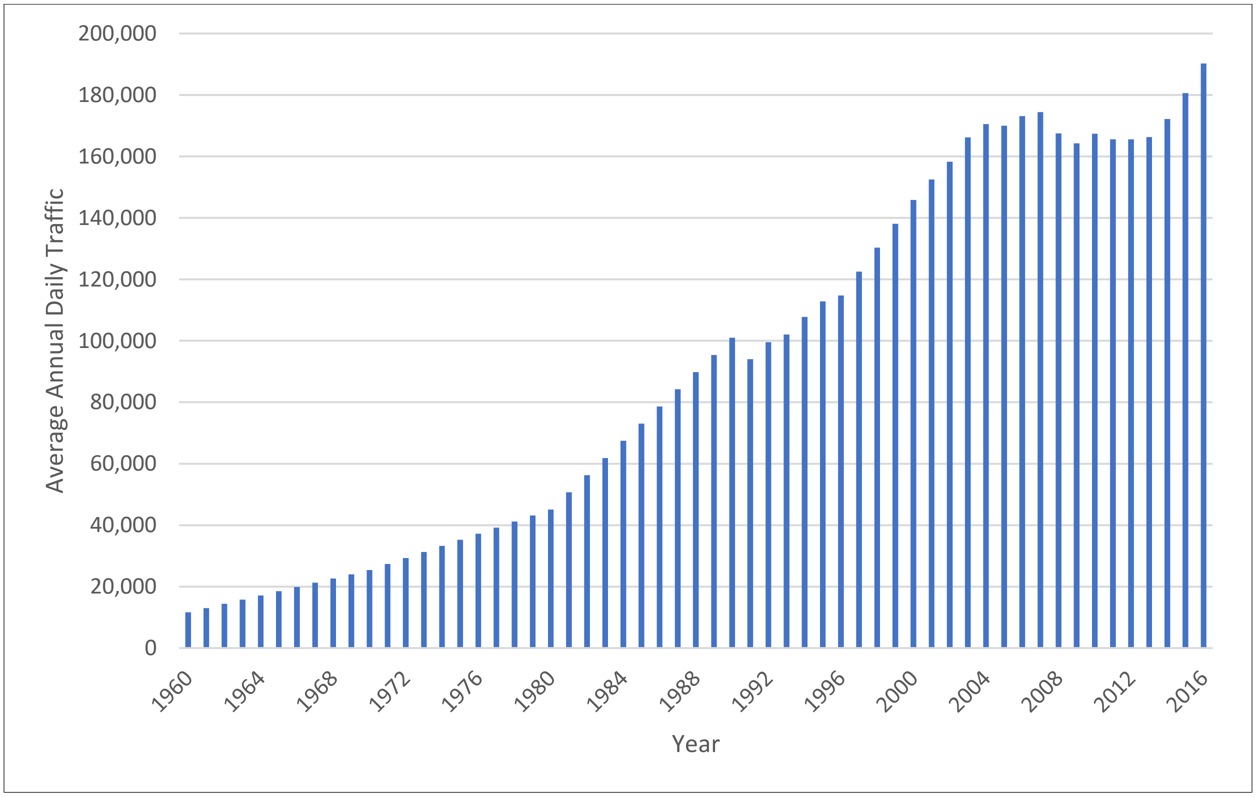

Figure 3-2: Historical AADT Along the Maine Turnpike

3.4.2 Traffic Volume Growth

Table 3-1 presents the two-way AADT from 2014 to 2016 for each mainline section of the Maine Turnpike in the PAM Study Area with the average annual growth. As seen from the table, the average growth rate ranges from 4% to 6% with the largest growth occurring between Exit 45 and 46 (6.2%). The least amount of growth occurred between Exit 44 to 45 (4.3%). Exit 46 to 47 had the highest AADT (52,046) on the Maine Turnpike within the PAM Study Area in 2016 with the third highest growth rate of 5.4%. Exit 52 to 53 had the lowest AADT of 34,025 on the Maine Turnpike within the PAM Study Area in 2016, with the third highest growth rate of 5.4%.

Table 3-1: 2014-2016 AADT and Average Growth Rate per Year

Segment	2014	2015	2016	Ave. Growth Rate/year
Exit 44 to 45	45340	47296	49271	4.3%
Exit 45 to 46	42198	44293	47442	6.2%
Exit 46 to 47	47006	49173	52046	5.4%
Exit 47 to 48	43681	45551	48119	5.1%
Exit 48 to 52	37124	38990	41302	5.6%
Exit 52 to 53	30711	32280	34025	5.4%

*Preliminary traffic data from 2017 show continued growth

3.4.3 Monthly Variation

Figure 3-3 represents the 2016 average monthly traffic variation from Exit 46 to 47, one of the busiest sections of the Maine Turnpike in the Portland area. Volumes are provided in the form of Average Daily Traffic (ADT). Hourly volumes fluctuate based on the season with the highest volumes occurring during the summer months and the lowest volumes occurring during the winter months. Volumes in the summer tend to be higher due to the combination of seasonal tourists and daily commuters. Volumes in the winter tend to be lower because of the lack of tourism and greater likelihood of winter weather events. Fall volumes tend to be the next highest due to back-to-school traffic coupled with fall-related tourism. As shown in Figure 3-3, the summer months include June, July, and August; the fall months include September, October, and November; the winter months include December, January, and February; and the spring months include March, April, and May. According to Figure 3-3, August has the highest traffic volume and January has the lowest traffic volume, which matches historical trends.

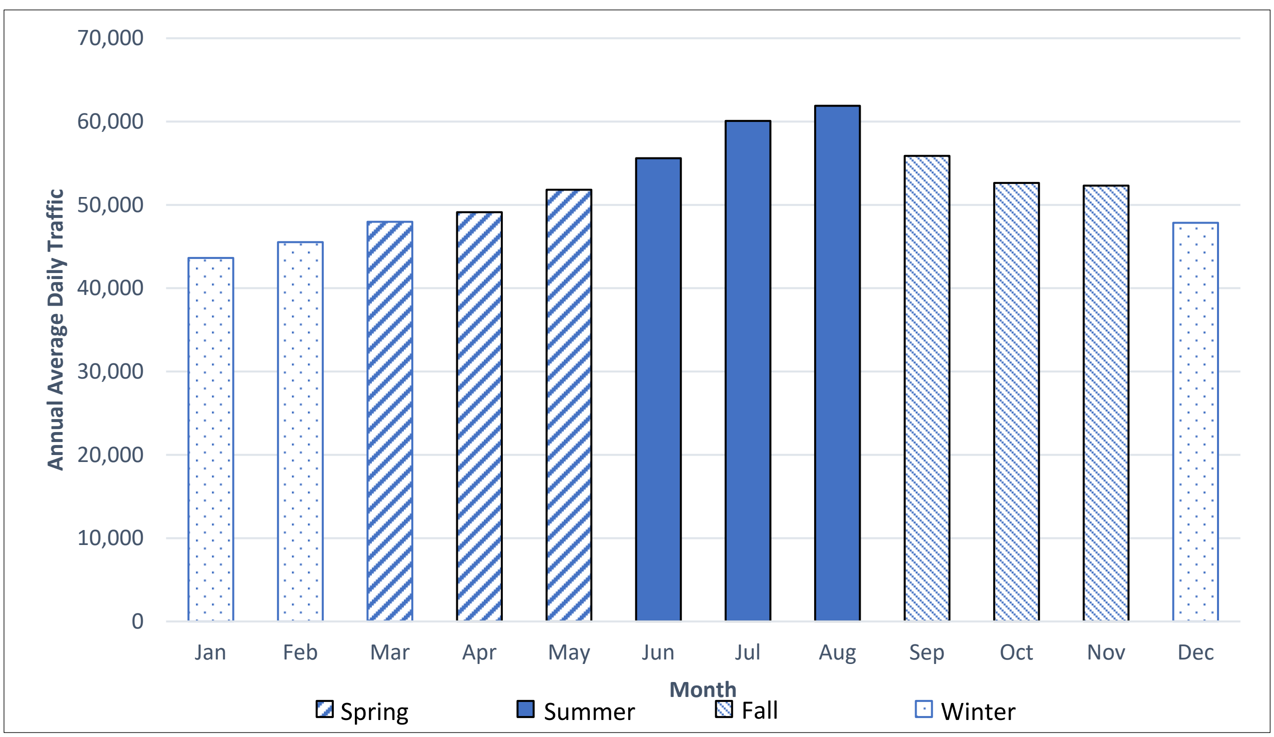

Figure 3-3: Exit 46-47 Monthly ADT

3.4.4 Day of the Week Variation

Figure 3-4 represents the two-way, day of the week ADT variation of a typical week in August (as August is the peak month of travel on the Maine Turnpike). Heading northbound traffic volumes gradually increase from Monday to Friday and then decrease on the weekend. Heading southbound, traffic gradually increases from Sunday to Friday, with a brief Tuesday dip. This data matches historical trends relating to commuter and season traffic on the Maine Turnpike. Commuter traffic dominates weekday northbound travel until reaching its peak on Friday when seasonal traffic heads to their vacation destination. Going southbound, seasonal traffic returns home on Sunday and Monday resulting in higher traffic volumes.

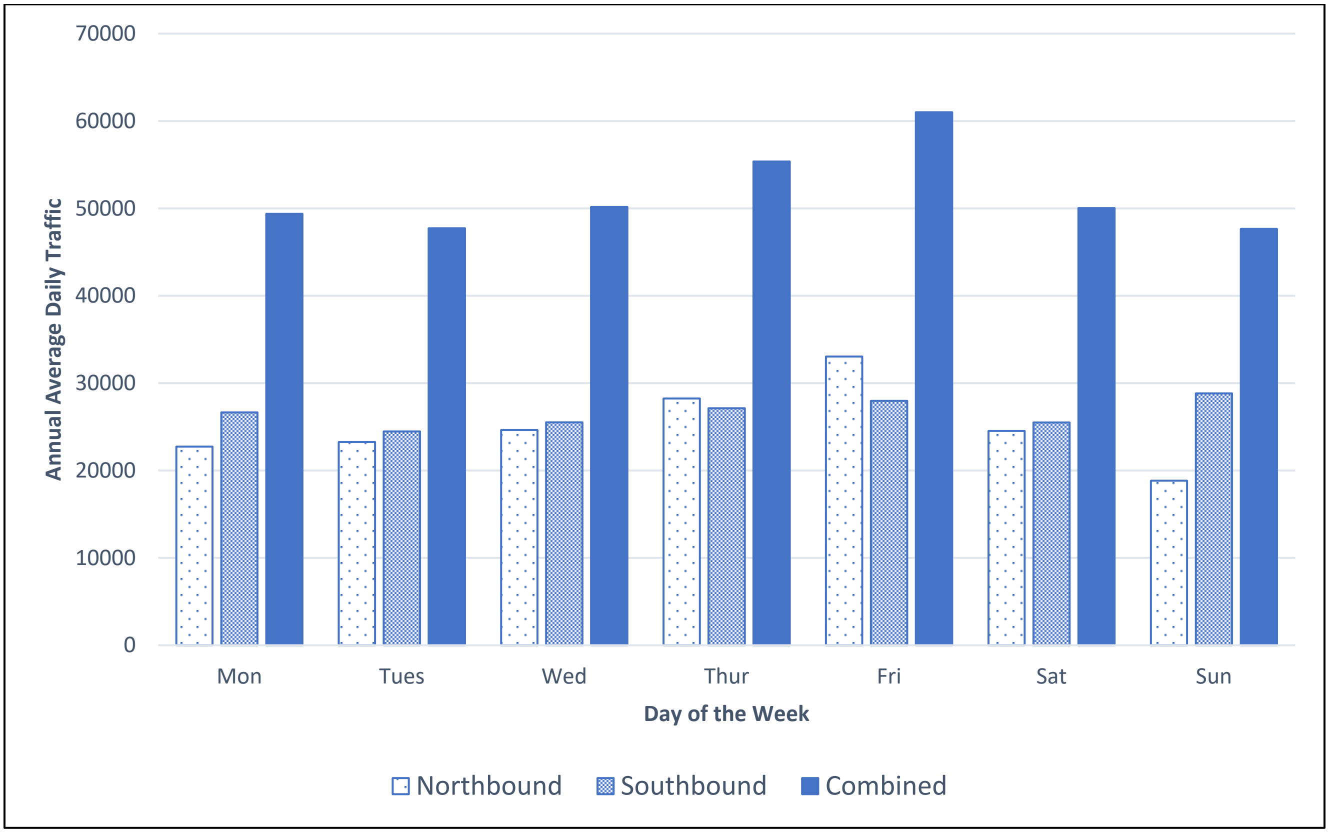

Figure 3-4: Day of the Week ADT, Typical Week in August

3.4.5 Hourly Traffic Volumes

Figure 3-5 represents the hourly traffic volume for a typical summer Friday on the Maine Turnpike between Exits 44 and 53. The data shown in Figure 3-5 indicates that the afternoon peak volume is significantly higher than the morning peak volume.

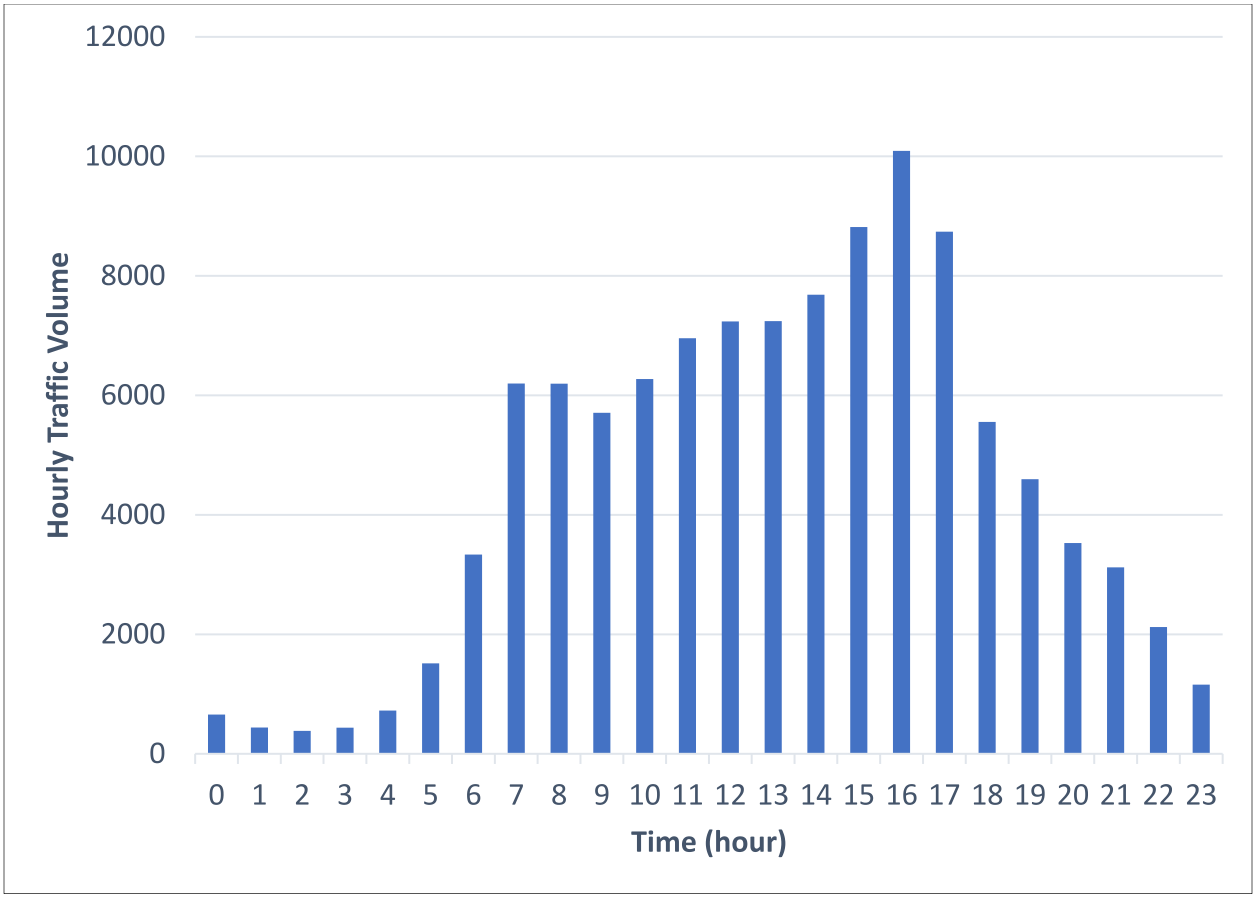

Figure 3-5: Hourly Traffic Volume, Typical Summer Weekday

3.4.6 Peak Hour Volumes

Peak hour volume, also referred to as Design Hour Volume (DHV), represents the 30th highest hour volume of a data set. The 30th highest hour is a widely accepted statistical parameter used by traffic engineers as the basis to design a roadway. Table 3-2 represents the 2016 peak hour volume and percentage of the total AADT for each section of the Maine Turnpike northbound and southbound. As you can see, the greatest northbound peak hour volume for the PAM Study Area occurs between Exit 46 and 47 and the greatest southbound peak hour volume for the PAM Study Area occurs between Exit 47 and 46. This represents a 13.7% and 11.9% share of the total AADT for 2016, respectively. The lowest northbound and southbound peak hour volume occurs between Exit 45 and 46. This represents a 9.2% and 7.1% share of the total AADT for 2016, respectively. The largest percent AADT during the peak hour occurs between Exit 48 and 52 northbound at 14.7% and Exit 52 to 53 southbound at 14.2%.

Table 3-2: 2016 Northbound & Southbound Peak Hour Volumes & Percent of AADT

	Northbound Peak		**Southbound Peak**	
Segment	**Peak Hour**	**% AADT**	**Peak Hour**	**% AADT**
Exit 44 to 45	2402	9.2%	1,651	7.1%
Exit 45 to 46	2776	11.9%	2,253	9.3%
Exit 46 to 47	3440	13.7%	3194	11.9%
Exit 47 to 48	3209	13.8%	2951	11.8%
Exit 48 to 52	2901	14.7%	2751	12.8%
Exit 52 to 53	2411	14.3%	2436	14.2%

3.4.7 Vehicle Class & Type

The Maine Turnpike Authority separates the vehicles traveling along the Maine Turnpike into eight classes:

Class 1 - Two-axle four-tire vehicles (cars, pickup trucks, vans and motorcycles)

Class 2 - Two-axle six-tire vehicles (buses, motor homes and dual-wheel pickups)

Class 3 - Three-axle vehicles and combinations (buses and class 2 vehicles towing one-axle trailers)

Class 4 - Four-axle vehicles and combinations (Class 2 vehicles towing 2-axle trailers)

Class 5 - Five-axle vehicles and combinations

Class 6 - Six or more axle vehicles and combinations

Class 7 - Class 1 vehicle towing one-axle trailer

Class 8 - Class 1 vehicle towing two-axle trailer

In more general terms, the MTA defines passenger vehicles as classes 1, 7 and 8; and defines commercial vehicles as classes 2 through 6. These classes are used to determine the Maine Turnpikes E-Z Pass and cash payment structure. Generally, the larger the vehicle the more money it costs to use the Maine Turnpike. Based on the MTA's Toll Plaza data, roughly 92% of the Turnpike is made up of passenger vehicles (classes 1, 7 & 8), and 8% is made up of Trucks (classes 2-6). The Study Area follows a similar pattern with 93% passenger vehicles mixed with 7% heavy vehicles.

3.4.8 Tolling Revenue

EZ-Pass is an electronic toll collection system that allows use of a transponder, which saves time and creates less congestion at the plazas. However, cash lanes are still relevant as not all travelers utilize EZ-pass, because;

- They are traveling from a state that does not use EZ-Pass;
- They do not use the Maine Turnpike often enough to warrant getting an EZ-Pass; or
- They have not yet switched to an EZ-Pass.

Figure 3-6 shows the breakdown of 2016 EZ-Pass vs. cash users by class for the entire Turnpike. EZ-Pass has a greater than 60% utilization for all classes with the highest being class 6 and the lowest being class 8. Overall, commercial vehicles have the highest utilization rate (89%) followed by passenger vehicles (72%).

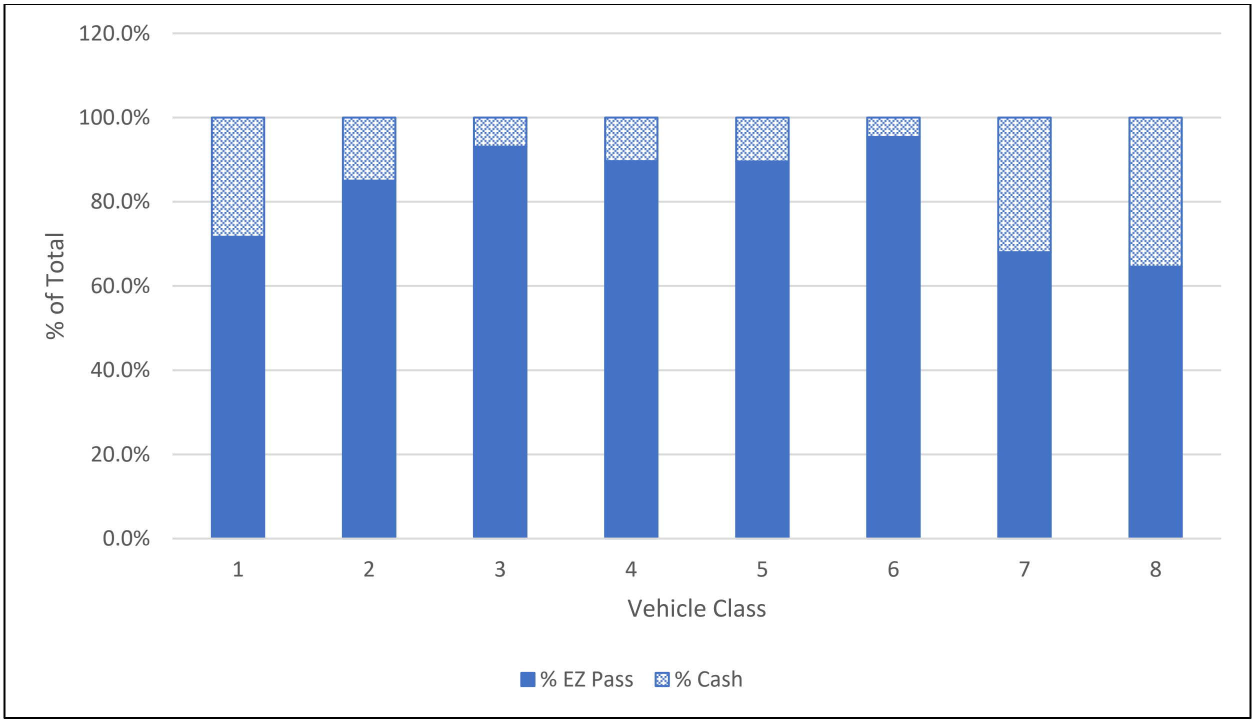

Figure 3-6: 2016 EZ-Pass Users vs. Cash Users

Figure 3-7 compares the 2016 EZ-Pass utilization of the entire Maine Turnpike to EZ-Pass utilization of vehicles exiting/entering within the PAM Study Area. Based on the data, EZ-Pass usage is higher for all vehicle classes among vehicles entering or exiting within the PAM Study Area. Passenger vehicles (classes 1, 7 & 8) appear to have greater utilization then trucks (classes 2-6) within the PAM Study Area.

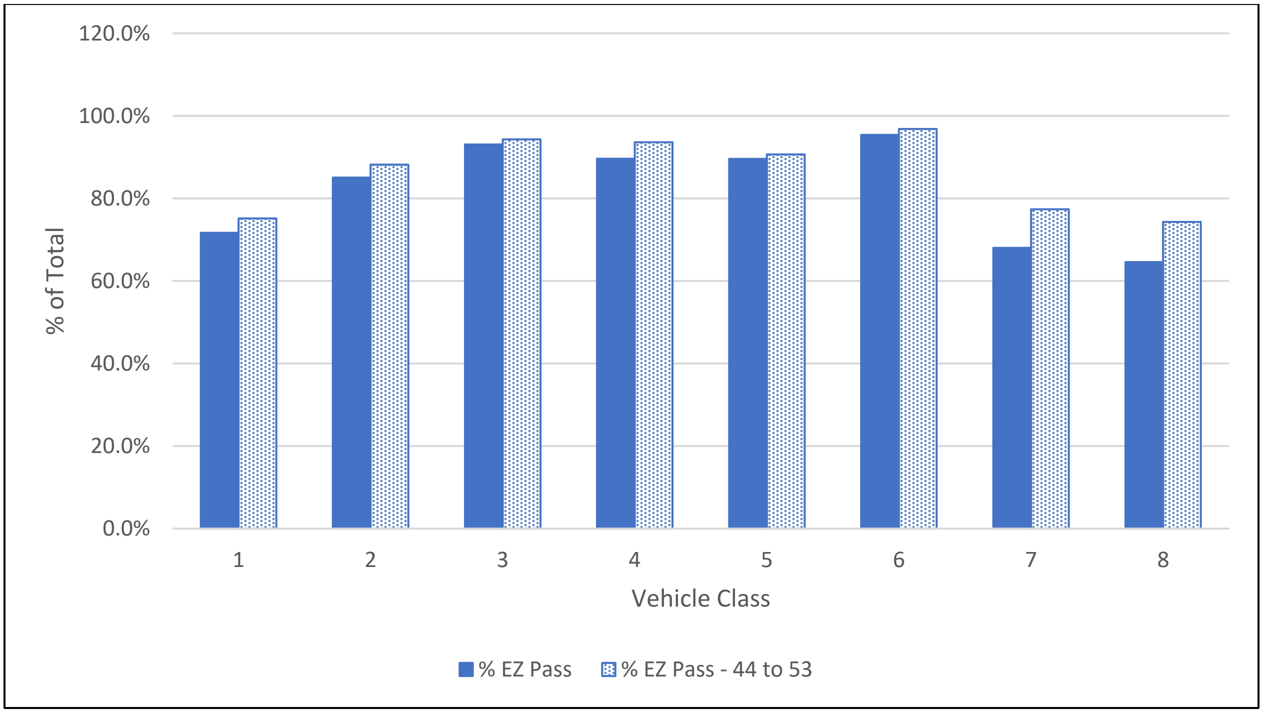

Figure 3-7: 2016 Maine Turnpike EZ-Pass Utilization vs. Study Area EZ-Pass Utilization

3.4.9 Interchange Origin & Destination Patterns

The interchange origin-destination patterns for 2016 for all the traffic on the Maine Turnpike, total vehicular volume, is presented in Table 3-3. The table represents the percent of the total traffic entering and exiting at a specific interchange. For example, 1% of the total traffic entering the Maine Turnpike at Exit 48 exits at Exit 45. Key observations include:

- 23% of the total traffic that is passing through or exiting within the Study Area is traveling north from the southern end of the Maine Turnpike (New Hampshire through Exit 42);
- 9% of the total traffic that is passing through or exiting within the Study Area is traveling south from the northern end of the Maine Turnpike (Exit 103 through Exit 53);
- 69% of the Total Traffic on the Maine Turnpike is either entering, exiting or passing through Exits 42 to 53; and
- 20% of the total traffic entering the Maine Turnpike within the PAM Study Area are traveling south and 6% are traveling north.

Table 3-3: Interchange Origin & Destination Patterns by Percentage

Exit #	Entering Exit	Departing Exit																	
		7	19	25	32	36	42	44	45	46	47	48	52	53	63	75	80	86	103
7	York		2.3%	1.0%	1.0%	1.4%	0.8%	3.1%	1.5%	0.4%	0.4%	0.7%	0.5%	0.3%	0.6%	0.5%	0.3%	0.1%	0.3%
19	Wells	2.2%		0.2%	0.4%	0.4%	0.2%	0.4%	0.4%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%
25	Kennebunk	1.0%	0.2%		0.3%	0.3%	0.2%	0.3%	0.4%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	Biddeford	0.9%	0.4%	0.3%		1.4%	0.6%	1.2%	1.3%	0.4%	0.3%	0.4%	0.2%	0.2%	0.2%	0.1%	0.1%	0.0%	0.1%
36	Saco	1.4%	0.4%	0.4%	1.3%		0.5%	1.5%	1.5%	0.6%	0.4%	0.5%	0.2%	0.2%	0.2%	0.2%	0.1%	0.0%	0.0%
42	Scarborough	0.7%	0.2%	0.2%	0.6%	0.5%		0.4%	0.2%	0.2%	0.2%	0.3%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%	0.0%
44	Scar/I-295	3.8%	0.6%	0.6%	1.6%	2.1%	0.5%												
45	S. Portland	0.9%	0.2%	0.2%	0.8%	0.9%	0.1%			0.3%	0.6%	1.0%	0.2%	0.5%	0.7%	0.4%	0.2%	0.1%	0.1%
46	Jetport	0.4%	0.1%	0.1%	0.4%	0.5%	0.1%		0.3%		0.3%	0.7%	0.5%	0.6%	0.5%	0.3%	0.2%	0.0%	0.1%
47	Rand Rd	0.3%	0.1%	0.1%	0.2%	0.3%	0.2%		0.5%	0.3%		0.1%	0.5%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%
48	Riverside	0.7%	0.1%	0.1%	0.4%	0.5%	0.3%		1.0%	0.8%	0.1%		0.6%	0.3%	0.4%	0.3%	0.1%	0.0%	0.1%
52	Falmouth	0.8%	0.1%	0.1%	0.2%	0.2%	0.1%		0.2%	0.6%	0.3%	0.8%		0.3%	0.3%	0.2%	0.1%	0.0%	0.0%
53	W. Falmouth	0.2%	0.0%	0.0%	0.1%	0.2%	0.1%		0.5%	0.6%	0.1%	0.3%	0.2%		0.4%	0.3%	0.2%	0.0%	0.1%
63	Gray	0.6%	0.1%	0.1%	0.2%	0.2%	0.1%		0.6%	0.6%	0.1%	0.5%	0.3%	0.4%		0.4%	0.2%	0.1%	0.3%
75	Auburn	0.5%	0.1%	0.0%	0.1%	0.1%	0.1%		0.3%	0.3%	0.1%	0.3%	0.1%	0.3%	0.3%		0.8%	0.2%	0.8%
80	Lewiston	0.3%	0.0%	0.0%	0.1%	0.1%	0.0%		0.2%	0.2%	0.1%	0.2%	0.1%	0.2%	0.3%	0.8%		0.2%	0.7%
86	Sabattus	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%		0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.2%	0.2%		0.4%
103	Gard/I-295	0.4%	0.0%	0.0%	0.1%	0.0%	0.0%		0.1%	0.1%	0.0%	0.1%	0.0%	0.1%	0.3%	0.8%	0.7%	0.4%	

3.4.10 Local, Regional & Thru Traffic

The local, regional, and through traffic is derived from a combination of 2016 MTA interchange origin and destination toll data and 2010 origin and destination survey data collected by the Study Team for the MTA. Table 3-4 is a breakdown of these trips and the definitions of each:

Table 3-4: Local, Regional and Through Traffic Origin and Destination

Local	Regional (to/from South)	Regional (to/from North)	Through
17.8%	44.7%	13.9%	23.6%

Figure 3-8 shows a map depicting local regional and through trips.

Local trips, depicted by the blue arrows in Figure 3-8, are defined as trips that enter and exit between Exits 42 and 53, except for those trips that use Exit 52 (the Falmouth spur) or Exit 44 (I-295). Trips that use Exit 52 were only counted as a local trip if the origin or destination was Falmouth, entering or exiting between Exits 42 and 53. Trips that use Exit 44 were only counted as a local trip if the origin or destination was the Portland area, entering or exiting between Exits 42 and 53.

Regional trips, depicted by the orange arrows in Figure 3-8, are defined as trips that enter or exit the Maine Turnpike south of Exit 42 or north of Exit 53, with the corresponding exit or enter anywhere between those two exits (42 and 53). Trips that use Exit 52 (the Falmouth spur) are only counted as a regional trip if they used I-295 with an enter and exit between 42 and 53; or trips that use Exit 52, connecting to/from north of Exit 53 or south of Exit 44.

Through trips, depicted by the yellow arrows in Figure 3-8, are defined as trips that enter or exit the Maine Turnpike south of Exit 42, with the corresponding exit or enter north of Exit 53. Additionally, trips that enter or exit at Exit 52 (Falmouth Spur) connecting to I-295, with the corresponding exit or enter south of Exit 42 or north of Exit 53, are also counted as a through-trip. Trips accessing Exit 44 traveling on I-295 to north of the Falmouth Spur or southbound connecting south of Exit 42 were also considered through-trips.

Based on the data, most trips are regional trips traveling to and from the southern end of the Maine Turnpike (south of Exit 44) at roughly 45%. Only 14% of the trips are regional trips traveling to and from the northern end of the Maine Turnpike (north of Exit 53). There is also a significant number of local trips that, for example, enter the Maine Turnpike at Exit 48 heading southbound and exit at Exit 46 (18%). This indicates that some travelers are using the Maine Turnpike instead of local roads to reach their destination if the trip is short enough. This may be due to increased congestion on local streets, which creates longer travel times and more delays than using the Maine Turnpike. Nearly 24% of trips are through trips, which can either be vehicles traveling straight through on the Maine Turnpike or those diverting to I-295 via Exit 44 or Exit 52. It is widely believed by the public that I-295 is a quicker route to get to places like Freeport, Brunswick, or the coast heading north or places like Ogunquit, York and New Hampshire heading south by taking Exit 44 instead of the Falmouth Spur. This perception partially contributes to the traffic congestion on I-295, as vehicles will take Exit 44 instead of Exit 52 to the Falmouth spur to travel to their destinations. Section 2.4.11. will further explore the time differential between the two routes.

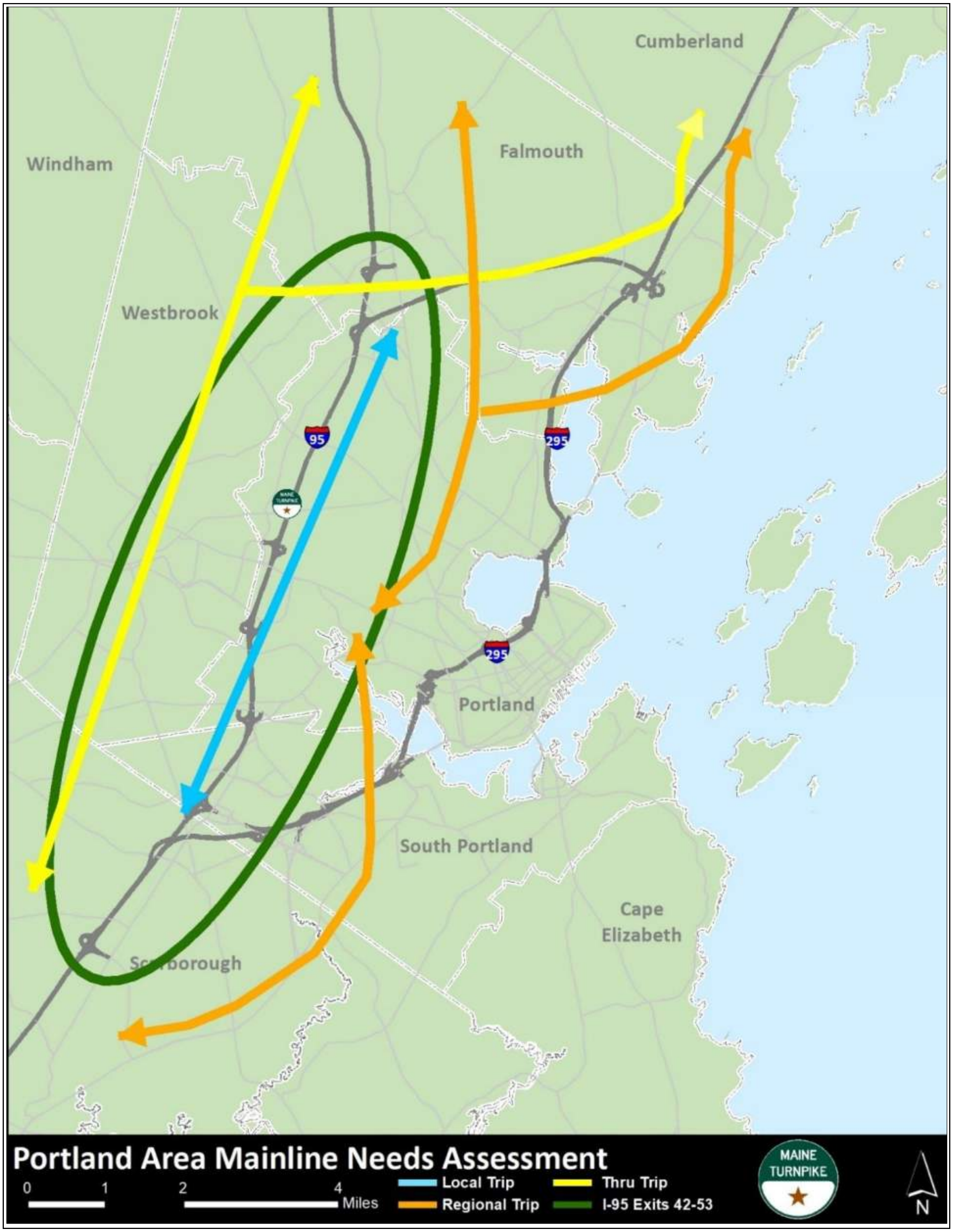

Figure 3-8: Local, Regional and Through Trips

3.4.11 Travel Time – Maine Turnpike vs. I-295

Theoretical travel time calculations were performed by the Study Team. These calculations compared the travel time on the Maine Turnpike to Interstate I-295 starting and ending at the same location using the set speed limit and roadway length. Figure 3-9 illustrates the paths and speed limits of each of the two routes. Based on this analysis, these sections of the Maine Turnpike/I-95 and I-295 are almost the same length and take the same amount of time to travel. The perception that Interstate I-295 is quicker than the Maine Turnpike/I-95 is incorrect. If congestion is considered, the Maine Turnpike route will often be the faster route.

3.5 Existing Traffic Operations

Understanding the relationship between supply and demand is a fundamental consideration in evaluating how well a transportation facility or source fulfills its objective to service the traveling public. For a highway facility, this is accomplished by conducting a level-of-service (LOS) analysis using the traffic engineering procedures outlined in the Highway Capacity Manual (HCM)[11]. The LOS analysis compares "peak" traffic demands with the available highway capacity. The peak demand utilized for this analysis is based on hourly flows. For multi-lane, divided highways such as the Maine Turnpike, these flows are broken down and analyzed by direction. The following sections discuss the two industry standard performance measures used in the analysis, the analysis assumptions and describe existing traffic operations evaluated using the 2010 Highway Capacity Software (HCS).

3.5.1 Level of Service

Level of Service describes the operating conditions of the highway using a scale of A-F, with LOS A being a free-flow open condition and LOS F being a heavily congested condition with frequent slowing or stops, representing where vehicular demand exceeds available capacity.

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[11] Transportation Research Board, *Highway Capacity Manual* (Transportation Research Board, 2010)

Figure 3-9: Travel Time Map Using Posted Speeds at Free Flow Conditions

Table 3-5 pictorially describes the level of service. Although specifics are dictated by presiding agencies, roadways are "typically" designed to operate at an LOS C or better under 20-year projections. Failing conditions are generally described as LOS E or LOS F, where the roadway has met or exceeded its capacity.

Table 3-5: Level of Service Measure Description (Photo source: HCM[12])

Level of Service	Example	Description
A		- Free Flow Operation
B		- Reasonably Free Flow - Ability to maneuver is only slightly restricted - Effects of minor incidents still easily absorbed
C		- Speeds at or near Free Flow Speed - Freedom to maneuver is noticeably restricted - Queues may form behind any significant blockage
D		- Speeds decline slightly with increasing flows - Density increases more quickly - Freedom to maneuver is more noticeably limited - Minor incidents create queuing
E		- Operation near or at capacity - No useable gaps in the traffic stream - Operations extremely volatile - Any disruptions cause queuing

[12] Transportation Research Board, *Highway Capacity Manual* (Transportation Research Board, 2010)

F		- Breakdown in flow - Queues form behind breakdown points - Demand is greater than capacity

3.5.2 Volume to Capacity Ratio

The Volume to Capacity (v/c) ratio was calculated manually by dividing segment volumes by the capacity of the roadway. This represents how much of the roadway's capacity is occupied during the peak period. For instance, a v/c ratio of 0.8 indicates that approximate 80% of the roadway's capacity is in use and is likely constrained, a v/c ratio of 1.0 indicates vehicles are using the maximum capacity of the roadway, and a v/c ratio greater than 1.0 indicates the vehicular demand exceeds available capacity.

Based on previous studies, the capacity of the Maine Turnpike was determined to be 1800 vehicles per hour per lane. Capacity continues linearly, meaning a two-lane mainline section would have a capacity of 3600 vehicles per hour (vph) and a three-lane mainline section would have a capacity of 5400 vph.

Conditions where capacity is constrained or has been exceeded also have safety implications. Safety conditions will be addressed in Chapter 3.

3.5.3 Analysis Assumptions

For the purposes of this study, analysis was performed using Highway Capacity Software (HCS) 2010. The HCS utilizes the current methodologies presented in the HCM and is used to analyze a section of roadway in isolation to determine its capacity and level of service for design purposes. The following assumptions were made in this analysis:

- Peak Hour Factor (PHF) – a factor that allows designers to take into account the highest 15 minute peak of a study hour: 0.95 (historic)
- Commercial Vehicle: 7%
- Recreation Vehicle Percentage: 2%
- Terrain: Level (with the exception of the Exit 47-48 corridor)
- Driver Population Factor: 0.86 (historic)

3.5.4 2016 Existing Conditions Analysis Results

Volumes are generally lower in the Southbound AM peak then the Northbound PM peak. Based on the 2016 Existing Conditions HCS analysis (as shown in Table 3-6), Exits 45 to 52 currently approach or have failing LOS. The mainline section between Exit 46 and 47 has the highest volume of 3440 which translates into a 0.96 volume to capacity ratio (v/c) and an LOS E. While the mainline section between Exits 42 and 44 has a higher volume of 3634 vph, the volume to capacity ratio is only 0.67 with a LOS C, because Exit 42-44 is already three-lanes in each direction and therefore has a 5400-vehicle capacity compared to

3600-vehicle capacity for a two-lane section. The data tells us that two mainline sections northbound are already approaching a breakdown in traffic flow.

Table 3-6: 2016 Traffic Analysis Results

Location	**Capacity**	**Northbound PM Design Hour Volume**			**Southbound AM Design Hour Volume**		
		Volume	**v/c**	**LOS**	**Volume**	**v/c**	**LOS**
42 to 44	**5400**	3634	0.67	C	2,466	0.46	B
44 to 45	**3600**	2402	0.67	C	1,651	0.46	B
45 to 46	**3600**	2776	0.77	D	2,253	0.63	C
46 to 47	**3600**	3440	0.96	E	3194	0.89	E
47 to 48	**3600**	3209	0.89	E	2951	0.82	D
48 to 52	**3600**	2901	0.81	D	2751	0.76	D
52 to 53	**3600**	2411	0.67	C	2436	0.68	C

4. Existing Safety Conditions

This chapter will provide information on the existing safety conditions along the Maine Turnpike including: high crash locations, total crashes, crash rates, seasonal crashes and injury severity for the PAM Study Area.

4.1 High Crash Locations

A High Crash Location (HCL) is defined by MaineDOT as a roadway segment or intersection that has both a critical rate factor (CRF) greater than one and eight or more crashes over a three-year period. The CRF compares the actual crash rate to similar locations (using Hundred Million Vehicle Miles (HMVM) in the state – if the CRF is greater than one, the intersection is worse than comparable locations.

According to ITE Maine[13], from 2014-2016 there were only three mainline HCL's along the entire Maine Turnpike, the locations are listed in Table 4-1. Based on the most recent data available, all the HCL's occurred north of the PAM Study Area. The New Gloucester HCL exists southbound at the Barrier toll plaza, the Auburn HCL exists upstream of the SB off ramp at Exit 75, and the Litchfield HCL exists northbound on a roadway section with a curve several miles from the closest interchange or toll plaza.

Table 4-1: Maine Turnpike Mainline High Crash Locations

Location	Crashes	CRF
New Gloucester	12	1.12
Auburn	16	1.23
Litchfield	20	1.03

There are, however, two HCL's that occurred within the PAM Study Area outside of the Maine Turnpike. The Exit 53 Toll plaza had nine crashes between 2014 and 2016 with a CRF of 2.46, and the Exit 48 Toll Plaza had nine crashes between 2014 and 2016 with a CRF of 2.66. The adjacent intersection to the Exit 48 Toll Plaza and Riverside Street north of the intersection are an HCL. The intersection had 77 crashes with a CRF of 2.01 and Riverside street had 24 crashes with a CRF of 1.64. Every effort should be made to improve safety at these HCL's.

4.2 Total Crashes

Figure 4-1 presents the total crashes compared to the AADT from 2007 to 2016 within the PAM Study Area. One of the reasons for this comparison is to equate periods such as that from 2008 to 2012, where a decrease in traffic volume from the housing market crash and increase in gas prices was most likely the cause for reduction in crashes. According to the data, while crashes have increased in the last 5 years,

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[13] Maine ITE. Accessed July 02, 2018. http://www.itemaine.org/trafficdata/highcrashlocations/

they have not reached post 2008 levels when crashes were at their highest. However, if this upward trend continues, crashes in 2017 or 2018 could exceed the previous high.

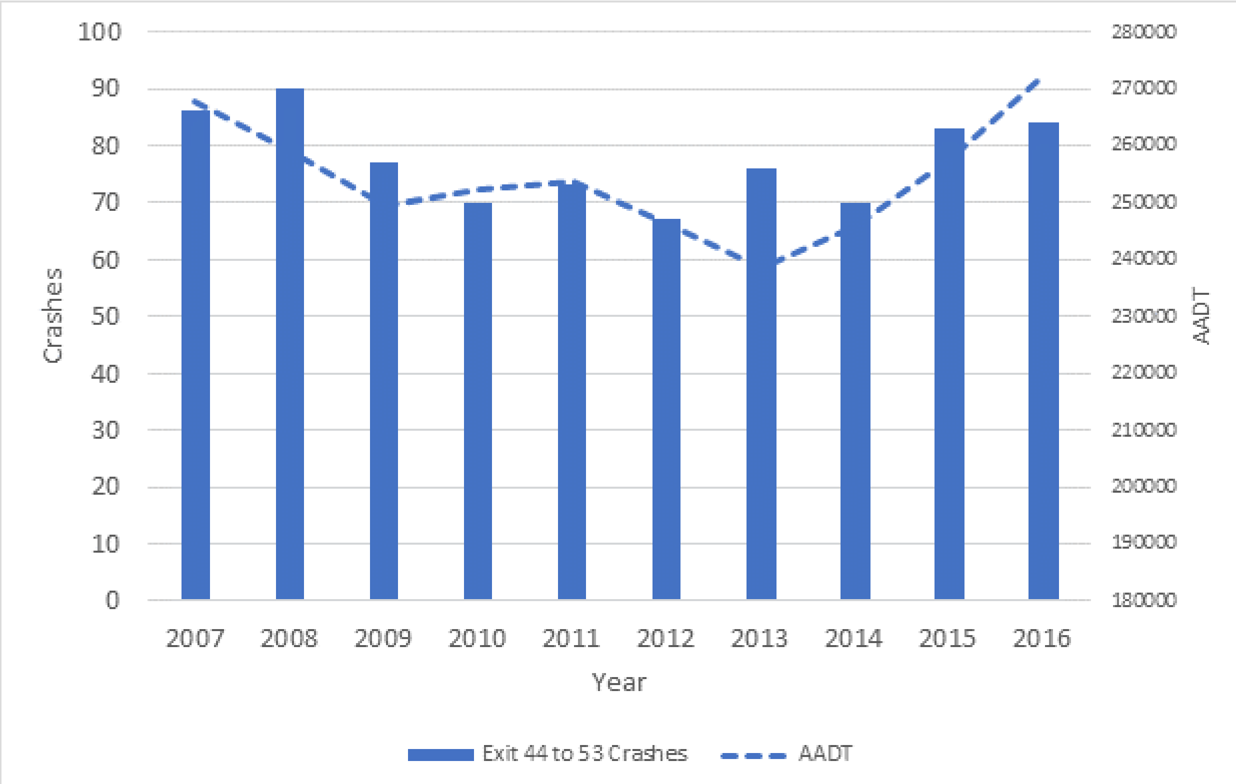

Figure 4-1: PAM Study Area 10-Year Crash History Compared to AADT

4.3 Seasonal Crashes

Figure 4-2 presents the Exit 44 to 53 crashes by season.

Crash totals fluctuate throughout the year based on the season. Winter generally experiences the most crashes, likely due to road conditions and winter weather events, summer and fall are next, followed by Spring which experiences the least amount of crashes. Historically, summer experiences more crashes than fall, likely due to higher traffic volumes; however, since 2012, crashes in the fall have steadily increased at a rate greater than the increase in summer crashes. Each of the four seasons independently sees a decrease in crashes from 2007 to 2012 and then an increase in crashes from 2012 to 2016.

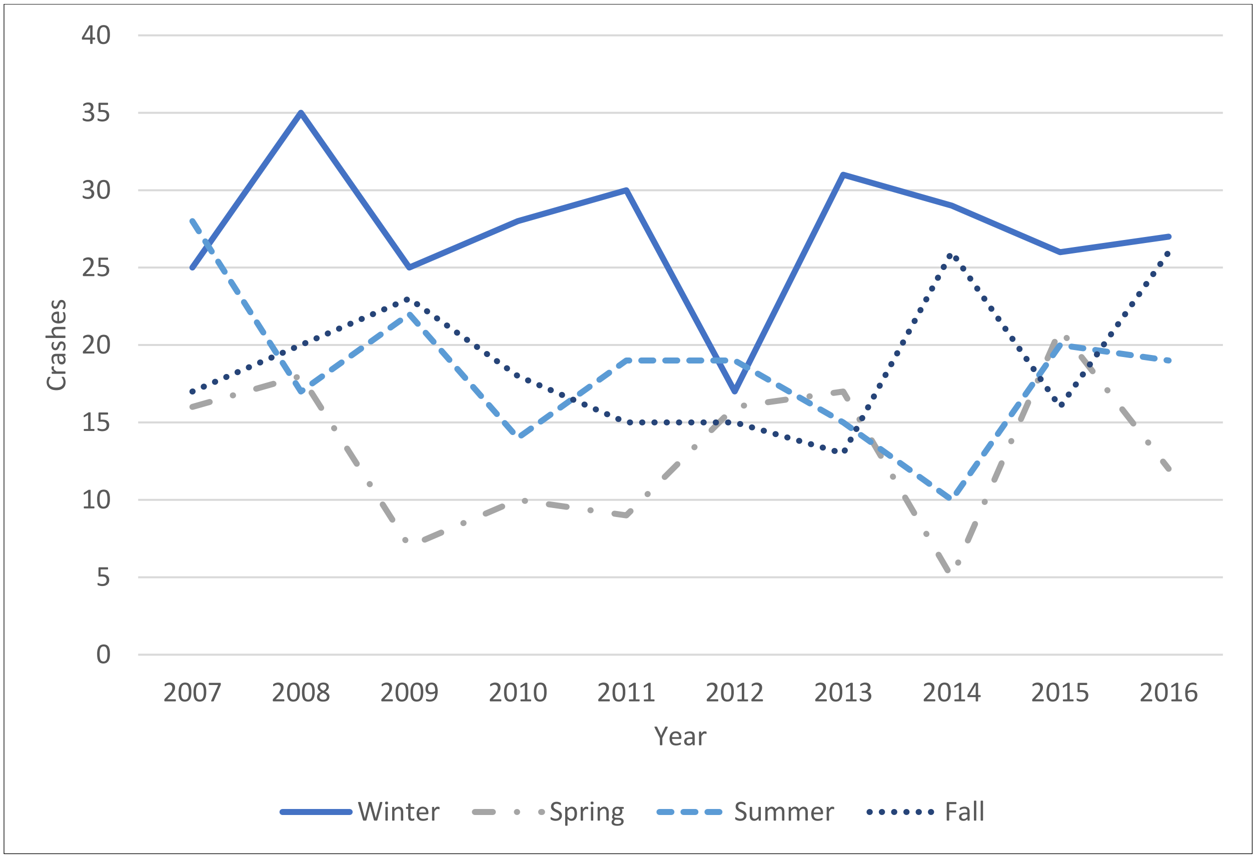

Figure 4-2: Seasonal Crashes with Trend Lines

4.4 Crash Rate

Crash Rate is a metric that measures the relative safety of a roadway by balancing crash frequency, traffic volume and length and is typically expressed in hundred million vehicle miles (HMVM). Like HCL, crash rate is used to determine the safety of a roadway relative to other roadways of the same class, i.e. crash rate is used to compare the safety of the Maine Turnpike to Interstate I-295 as they are both freeways. Crash rate however would not be used to compare the safety of the Maine Turnpike to a local street as they are not the same class of roadway.

Table 4-2 represents the crash rate for the Maine Turnpike divided into three sections, and Interstate I-295 divided into two sections from 2014 to 2016. The Maine Turnpike is divided into south of Exit 44 (3-lanes) to New Hampshire, between Exit 44 and 53 (PAM Study Area), and north of Exit 53 to Exit 103. I-295 is divided into south of the Falmouth Spur through Portland to Exit 44 connecting to the Maine Turnpike in South Portland and North of the Falmouth Spur to Exit 103 connecting to the Maine Turnpike near Augusta.

In comparison to other sections of highway, the Maine Turnpike south of 44 has the lowest crash rate of 39.75 HMVM average between 2014 and 2016. I-295 south of the Falmouth spur through the Portland area has the highest crash rate of 98 HMVM average between 2014 and 2016. Both the PAM Study Area and Interstate I-295 north of the Falmouth spur have roughly the same crash rate of 60.64 HMVM and 60.02 HMVM average between 2014 and 2016 respectively. I-295 north and south of the Falmouth spur is seeing a steady increase in crash rate from 2014 to 2016 whereas the Maine Turnpike south of Exit 44 and the PAM Study Area saw an increase in crash rate from 2014 to 2015 but a decrease from 2015 to 2016. The Maine Turnpike north of Exit 53 saw the largest fluctuations in crash rate between 2014 and 2016, changing as much as 25 HMVM from one year to the next.

Table 4-2: 3-Year Crash Rate

Location	2014	2015	2016	Average
I-95 Exit 0 – 44	39.57	41.00	38.68	39.75
I-95 Exit 44 - 53 (PAM Study Area)	56.44	63.93	61.55	60.64
I-95 Exit 53 – 109	70.35	59.07	84.49	71.30
I-295 South of Spur (Portland Area)	92.43	95.91	105.65	98.00
I-295 North of Spur	55.74	58.83	65.50	60.02

4.5 Crash Severity

Crash severity is influenced by the type of roadway facility. Generally, higher crash severity is prevalent on higher speed roadways such as freeways and interstates. Looking at historical crash data we can see how crash severity has changed over time on the Maine Turnpike within the PAM Study Area. Table 4-3 summarizes the crash severity from 2007 to 2016 as a percentage of the total number of crashes. According to the most recent data available, the largest portion of crashes results in property damage with no reported injury ranging from 70% to 80%. The next largest portion is possible injury and non-incapacitating crashes that fluctuate from 10-15% from 2011 on. Prior to 2011, possible injury crashes were as high as 20% and non-incapacitating dipped below 10%. Incapacitating crashes range from 0% to 5% and fatal crashes are, for the most part, a non-factor. There were only four fatalities within the last 10 years on the Maine-Maine Turnpike within the PAM Study Area: two in 2013, one in 2009 and one in 2008. 2013 was somewhat of an anomaly as AADT was at an all-time low, but crashes jumped 15% from the previous year. From 2014 to 2016, there were no fatalities, roughly 3% Incapacitating crashes, roughly 11% non-incapacitating crashes, roughly 12% possible Injury crashes, and roughly 76% property damage crashes. While crashes increased from 2014 to 2016, crash severity has maintained typical levels for the PAM Study Area and doesn't indicate any increased safety risk.

Table 4-3: PAM Study Area 10-year Crash Severity as a Percentage of Total Crashes

Crash Severity %	Year									
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Fatality	1%	0%	1%	0%	0%	0%	3%	0%	0%	0%
Incapacitating	0%	3%	1%	0%	1%	0%	4%	0%	6%	1%
Non-Incapacitating	2%	4%	10%	6%	14%	10%	11%	14%	12%	8%
Possible Injury	17%	20%	19%	10%	8%	12%	8%	10%	12%	14%
Property Damage	79%	71%	68%	84%	77%	78%	75%	76%	70%	76%
Misc.	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%
Total Crashes	**86**	**90**	**77**	**70**	**73**	**67**	**76**	**70**	**83**	**84**

5. Future Traffic Conditions

5.1 Overview

This chapter covers the methodology and analysis of estimated future traffic conditions for the Maine Turnpike in the Study Area. The future traffic conditions represent No Action traffic conditions, which assumes that no capacity improvements would be made, and no travel demand or transportation system strategies would be implemented, with all existing conditions remaining in their current state. The future No Action traffic conditions provides the baseline to which the alternatives are compared (see Chapter 5).

5.2 Forecast Year

The first step to estimate future traffic conditions involves determining a year in the future as the target for which to plan, called a forecast year. Projecting traffic conditions to a future year prevents the transportation facility from operating at or over capacity shortly after construction is completed. For roadway design projects in Maine, the typical forecast year is 20 years[14] in the future.

The tool used for analyzing different measures of effectiveness for the alternatives of this study is the most recent Travel Demand Model developed by the Portland Area Comprehensive Transportation System (PACTS), for which the forecast year is 2040. Therefore, 2040 is the long-term forecast year used for this study.

Traffic conditions for a near-term forecast year, 2025, are also included. The purpose of the near-term forecast year is to help determine a mid-term need and whether construction can be delayed.

5.3 Growth Rate

The next step to determine future traffic conditions was to establish an expected growth rate. To develop a peak hour traffic growth rate, several sources of data, including historic data and forecasts, were considered including the following:

- Historic daily traffic growth on the Maine Turnpike between Exits 44-53
- Maine Turnpike Authority (MTA) Safety and Capacity Study[15]
- 2017 Toll Revenue Study[16]
- Dr. Charles Colgan Turnpike Transaction Forecast[17]

[14] MaineDOT, *Highway Design Guide* (MaineDOT, February 2015)
[15] Maine Turnpike Authority, *Maine Turnpike Needs Assessment, Safety and Capacity Study* (HNTB Corp., May 2016)
[16] Maine Turnpike Authority, *Maine Turnpike 2017 Toll Revenue Study* (CDM Smith, December 2014)
[17] Charles S. Colgan PhD., 16 February 2015, memorandum, *Turnpike Transaction Forecast*

- Total Gross Domestic Product for Maine[18]

Daily traffic is also known as Average Annual Daily Traffic (AADT). AADT is a basic measure of the traffic demand for a roadway. The AADT data indicates approximately how many vehicles are moving through a section of the mainline on an 'average' day of the year. AADT is calculated by taking the total volume of traffic on a highway segment for one year and dividing it by the number of days in the year. The average growth in AADT from 1996-2016 was 2.3% annually.

The Maine Turnpike Safety and Capacity Study is a traffic operation and safety study of the Maine Turnpike. The study included an assessment of both current and future operating conditions of interchanges, mainline sections, and ramps on the Maine Turnpike. The study also included a system-wide assessment of safety for all mainline sections, ramps, toll plazas, and intersections of local roads with Maine Turnpike ramps. The study was intended to present a look at safety and capacity needs on the Maine Turnpike over the next 20 years and to provide information for capital improvements. As part of the study, future year peak hour traffic was estimated. It was determined that 1.5% growth could be expected in this region of the Maine Turnpike.

Annual traffic volume estimates for the Maine Turnpike were developed as part of the MTA's 2017 Toll Revenue Study. Daily traffic volumes were estimated for a 20-year period, 2017-2037 by CDM Smith. The study is a comprehensive traffic and toll revenue report. It analyzes historical Maine Turnpike traffic and revenue data as well as socioeconomic factors to estimate future daily traffic. This study estimated that daily traffic growth on the Maine Turnpike in the Portland area would be 1.4% in the next 20 years.

Dr. Charles Colgan prepared estimates of daily traffic for the years 2017-2022 as part of the MTA's Revenue Certificate. The MTA regularly estimates annual traffic growth as part of the Revenue Certificate. The purpose of this Toll Revenue Certificate is to provide the annual toll revenue estimates required by the General Turnpike Revenue Bond Resolution of the MTA, Section 802(b). As part of the Toll Revenue Certificate, the average daily traffic growth was estimated at 1.6% for the next five years.

In 1996, the MTA studied the widening of the Maine Turnpike south of Exit 44. In the report produced for that project, Maine Turnpike Alternatives Study[19], it was found that historical Maine Turnpike traffic correlated well with Maine State Gross Domestic Product. That report found that Maine Turnpike traffic can be expected to grow at a rate of more than twice the expected growth in State Gross Domestic Product. Therefore, the recent historical trends in Maine State Gross Domestic Product are provided. The Total Maine State Gross Domestic Product has grown by an average of 2.1% over the last 10 years.

Table 5-1 summarizes the historic and estimated future growth rates from the above sources.

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[18] https://fred.stlouisfed.org/series/MENGSP

[19] Maine Turnpike Authority, *Maine Turnpike Alternatives Study, Final Report to the Maine Turnpike Authority* (VHB/Vanasse Hangen Brustlin, Inc., December 1996)

Table 5-1: Summary of Maine Turnpike Traffic Growth Rates

Source	Time Period	Annual Growth Rate
Historic daily traffic growth	1996-2016	2.3%
Safety and Capacity Study	2014-2034	1.5%
2017 Toll Revenue Study	2017-2037	1.4%
Dr. Colgan Forecast	2016-2022	1.6%
Maine Gross State Product	2007-2017	2.1%

Based on the summary of growth rates shown in Table 5-1, forecast year traffic estimates were developed using a growth rate of 1.5% growth per year. This growth rate is consistent with the MTA's Safety and Capacity Study, another long-range transportation planning study. The 1.5% growth rate was considered conservative, as it is lower than the daily traffic growth rate on the Maine Turnpike in Portland from 1996 to 2016, which averaged 2.3% per year.

The resulting traffic volume forecasts for the design hour of 2025 are shown in Figure 5-1 and Figure 5-2. The traffic volume forecasts for the design hour of 2040 are shown in Figure 5-3 and Figure 5-4.

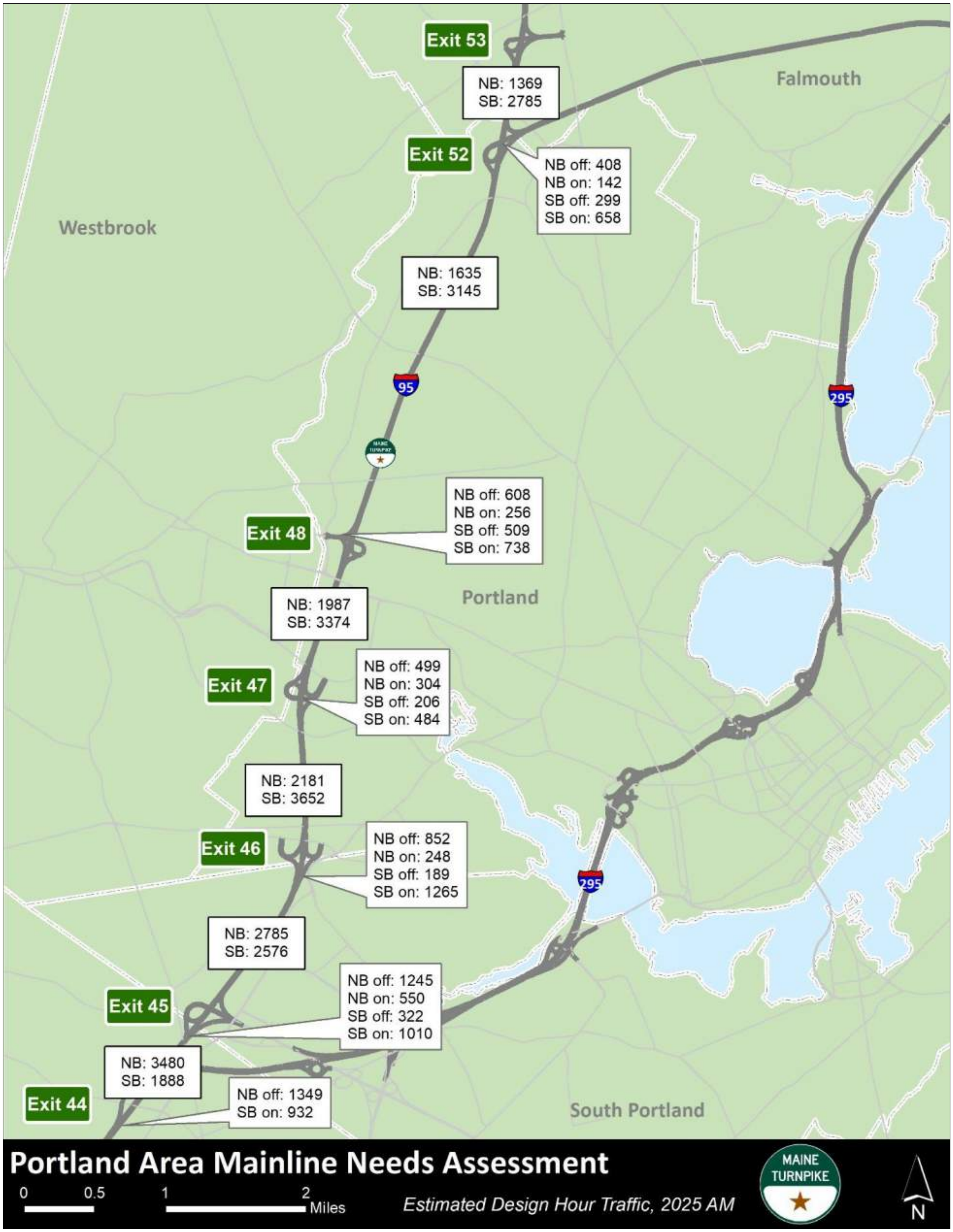

Figure 5-1: Estimated Design Hour Traffic, 2025 AM

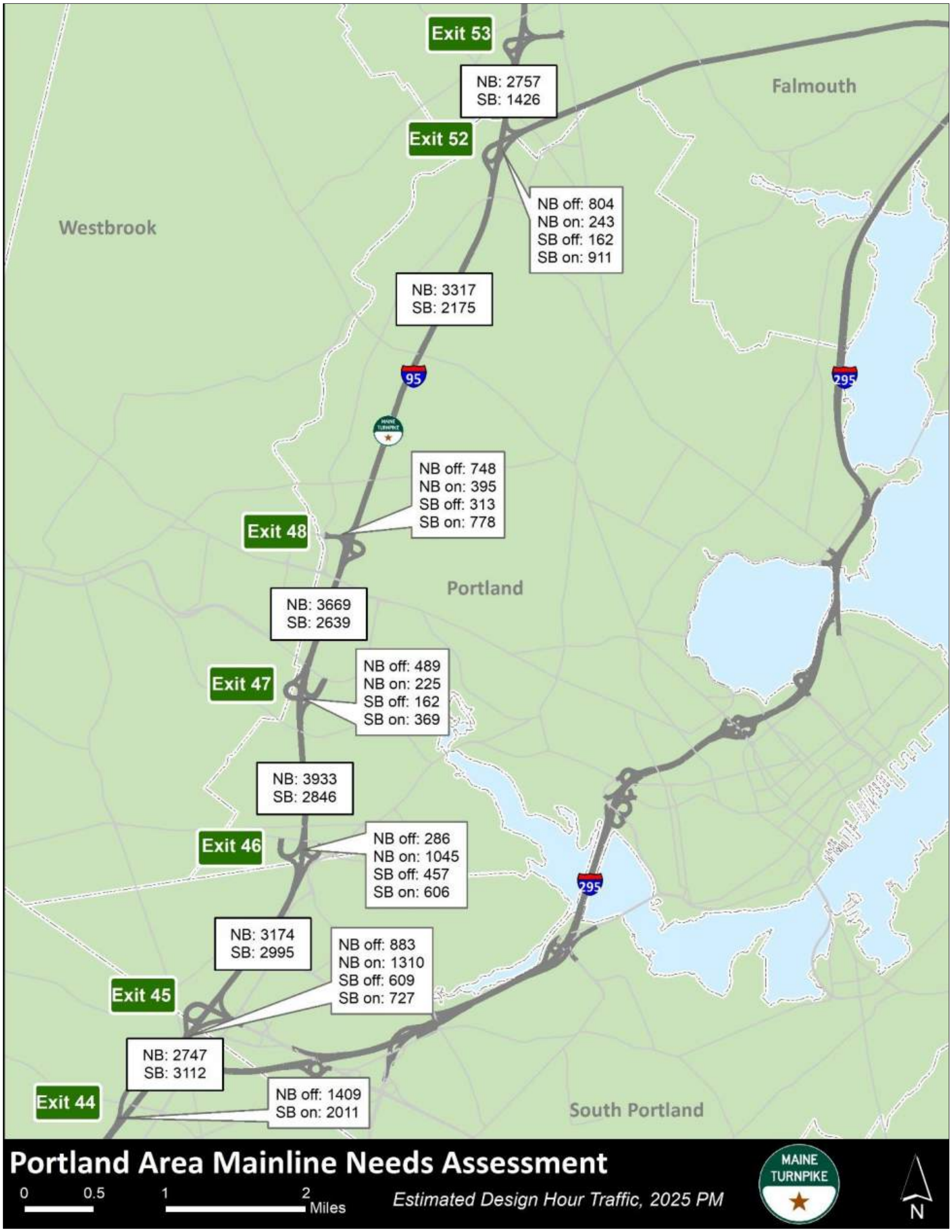

Figure 5-2: Estimated Design Hour Traffic, 2025 PM

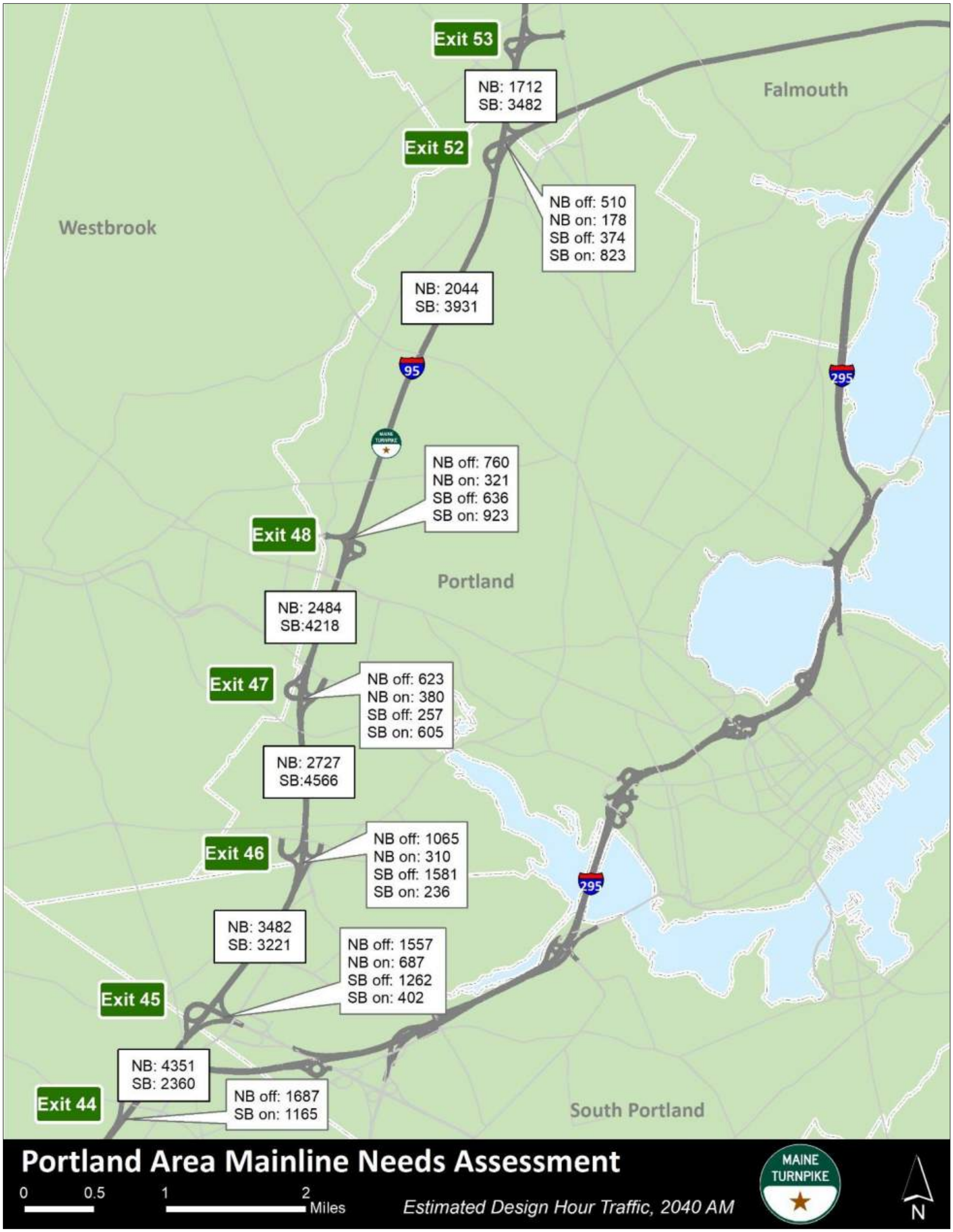

Figure 5-3: Estimated Design Hour Traffic, 2040 AM

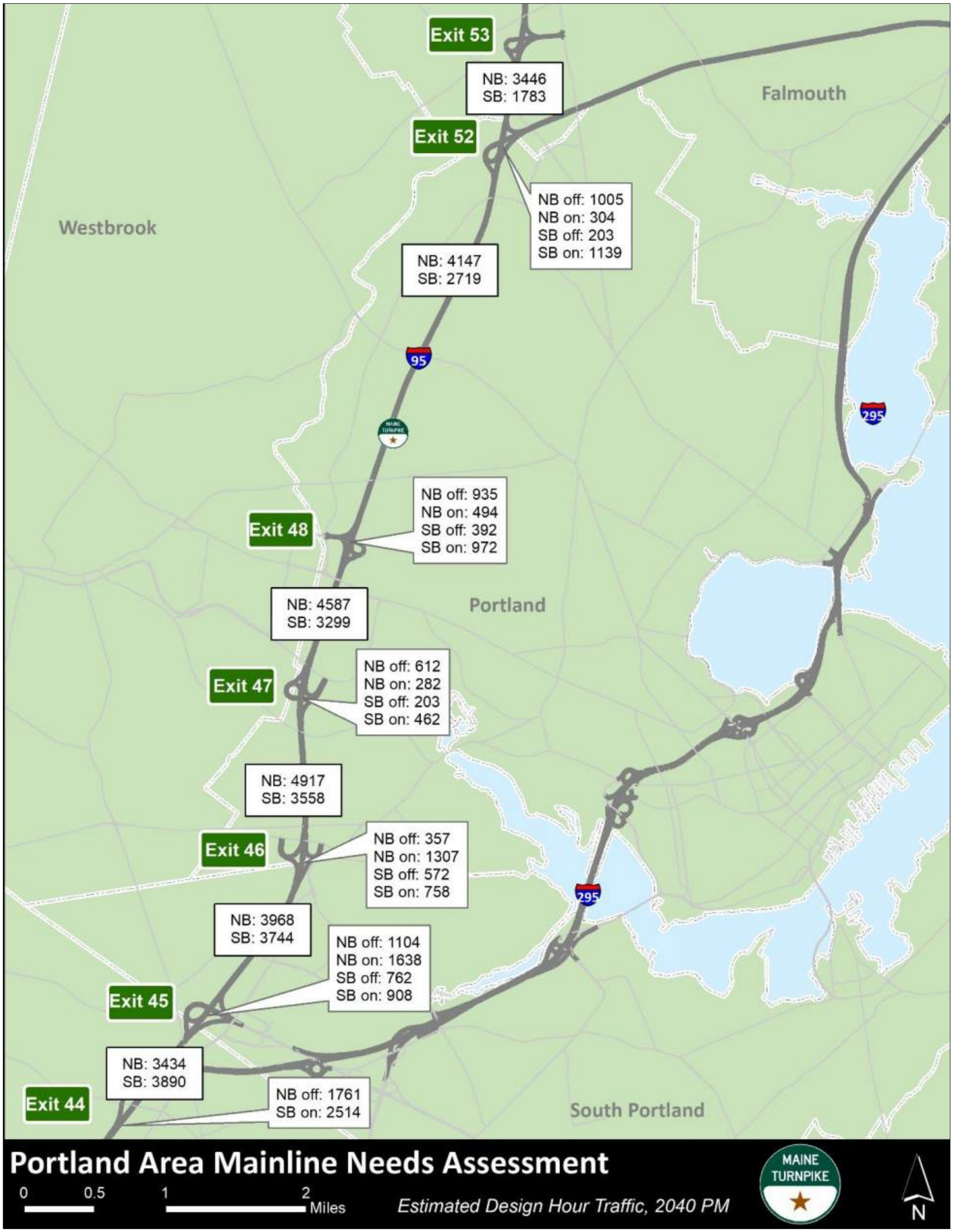

Figure 5-4: Estimated Design Hour Traffic, 2040 PM

5.4 Future Traffic Operations

The forecasted traffic volumes on the mainline sections of the Maine Turnpike were evaluated using the traffic engineering procedures outlined in the Highway Capacity Manual[20] (HCM), using Highway Capacity Software (HCS). Further discussion of the evaluation guidelines is located in Chapter 3. The design hour traffic volumes and the resulting levels-of-service for the northbound and southbound directions of the Maine Turnpike are shown in Table 5-2 and Table 5-3.

Table 5-2: NB PM Design Hour Volume, Level of Service, and V/C Ratios

	2016		2025		2040	
Location	**Traffic Volume (vehicles/ hour)**	**LOS**	**Traffic Volume (vehicles/ hour)**	**LOS**	**Traffic Volume (vehicles/ hour)**	**LOS**
Exit 44 to 45	2,402	C	2,746	D	3,434	E
Exit 45 to 46	2,776	D	3,174	E	3,969	F
Exit 46 to 47	3,440	E	3,934	F	4,919	F
Exit 47 to 48	3,209	E	3,670	F	4,588	F
Exit 48 to 52	2,901	D	3,317	E	4,147	F
Exit 52 to 53	2,411	C	2,756	D	3,446	E

Table 5-3: SB AM Design Hour Volume, Level of Service, and V/C Ratios

	2016		2025		2040	
Location	**Traffic Volume (vehicles/ hour)[21]**	**LOS**	**Traffic Volume (vehicles/ hour)**	**LOS**	**Traffic Volume (vehicles/ hour)**	**LOS**
Exit 52 to 53	2,436	C	2,785	D	3,482	E
Exit 48 to 52	2,751	D	3,145	E	3,932	F
Exit 47 to 48	2,951	D	3,375	E	4,219	F
Exit 46 to 47	3,194	E	3,653	F	4,566	F
Exit 45 to 46	2,253	C	2,577	D	3,222	E
Exit 44 to 45	1,651	B	1,889	C	2,363	C

It should be noted that the traffic levels of service shown in Table 5-2 and Table 5-3 reflect the impacts of the traffic demand for that section of roadway only. Traffic congestion can impact upstream roadway segments. For example, the southbound segment of the Maine Turnpike between Exits 52 and 53 could be an LOS F due to impacts downstream. Likewise, the southbound segment of the Maine Turnpike between Exits 63 and 53 could be an E or F due to impacts from traffic congestion on the segment between Exits 52 and 45.

By 2025, traffic demands for most of the Study Area corridor would result in poor traffic operations and traffic congestion during one or both of the design hours. All the mainline segments of the Maine Turnpike

[20] Transportation Research Board, *Highway Capacity Manual* (Transportation Research Board, 2010)

[21] Some SB volumes are higher during the PM peak hour, specifically south of Exit 46. However, generally the SB peak volumes occur during the AM peak hour.

between Exits 44 and 53 under future No Action conditions can be expected to have poor traffic operations and traffic congestion by Year 2040 during one or both of the design hours.

5.5 Impacts of a Possible Westerly Connection to Gorham

The 2010 Gorham East-West Corridor Study[22] identified the need for additional roadway capacity in the region west of the Maine Turnpike near the terminus of the Gorham Bypass in Gorham, Maine. In May of 2017, the State of Maine Legislature enacted into law "An Act to Authorize the Construction of a Maine Turnpike Connector to Gorham"[23]. This law directed the MTA and MaineDOT to "construct, maintain, reconstruct and operate a connector in Cumberland County from Route 114 in South Gorham to an interchange on the turnpike to address safety and mobility deficiencies in a manner that maximizes public safety, enhances the mobility of people and goods and minimizes adverse effects on the community in accordance with local and regional comprehensive planning." The law also required the MTA and MaineDOT to conduct a full evaluation of reasonable alternatives prior to implementation.

Even with this direction, the likelihood of a Gorham Connector is still to be determined. Accordingly, the Gorham Connector was not included in the No Action Alternative as a future transportation project due to this uncertainty. This is a conservative approach. If a Gorham Connector is built, future traffic conditions as shown in this Study for the Maine Turnpike in the Portland region would be exacerbated.

Previous analysis and evaluation by the MTA identified that, if a Gorham Connector was constructed, it would likely add additional traffic to the mainline in the Study Area. This is due to traffic currently traveling along Routes 22, 25, and 114 that could travel more expediently if a Gorham Connector linked with the Maine Turnpike in the Portland region. Due to the likelihood of this additional traffic with the construction of the Gorham Connector and current level of traffic operation on the Maine Turnpike between Exits 44 and 53, it is reasonable to conclude that additional capacity on the Maine Turnpike in the Study Area would be required to accommodate a future Gorham Connector. Therefore, it would not be prudent to manage capacity or demand between Exits 44 and 53 on the Maine Turnpike before constructing a Gorham Connector.

[22] Gorham East-West Corridor Study, 2010, Maine Turnpike Authority/MaineDOT
[23] LD 905

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6. Alternatives Evaluation

The Alternatives Evaluation was conducted for the Maine Turnpike Authority (MTA) to help identify possible solutions to address the safety and mobility deficiencies. The Alternatives Evaluation follows the direction and requirements identified by Maine's Sensible Transportation Policy Act (STPA). STPA, as identified under 23 M.R.S.A. §73, requires that the MTA evaluate a full range of reasonable transportation strategies to address the transportation need before adding transportation capacity. Strategies that adequately respond to the identified deficiency or need in the transportation system, are cost effective, and are capable of being implemented within a reasonable time period necessary to meet the transportation deficiency or need are considered reasonable.

This chapter focuses on the potential transportation demand and operational effects that each alternative analyzed will have on both the Turnpike corridor and Portland Area Comprehensive Transportation System (PACTS) region. Alternatives analyzed fall into the following categories:

- No Action;
- Travel Demand Management (TDM) Alternatives;
- Transportation System Management (TSM) Alternatives;
- Capacity Alternatives; and
- Combination Alternatives

6.1 Alternatives Considered

The original scope of the PAM Study identified 10 alternatives for evaluation. Through the PAC and Public Outreach Process (as described in Chapter 2), an additional nine alternatives were added, for a total of 19 alternatives. The alternatives evaluated are summarized in Table 6-1 by category.

Table 6-1: Portland Area Needs Assessment Study, Alternatives Evaluated

Alternative Category	Alternative Number	Alternative Name	Alternative Source (Study Scope, PAC, Public)
No Action			
	Alternative 1	No Action	Study Scope
Travel Demand Management (TDM) Alternatives			
	Alternative 2	Travel Demand Management (TDM)	Study Scope
	Alternative 3	Congestion Pricing	Study Scope
	Alternative 4	Intercity Bus	PAC
	Alternative 5a	Regional Bus	Study Scope
	Alternative 5b	Local Bus	Study Scope
	Alternative 5c	I-95 Corridor Regional Bus	PAC
	Alternative 6a	Commuter Rail	PAC, Public
	Alternative 6b	Local Commuter Rail	PAC

Alternative Category	Alternative Number	Alternative Name	Alternative Source (Study Scope, PAC, Public)
	Alternative 7	Freight Rail	PAC, Public
	Alternative 8	Land Use	Study Scope
Transportation System Management (TSM) Alternatives			
	Alternative 9a	Ramp Metering	PAC
	Alternative 9b	HOV/HOT Lanes	PAC
	Alternative 9c	Reversible Lanes	PAC
Capacity Alternatives			
	Alternative 10	I-295 Widening	Study Scope
	Alternative 11	I-295 Widening with Tolls	Study Scope
	Alternative 12	I-95 Widening	Study Scope
Combined Alternatives			
	Alternative 13	Alternatives 2, 4, 5a, 5b, and 8	PAC
	Alternative 14	Alternatives 2, 4, 5a, 5b, 8, and 12	PAC

Each alternative was analyzed for the Year 2040, the future analysis year determined for the PAM Study.

6.2 Methodology

The Alternatives Evaluation was conducted using industry standard methodologies and tools. Three specific elements of the methodology are described below.

6.2.1 PACTS Model

The majority of the alternatives analysis was conducted using the Portland Area Comprehensive Transportation System (PACTS) Regional Travel Demand Model. The PACTS Travel Demand Model estimates future vehicular and person travel throughout the PACTS region, and examines regional travel through provided demographic information. The model reflects the geographic distribution and densities of residential, commercial, government, and recreational development as forecast by Greater Portland Council of Governments (GPCOG) and municipal staff. The model accounts for the factors that affect a person's choice of travel mode (either private vehicle, transit, or walk) and selection of a travel path (to avoid traffic congestion delays).

Further, the PACTS Travel Demand Model allocates person trips between Traffic Analysis Zones (TAZs) based on the accessibility of each pair of TAZs and their land use composition. The trips between pairs of TAZs are compiled into matrices called trip tables. Separate trip tables are developed for each trip purpose and for each weekday time period. The travel modes for trips between TAZ are functions of the relative performance and availability of the competing travel modes in the model: walk/bike, transit, and auto driver/passenger. Transit accessibility is measured using two primary factors: cost and travel time. Transit travel time is in turn comprised of on-board travel time, walk access and egress travel time, and transfer time. As values for these parameters change for services between TAZs (e.g., shorter service headways, more direct service requiring no transfers), the number of transit trips between individual TAZs are forecast to change.

6.2.2 Benefit/Cost

A Benefit-Cost Analysis (BCA) was prepared for the PAM Study for each alternative. These alternatives were considered as strategies to reduce vehicular traffic demand, improve system management, or add capacity on the Maine Turnpike in the Portland Area.

Based on provided input data, project benefits and costs were calculated for each Build alternative under consideration. Project costs include construction, ROW, environmental impacts, and operating/maintenance expenses. Project benefits related to travel time, vehicle operating costs, accident reductions, emissions costs, and where appropriate, freight and active lifestyle benefits were considered. The No Action alternative (Alternative 1) was used as a baseline for comparison to 18 build alternatives (Alternatives 2-14).

A Benefit/Cost (B/C) ratio above 1.0 is considered favorable, meaning that the life-cycle benefits of a project exceed the estimated project-related costs over the same period. Results of the benefit/cost analysis can be found in the Evaluation Summary Matrix at the end of this chapter.

6.2.3 Effects of Induced Demand

Induced demand represents the increase in transportation demand that follows when an increase in transportation supply occurs, lowering the cost of traveling and encouraging additional demand for travel. As additional roadway capacity is provided, traffic volume growth is induced. Likewise, as additional transit service is provided, transit ridership is induced. And as more pedestrian facilities are provided, walk trips are induced. For the Maine Turnpike, traffic will continue to grow due to increases in population, employment, and the shifting of traffic from other routes. The underlying issue is to confirm that any investment in the transportation system does not quickly fill up with induced demand and result in a relatively immediate need to address the capacity and safety problem again.

Induced demand resulting from an increase in transportation capacity comes from:

- A change in the travel route for a trip taken by a motorist;
- A change in the travel mode of a person making a trip; and/or
- A change in the time-of-day of a trip made by a person.

The potential effects in this Study Area based on the level of existing congestion, scale and type of proposed transportation system changes are anticipated to be limited. The effects of induced demand are unlikely to significantly shorten the period in which a widening of the Maine Turnpike segment at issue is an effective means of addressing congestion, all else equal. Over the long term, population and economic growth will be the primary drivers to increased use of the highway and result in the need to readdress congestion at some point in the future. This is likely decades away based on forecasted growth. In the meantime, implementation of current non-highway capacity alternatives (examples: TDM, transit) and developing technologies (examples: mobility as a service, autonomous or connected vehicles) could delay or perhaps even eliminate the need to add highway capacity to address this future challenge.

The two primary elements of induced demand – route choice and model choice – have been addressed with the use of the PACTS Travel Demand Model.

6.3 Measures of Effectiveness

Measures of Effectiveness (MOE's) are evaluation criteria used for comparing the performance of the alternatives that were developed by the Study Team, PAC, and with input from the Public. The MOE's developed were based on the issues, opportunities, and goals identified in the Study Purpose statement identified in Chapter 1.

Twenty-two MOE's were developed and divided into five groups:

- Transportation Measures
- Environmental Measures
- Cost/Funding Measures
- Implementation Measures
- Summary Measures

The following provides a description of each MOE in each group.

Transportation Measures

1. Safety Benefits on the Maine Turnpike – identifies the level of increase or decrease in crashes and crash rate on the Maine Turnpike using Highway Safety Manual Methodology.
2. Mainline Turnpike Capacity – identifies the estimated change in mainline turnpike capacity within the Study Area for each alternative evaluated based on historic data.
3. Change in Mainline Turnpike Demand – measures the forecasted change in peak hour demand on the Maine Turnpike between Exits 46 and 47 (busiest section) for each alternative evaluated.
4. Mainline Volume to Capacity Ratio – a calculation based on the forecasted mainline turnpike demand (MOE #3) divided by the estimated mainline turnpike capacity (MOE #2).
5. Regional Off-Turnpike Benefits – forecasted number of off-turnpike roadway miles that are near or over capacity for each alternative using the PACTS Travel Demand Model in the peak hour.
6. Vehicle Miles Traveled – forecasted number of all miles traveled by all vehicles within the PACTS Travel Demand Model area (18 municipalities) for all roads including residential roads in the peak hour.
7. Vehicle Hours Traveled – forecasted number of vehicle hours by all vehicles within the PACTS Travel Demand Model area (18 municipalities for all roads including residential roads in the peak hour.
8. Change in Transit Ridership – forecasted measure of the change in number of transit trips compared to the No Action Alternative for the entire Study Area using the PACTS mode choice model in the peak travel hour.

Environmental Measures

9. Regional Air Quality – forecasted summary of vehicle emissions for the entire Study Area using outputs from the PACTS Travel Demand Model and EPA'ss Motor Vehicle Emission Simulator

(MOVES) which is a state-of-the-science emission modeling system that estimates emissions for mobile sources for criteria air pollutants, greenhouse gases, and air toxics for the Study Area for each alternative.

10. Change in Regional Impervious Pavement – measure of change in impervious pavement within the Study Area for each alternative that may add impervious pavement.
11. Change in Regional Impervious Pavement within Urban Impaired Stream Watershed – measure of change in impervious pavement within the four Urban Impaired Stream Watersheds (Long Creek, Red Brook, Capisic Brook, and Nasons Brook) for each alternative.
12. Potential Wetland Impacts – measure of potential wetland impacts solely based on the identification of new infrastructure construction within the Study Area for each alternative.

Cost/Funding Measures

13. Initial Capital Cost – order of magnitude capital cost for each alternative in 2018 dollars. Capital costs include estimated costs for right-of-way acquisition, wetland mitigation, and engineering.
14. Capital Funding Viability – measure of available funding for capital costs based on funding agency, current identification of capital funding for identified alternative, and likelihood of funding based on type of alternative.
15. Operations and Maintenance (O&M) Cost – order of magnitude O&M cost for each alternative in 2018 dollars. O&M costs are typically annual or recurring costs that are required to operate or maintain a specific alternative.
16. Operation and Maintenance (O&M) Funding Viability – measure of available O&M funding for identified alternative based on funding agency, current identification of O&M funding, and likelihood of funding based on type of alternative.
17. Potential Toll Revenue Impacts – estimated change in Maine Turnpike toll revenue for the identified alternative as compared to Alternative 1 - No Action.

Implementation Measures

18. Legal/Policy Obstacles – identification of any legal or policy obstacles. Implementation of alternatives may have existing legal or policy obstacles, such as specific laws in place prohibiting such an alternative or strong public or political policy for or against an alternative.
19. Timeframe to implement – identifies the approximate timeframe for implementation for an alternative. Short (<5 years), medium (5 to 10 years), and long or unknown (>10 years) implementation periods are identified.
20. Likely Implementation Agency – identifies the likely implementation agency for the identified alternative. Implementation agencies can include the MTA, MaineDOT, Northern New England Passenger Rail Authority (NNEPRA), local/regional bus providers, and municipalities.

Summary Measures

21. Benefit/Cost - ratio of the transportation benefits (safety improvements, congestion reduction, vehicle-miles and hours traveled, air quality benefits) to transportation costs (capital costs, O&M costs). A benefit/cost ratio of greater than 1.0 is considered a minimum for a transportation alternative to be viable.

22. Address Study Purpose – a determination of the identified alternative fully, partially, or does not meet the overall Study purpose which is to address identified safety and mobility issues on the Maine Turnpike.

6.4 Alternative 1 – Future No Action

The Future No Action Alternative provides the baseline to which all other alternatives will be compared. Using the status quo as a baseline allows the Study Team to determine how the other proposed alternatives would affect mobility in the study area and particularly on the Maine Turnpike between Exits 44 and 53. In the Future No Action Alternative, as the name implies, no capacity improvements would be made, and no travel demand or transportation system strategies would be implemented, with all existing conditions remaining in their current state.

A traffic operations analysis was performed for the forecast years of 2025 and 2040 and the results are provided in Chapter 4. Findings indicate that by 2025, traffic demands for most of the study area corridor would create congested traffic conditions. All the mainline segments of the Maine Turnpike between Exits 44 and 53 under future No Action conditions can be expected to be at or near failing level of service by Year 2040.

The traffic demand reflects the amount of traffic that wants to use the Maine Turnpike. However, the Maine Turnpike has a practical limit, or capacity, regarding the amount of traffic it can handle. On two lane sections of the Maine Turnpike, the capacity has been measured at approximately 3,600 vehicles per hour. Table 6-2 and Table 6-3 show the design hour traffic demand for the forecast years. As can be seen from Table 6-2, the traffic volume demand for the Maine Turnpike in the Portland area can be expected to be about 37% over capacity in 2040.

Table 6-2: NB PM Design Hour Volume and V/C Ratios

		2016		2025			2040		
Location	Capacity (vehicles/ hour	Traffic Volume (vehicles/ hour)	v/c	Traffic Demand (vehicles/ hour)	v/c	Unmet Traffic Demand (vehicles/ hour)	Traffic Demand (vehicles/ hour)	v/c	Unmet Traffic Demand (vehicles/ hour)
Exit 44 to 45	3,600	2,402	0.67	2,746	0.76	--	3,434	0.95	--
Exit 45 to 46	3,600	2,776	0.77	3,174	0.88	--	3,969	1.1	369
Exit 46 to 47	3,600	3,440	0.96	3,934	1.09	334	4,919	1.37	1,319
Exit 47 to 48	3,600	3,209	0.89	3,670	1.02	70	4,588	1.27	988
Exit 48 to 52	3,600	2,901	0.81	3,317	0.92	--	4,147	1.15	547
Exit 52 to 53	3,600	2,411	0.67	2,756	0.77	--	3,446	0.96	--

Table 6-3: SB AM Design Hour Volume, Level of Service, and V/C Ratios

		2016		2025			2040		
Location	Capacity (vehicles/ hour)	Traffic Volume (vehicles/ hour)[24]	v/c	Traffic Demand (vehicles/ hour)	v/c	Unmet Traffic Demand (vehicles/ hour)	Traffic Demand (vehicles/ hour)	v/c	Unmet Traffic Demand (vehicles/ hour)
Exit 52 to 53	3,600	2,436	0.68	2,785	0.77	--	3,482	0.97	--
Exit 48 to 52	3,600	2,751	0.76	3,145	0.87	--	3,932	1.09	332
Exit 47 to 48	3,600	2,951	0.82	3,375	0.94	--	4,219	1.17	619
Exit 46 to 47	3,600	3,194	0.89	3,653	1.01	53	4,566	1.27	966
Exit 45 to 46	3,600	2,253	0.63	2,577	0.72	--	3,222	0.9	--
Exit 44 to 45	3,600	1,651	0.46	1,889	0.52	--	2,363	0.66	--

Excess demand for the Maine Turnpike will use other roadways, travel at different times, or may use alternative modes of transportation. To understand the impacts of the unmet travel demand, the Study Team used the PACTS Regional Travel Demand Model.

The PACTS Travel Demand Model estimates future vehicular and person travel throughout the PACTS region. The model reflects the geographic distribution and densities of residential, commercial, government, and recreational development as forecast by GPCOG staff. The model accounts for the factors that affect a person's choice of travel mode (either private vehicle, transit, or walk) and selection of a travel path (to avoid traffic congestion delays). The model provides information on travel by vehicles on all the roadways in the study area, providing information on vehicle-miles traveled (VMT), vehicle-hours traveled (VHT), and number of miles of roadway that are at or over capacity.

By 2025, traffic demands for the majority of the study area corridor would exceed roadway capacity. All the mainline segments of the Maine Turnpike between Exits 44 and 53 under future No Action conditions can be expected to be significantly at or over capacity by Year 2040.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- No new potential wetland impacts; and
- No new impacts to Urban Impaired Streams.

[24] Some SB volumes are higher during the PM peak hour, specifically south of Exit 46. However, generally the SB peak volumes occur during the AM peak hour.

The key impacts and challenges are the following:

- No relief to Maine Turnpike capacity constraint (Year 2040 v/c = 1.37);
- No relief to regional off-Turnpike miles near or over capacity (460 miles). As the traffic demand for the Maine Turnpike cannot be accommodated, more traffic is using local roads;
- Potential for lost revenue on Maine Turnpike; and
- Does not address Portland Area Mainline Needs Assessment Study Purpose.

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6.5 Travel Demand Management Alternatives

Travel Demand Management (TDM) strategies are measures that affect the demand on a transportation facility. TDM strategies seek to change people's behavior by using either incentives or disincentives to encourage these shifts in demand. The TDM alternatives evaluated for the PAM Study are:

- TDM programs
- Congestion Pricing
- Alternative modes (bus, rail, freight)
- Land Use

Each of these TDM alternatives were evaluated individually, with a select number evaluated in combination under the Combination Alternatives. It should be noted that the market for each TDM alternative potentially overlap, and therefore the potential effectiveness of each is not strictly additive.

Travel Demand Management Programs:

6.5.1 Alternative 2 – Transportation Demand Management

Tolling:

6.5.2 Alternative 3 – Congestion Pricing

Alternative Mode Choices:

6.5.3 Alternative 4 – Public Transportation: New or Improved Interstate Bus Service

6.5.4 Alternative 5a – Public Transportation: New or Improved Regional Bus Service

6.5.5 Alternative 5b – Public Transportation: New or Improved Local Bus Service

6.5.6 Alternative 5c – Public Transportation: New I-95 Corridor Regional Bus

6.5.7 Alternative 6a – Alternative Modes: Expanded Amtrak, New Mountain Division Commuter Rail and New Lewiston-Auburn Commuter Rail

6.5.8 Alternative 6b – Alternative Modes: New commuter Rail Service to Westbrook, West 2.9: Falmouth and Biddeford

6.5.9 Alternative 7 – Freight Transportation: New or Improved Intermodal Freight Service

6.5.10 Alternative 8 – Land Use Scenario

It is important to note that for the purposes of Travel Demand Alternatives Analysis, each alternative was individually analyzed. These results are not strictly additive as they have overlapping markets (for example in the overlapping modes a user may choose between taking the bus or rail to Lewiston/Auburn area).

6.5.1 Alternative 2 – Transportation Demand Management Programs

TDM programs provide tools to commuting travelers (typically the lowest vehicle occupancy periods with the greatest number of vehicles) to reduce the demand for transportation, i.e., reduce the number of vehicles on the road. These tools include both employer based and area wide programs including: ride share programs, park and ride lots (which can support rideshare programs), and work from home opportunities. In this Alternative, these programs will be evaluated to determine:

- The impacts on travel demand by enhancing or implementing new rideshare programs such as increased employer incentivization, expanding or constructing new park and ride facilities, increasing rideshare advertisement, and expanding ride share services; and
- The current trend in working from home may impact travel demand and traffic volumes between now and the year 2040.

Large local employers were surveyed to look at current programs being offered in the region. These employers offered a variety of incentives to encourage employees to participate in TDM Programs – often a necessity due to parking and/or road capacity constraints. Current incentives include:

- Preferred parking for rideshare and environmentally friendly vehicles;
- Staggered/flexible start and end times;
- Reduced work weeks including options such as 4-10 hour days;
- Work from home options;
- Financial incentives for employees that don't require parking spaces;
- Information about rideshare programs; and
- Discounts for bus and rail transit.

In addition to employer-based incentives, there are several regional and national rideshare alternatives available. These include GoMaine[25], Enterprise RideShare, and various phone application ride matching applications. GoMaine is a state-wide commuter program run by the Maine Turnpike Authority responsible for coordinating carpools and setting up van pools. This program offers rewards to local, online and national retailers for users as well as emergency rides home for those who need it. Additionally, GoMaine encourages local employer participation through "Way 2 Go Maine", currently extended to be a month-long Business to Business Competition the month of October.

Enterprise Rideshare is a national program where Enterprise provides groups of employees with a newer model van or SUV at a centralized location. Fees vary but Enterprise participates in cost-reduction alternatives including the Federal Transit Benefit Program. The program currently operates in 45 states, including Maine, and in 2018 participated in more than 12,300 vanpools nationally.

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[25] GoMaine is the State of Maine rideshare program currently sponsored by MaineDOT and the Maine Turnpike Authority, www.gomaine.org.

Collected rideshare data, along with Cumberland County Census data[26], was used to estimate ride share utilization based on current carpool/vanpool use. Increased rideshare utilization was estimated from a review of the potential benefits identified in a literature search of successful area-wide TDM programs.

Park and Ride lots are popular central meeting locations for individuals looking to use alternative forms of transportation. Constructed and maintained by MTA and MaineDOT[27], there are 10 lots, 5 of which show a more than 50% utilization rate – which were identified for possible expansion opportunities. The Park and Ride lots are shown in Figure 6-1.

Data from the US Census[28] and the United States Department of Labor was gathered and analyzed to determine trends in the portion of the workforce that is working from home. Data was specifically gathered for Cumberland County to provide a baseline and future trend for the percentage of workforce that is working from home. Additional research was conducted to validate Census trends and used to determine the impacts of working from home on the peak hour traffic demand.

For this alternative, it was assumed that the reduction in traffic from the Maine Turnpike would be based on the potential to increase the number of people who would participate both in an enhanced area-wide and in an employer-based TDM program. The first step in estimating this increase was to understand the existing level of workforce in carpools or vanpools. Based on 2016 US Census data, 8.3% of the Cumberland County workforce population carpools, vanpools or uses some level of rideshare program. This rideshare population includes both regular and semi-regular users.

Next, an estimate of the additional percentage of the workforce that could shift to carpool and vanpool through a new or enhanced rideshare program was determined using data from studies summarized by the Federal Highway Administration (FHWA). This data indicated that successful commuter programs in similar regions (low transit density areas with free parking options) that offer alternative commuter services such as park and ride facilities and vanpools as well as financial incentives to employers can increase rideshare usage. Programs with strong support and marketing were shown to achieve an *additional* commuter vehicle volume reduction ranging from 3% to 7%[29].

Based on this, a mid-range quantity of 5% of additional commuter vehicle reduction was selected as a reasonable value. An historic rideshare vehicle occupancy and the percentage of additional rideshare users that travel during the peak period was then calculated. Table 6-4 provides a summary of additional vehicles removed with assumed new or enhanced rideshare programs from the peak hour traffic on the Maine Turnpike in the Portland Area. As can be seen from the table, hourly reductions range from 25-52 vehicles per hour, or about one percent of the total traffic.

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[26] Cumberland County Census Data, American Community Survey 5-Year Estimates, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml
[27] Maine Department of Transportation Park n' Ride Utilization Study, 2011.
[28] United States Census Data, American Community Survey 5-Year Estimates, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[29] U.S. Department of Transportation, Federal Highway Administration, Integrating Demand Management into the Transportation Planning Process; A Desk Reference (August 2012).

Figure 6-1: Park & Ride Lot Locations

Table 6-4: Traffic Reduction Estimates from Enhanced TDM

	Northbound PM		Southbound AM	
Location	**2040 Design Hourly Traffic**	**Traffic Reduction**	**2040 Design Hourly Traffic**	**Traffic Reduction**
Exit 42-44	5,195	54	3,526	37
Exit 44-45	3,434	36	2,360	25
Exit 45-46	3,968	41	3,221	34
Exit 46-47	4,917	52	4,566	48
Exit 47-48	4,587	47	4,218	44
Exit 48-52	4,147	43	3,931	41
Exit 52-53	3,446	36	3,482	36

Achieving these numbers will require a combination of measures, such as expanding existing park and ride facilities, working closely with large employers to increase employee rideshare, and promoting carpooling and vanpooling opportunities within the state through increased and enhanced rideshare marketing and financial incentives. Further evaluation of these measures will be required to identify the optional results.

The general perception is that the number of people working from home is increasing. In order to determine if the current trend in the percent of the workforce of people that work from home is growing faster than traffic growth, U.S. census data[30] for 2000-2016 was reviewed. The objective of this review was to estimate any additional reduction in travel demand that should be considered in the Year 2040.

Figure 6-2 presents the historic percent of the workforce population that work from home, both for the United States and Cumberland County. Similar trend lines exist for both United States Data and Cumberland County data.

[30] Base Condition Data is from the U.S. Census, American Community Survey 1 and 5-Year Estimate & Decennial Census. Identifies percentage of workforce who reported ‘‘work at home’’ on a question about how they ‘‘usually’’ commute to work.
https://www2.census.gov/library/publications/2012/demo/p70-132.pdf
https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

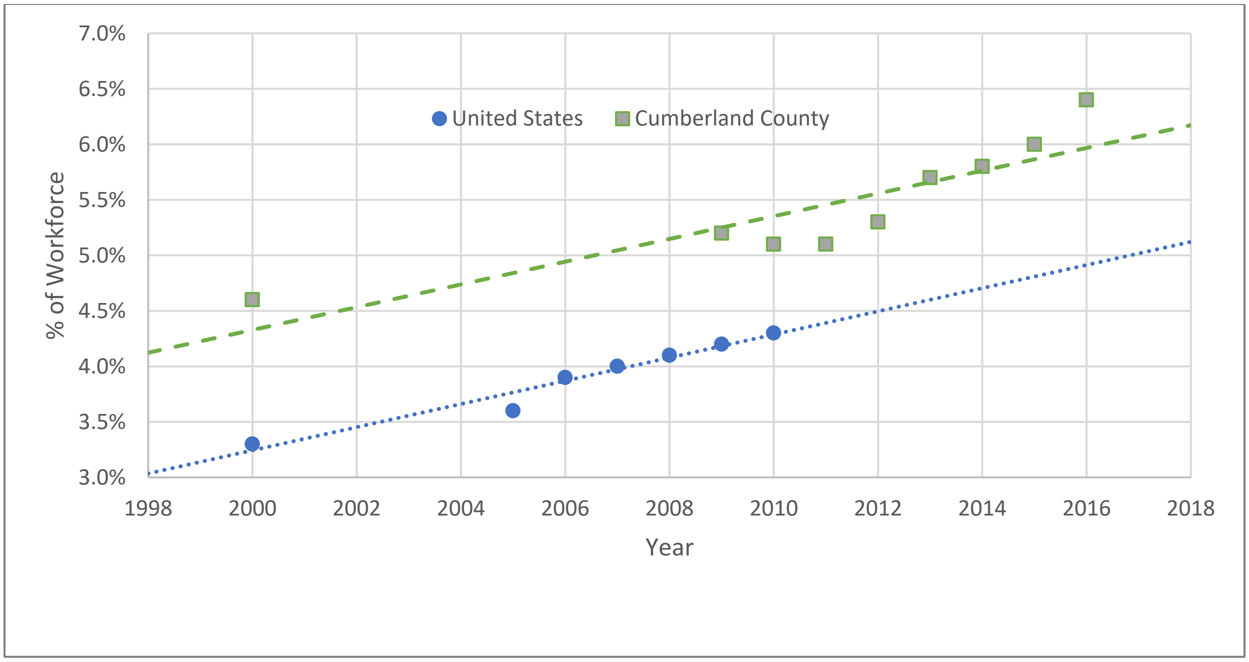

Figure 6-2: Historic Regional and National Percentage in Work from Home Workforce

As seen in Figure 6-2, the Cumberland County percent of workforce that works from home has averaged an approximate 1.9% increase per year since 1998. This growth is consistent with historic annual traffic growth seen on the Maine Turnpike. If this trend increases over time, the increase in work from home workforce may reduce overall future traffic demand. This trend should be carefully monitored in the future to assess changes in overall traffic demand.

The capital costs to enhance and expand TDM programs was estimated to be approximately $3 million in 2018 dollars. This estimate is based upon an assumed doubling of the GoMaine program funding and adding capacity to highly utilized park and ride facilities within the PACTS region.

Operation and maintenance (O&M) costs for the enhanced and expanded TDM programs was estimated to be approximately $1.35 million in 2018 dollars. These increased O&M costs are based on similar assumptions – expansion of the GoMaine program and increased park and ride facility size.

Implementing a new or expanded rideshare program is anticipated to reduce peak hour travel demand on the Maine Turnpike by up to 52 vehicles in 2040. While this provides some relief to the Maine Turnpike corridor between Exits 44 and 53, the resulting demand would still exceed the capacity of the roadway (v/c=1.35).

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 1% along the Maine Turnpike between Exits 44 and 53;
- 52 vehicle peak hour reduction along the Maine Turnpike between Exits 44 and 53;
- 0.5% reduction in regional VMT;
- 0.3% reduction in regional VHT;

- Reduction in NOx (-0.5%) and HC (-0.4%), improving air quality;
- New or Expanded TDM programs can be readily implemented with available funding;
- No legal or policy obstacles to implementation;
- Can be implemented in a short timeframe; and
- Has a Benefit/Cost ratio of 14.6.

The key impacts and challenges are the following:

- Little relief to Maine Turnpike capacity constraint (Year 2040 v/c = 1.35);
- Potential wetland impacts; and
- Potential loss of revenue for Maine Turnpike.

6.5.2 Alternative 3 – Congestion Pricing

Congestion pricing is an alternative where motorists are charged a premium to use a roadway during certain times of the day. The goal of congestion pricing is to encourage motorists to shift their travel away from peak travel times.

A sample of congestion pricing systems throughout the nation was examined. These systems fall into two broad categories – conventional toll facilities like the Maine Turnpike, or managed lane facilities. Managed lane facilities only toll certain lanes or only toll the roadway during certain hours. Examples of conventional toll facilities that utilize congestion pricing are shown in Table 6-5 and Figure 6-3. The summary in Table 6-5 focuses on rates for customers that are equipped with a valid electronic toll transponder.

Table 6-5: Examples of Congestion Pricing on Conventional Toll Facilities

Facility	Peak Pricing Period	Peak vs. Off-Peak Differential
Port Authority of New York and New Jersey	6am-10am (weekday mornings) 4pm-8pm (weekday evenings) 11am-9pm (weekends)	19% increase for passenger cars
New York State Thruway Authority	7am-9am (Tappan Zee) 4pm-6pm (Spring Valley)	100% increase, applied only to commercial vehicles
Chicago Skyway	4am-8pm	40% increase, applied only to commercial vehicles
The Toll Roads of Orange County	7:30am-8:30am (SB) 5pm-6pm (NB)	10% to 29% increase, depending on location
SR-520 Bridge (Seattle)	7am-9am & 3pm-6pm (Weekdays) 11am-6pm (Weekends)	244% increase (weekdays) 112% increase (weekends)

The Maine Turnpike charges tolls on entry and generally does not track trips to the exit. In the AM peak hour, 43% of traffic in the study area originated from one of the interchanges within the study area. In the PM peak hour, the share rose to 50%. In other words, *only about half of the traffic on the Maine Turnpike in the study area originated at an interchange located within the study area.*

Therefore, to exact a noticeable change in peak hour traffic, a surcharge would need to be assessed system wide. Due to the nature of the toll rate structure, the surcharge would not be able to discriminate between vehicles that do or do not travel in the Portland area.

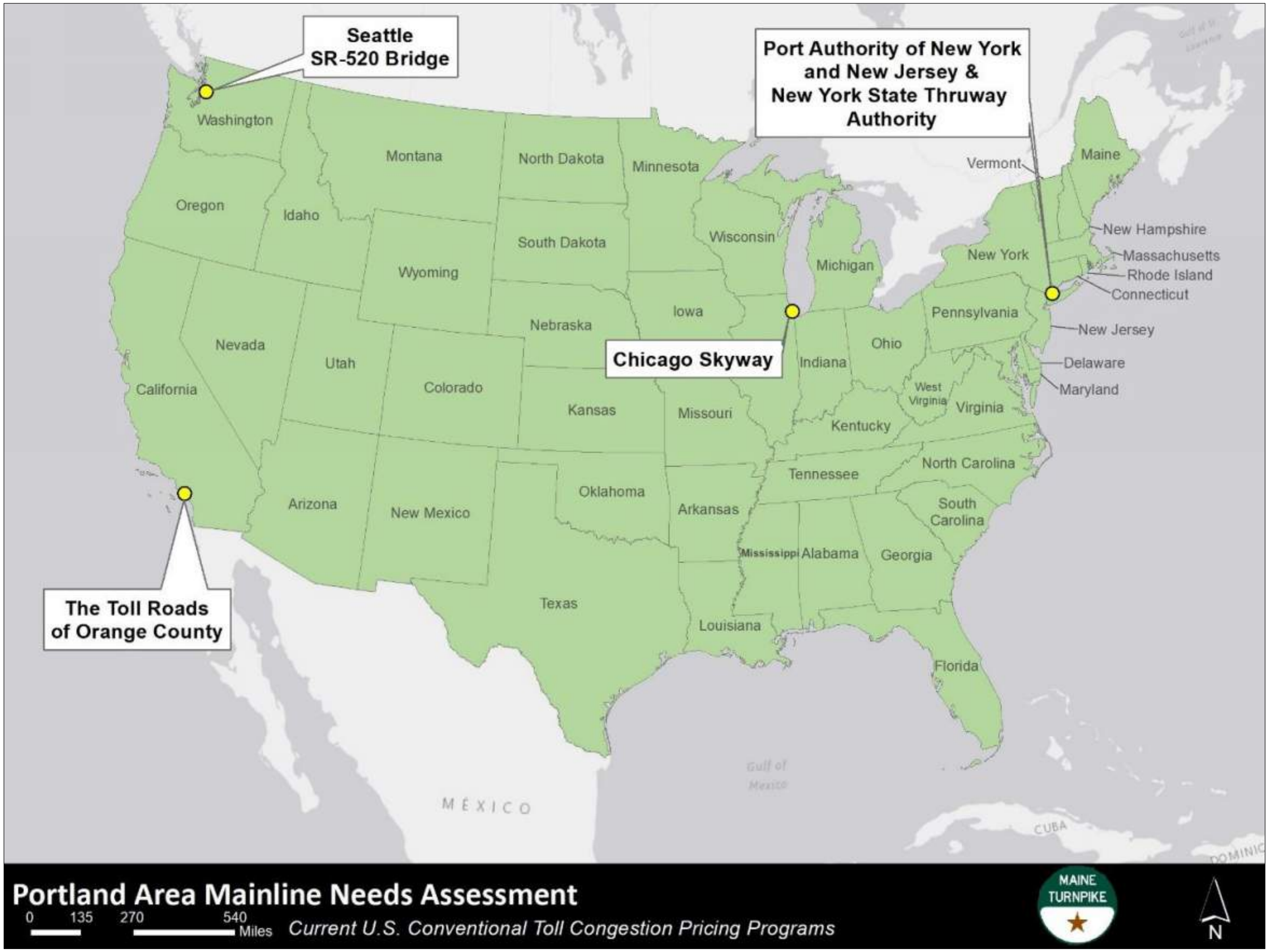

Figure 6-3: Examples of Congestion Pricing on Conventional Toll Facilities

Any potential congestion pricing system for the Maine Turnpike should be modeled after the systems that have been implemented at other conventional facilities. A congestion pricing system intended to reduce congestion in the Greater Portland area would therefore follow these parameters:

- A peak hour surcharge of **50% for E-ZPass customers** would be applied. This is well-positioned inside the range of surcharges used at various conventional facilities today.
- On the Maine Turnpike, E-ZPass rates are (in some instances) capped by the cash rate in effect for the same movement. Therefore, it would be critical to increase cash rates as well so that they would not constrain the implementation of the E-ZPass peak-period surcharge.

The PACTS Regional Travel Demand Model was run using the assumptions outline above regarding congestion pricing. The model provided information on travel on all the roadways in the study area using measures such as VMT and VHT.

Based on the results of the Travel Demand Model analysis, it was determined that approximately 250 vehicles would be removed from the Maine Turnpike in the peak direction in 2040 with the implementation of congestion pricing. While this is a sizeable reduction, it would not reduce traffic demand significantly enough to address the capacity demands identified in Alternative 1. It would also impact other off-Turnpike roadways, as vehicles that would choose not to pay the peak hour surcharge would seek alternate routes.

As noted above, while congestion pricing reduces traffic by approximately 250 vehicles, it does not reduce it enough to fully address future congestion between Exits 44 and 53 (v/c=1.3). Additionally, this alternative is currently not allowed by law, and it would require an act of the State Legislature in order to be implemented. This alternative would also create social justice issues with higher tolls being charged during peak times of the day.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 5.1% on the Maine Turnpike;
- An expected reduction of approximately 257 vehicles during the peak hour;
- No additional wetland impacts;
- Additional revenue to the Maine Turnpike Authority would be produced; and
- This alternative has a viable funding source.

The key impacts and challenges are the following:

- Limited relief to Maine Turnpike capacity constraint (Year 2040 v/c = 1.30);
- 9.2 mile Increase in miles of roadway near or over capacity off-Turnpike due to vehicles diverting from Maine Turnpike with Congestion Pricing surcharge;
- 0.7% increase in regional VHT;
- Obstacles to implementation include State of Maine law that prohibits a surcharge on tolls based on time of day;

- Timeframe to implement is unknown due to the Maine State law; and
- Has a Benefit/Cost ratio of -103.2.

6.5.3 Alternative 4 - Public Transportation: New or Improved Interstate Bus Service

The primary interstate bus providers in the study area are Concord Coach Lines and Greyhound. In this alternative, the Concord and Greyhound bus systems will be evaluated to determine the potential effects of practicable system improvements including increased service and additional transit infrastructure on:

- Overall interstate transit ridership; and
- Change in vehicular demand on the Maine Turnpike in the Portland Area.

Concord Coach Lines currently provides 16 runs between Portland and Boston/New York City beginning between 2:45 AM and 4:30 AM and ending at 10:30 PM daily - several of which originate as far north as Orono, ME. Figure 6-4 shows the Concord Coach Lines' routes. Parking is available in Portland at the Transportation Center for $5/day, and tickets range from $40 round trip from Portland to Boston up to $150 round trip from Portland to New York City. Trip lengths are comparable with driving by car, and amenities include wi-fi, power outlets and luggage storage.

Greyhound currently provides up to two round trips daily between Portland and Boston. Fares are comparable with Concord Coach Line fares. These buses originate north of Portland in Bangor with stops in Augusta and Lewiston.

Since Concord Coach Lines provides the majority of the interstate trips in the region, future interstate bus expansion was focused on this provider. Future plans would increase this total to 20 runs[31] between Portland and Boston/New York City, one of which would occur during peak vehicular demand periods.

Concord Coach Line currently provides six runs between Lewiston/Auburn and Portland each day, running between 5 AM and 11 PM each day. Free parking is available at the Exit 75 Transportation Center. The Concord service between Portland and Lewiston/Auburn is a new service, and existing ridership numbers were not provided by Concord Coach Lines. Therefore, the number of additional passengers traveling from Lewiston/Auburn to Portland was estimated based on information in the MaineDOT 2011 Intercity Feasibility Study[32].

Greyhound provides limited service between Portland and Lewiston/Auburn (1 to 2 trips per day). Fares are comparable with Concord Coach Lines.

It was assumed that interstate bus service would grow unconstrained and not be limited by infrastructure deficits such as inadequate parking or transit connections. One key constraint that was assumed to be addressed as part of this alternative was additional parking at the Portland Transportation Center. Parking is generally at capacity at the Portland Transportation Center. Parking will need to be sizably extended in the future to accommodate additional transit demand identified in this alternative, either through surface lot or parking structure.

[31] Dana Knapp, meeting, 14 February 2018, Portland Transportation Center

[32] Maine Department of Transportation, Portland to Lewiston/Auburn & Montreal Intercity Passenger Rail Feasibility Study (MaineDOT, August 2011)

Figure 6-4: Concord Coach Routes

Potential increases in interstate bus ridership were estimated using two methods – estimating passengers from Concord Coach Line plans for increasing service, and estimating passengers from information in the 2011 Interstate Feasibility Study for ridership from the Lewiston/Auburn area to Portland and points south.

As previously mentioned, Concord Coach Lines currently anticipates future plans to add one new bus trip during the peak periods. If the additional vehicle was a 54-person passenger bus (consistent with the current Concord buses), that would yield a maximum of 54 additional passengers on an interstate bus during the peak hour. It is estimated based on population data that 36 of these users, or 66%, could be removed from the Turnpike.

The 2011 Intercity Feasibility Study estimated that approximately 46,000 trips per year could use transit to commute from the Lewiston/ Auburn area to Portland and points south. To convert these trips to peak hour ridership, it was assumed that the route would operate only on week days and that the peak hour represents 25% of the daily trips, or 46 passenger trips.

Using American Commuting Survey data from the US Census[33], this results in an estimated four peak hour vehicles that would be removed from the Maine Turnpike between Exits 44 and 53. This is due to the vast majority of trips being destined to/from Portland Transportation Center, resulting in minimal trip reductions on the Maine Turnpike. with this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.36). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

The capital costs to add an additional Portland to Boston peak period bus trip for two peak periods was estimated to be approximately $0.6 million in 2017 dollars. No additional capital cost was identified for Portland to Lewiston/Auburn as Concord Coach Lines did not indicate any plans for expansion. With these additional Portland to Boston bus trips, the additional operating and maintenance costs for this alternative would be $0.75 million per year.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- 0.1% reduction in regional vehicle miles traveled (-0.1%);
- Increases Portland area transit ridership by an estimated 100 trips;
- Reduces NOx (-0.1%) and HC (-0.1%), improving air quality;
- No legal or policy obstacles to implementation;
- Can be implemented in a short timeframe; and
- Has a Benefit/Cost ratio of 5.8.

[33] https://www.census.gov/data/tables/time-series/demo/commuting/commuting-flows.html

The key impacts and challenges are the following:

- Has potential wetland impacts; and
- Has a volume to capacity ratio (v/c) that is still greater than one (1.36) on the Maine Turnpike.

6.5.4 Alternative 5a - Public Transportation: New or Improved Regional Bus Service

This alternative assesses the potential for new or improved regional bus services to reduce demands on the Maine Turnpike between Exits 44 and 53. Regional providers included in this alternative are the ZOOM Bus (Biddeford - Portland) and the METRO Breez (Portland - Brunswick). In this alternative, these bus systems were evaluated to determine the effects on:

- Regional bus system ridership with practicable system improvements including more frequent service (reduced bus headways); and
- Vehicular demand on the Maine Turnpike in the Portland Area.

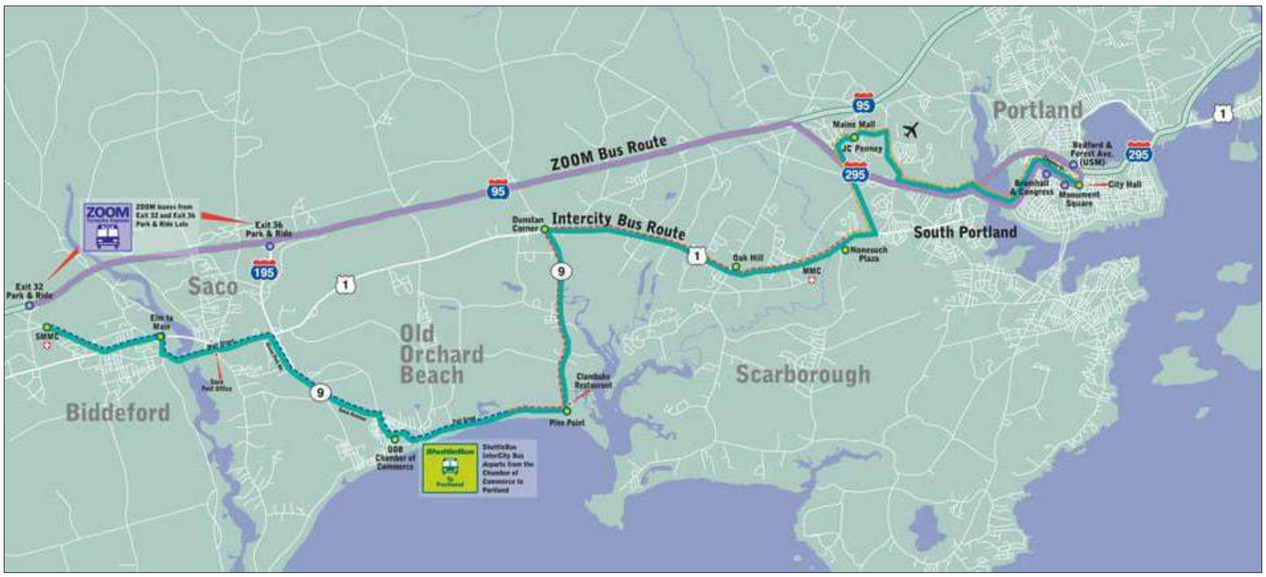

Figure 6-5: Intercity to Portland and Zoom Turnpike Express

For the purposes of this study, the transit network assumed in the Portland Area Comprehensive Transportation System (PACTS) Travel Demand Model for 2040. As shown in Figure 6-5, the Shuttle-Bus ZOOM has two routes that operate within the PACTS region: the Intercity to Portland and the Zoom Turnpike Express. The Intercity to Portland route begins in Biddeford and has routes that follow the coast north through Saco, Old Orchard Beach, Scarborough, and South Portland to Portland with several downtown stops. The Zoom Turnpike Express picks up from Park & Ride lots at Exit 32 (Biddeford) and Exit 36 (Saco) with stops in Downtown Portland. Ridership costs for the Shuttle-Bus ZOOM are $1.50 each way with 10-punch, monthly, and quarterly commuter cards.

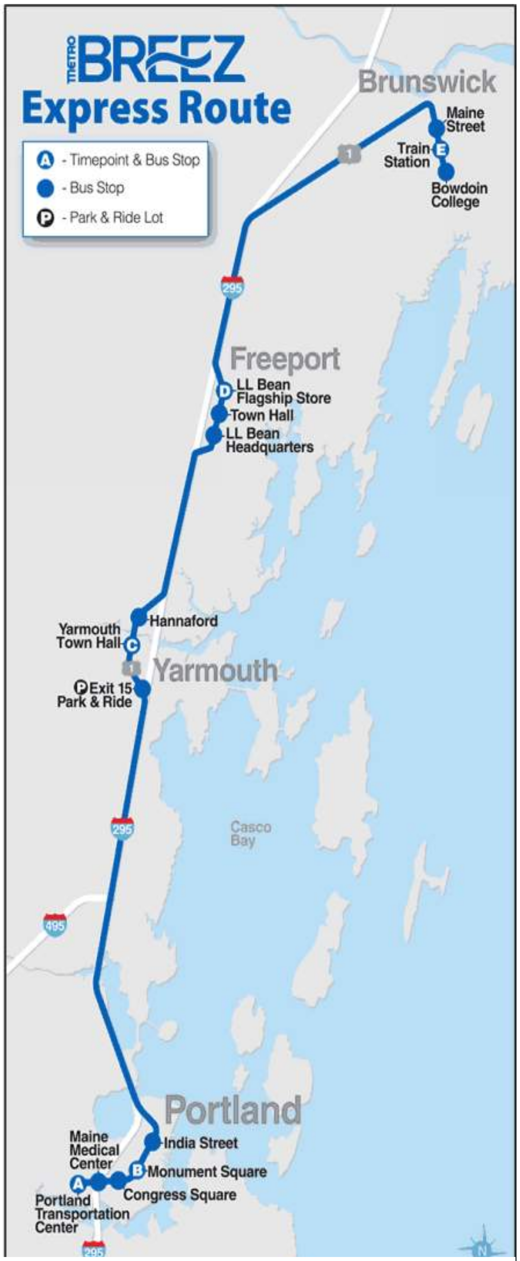

Figure 6-6: Metro Breez Express Routes

Figure 6-6 shows the current existing Metro Breez Express Route. Stops are limited to the Portland Transportation Center, Monument Square, Yarmouth Town Hall, Downtown Freeport, and the Brunswick Train Station. The stops have connections to other local and regional transit options including the Metro Bus, Bowdoin College, proximity to the Yarmouth Park & Ride, and Amtrak/Concord Trailways. Ridership costs range from $1.50 to $3 per person in each direction with discounts for punch cards and reduced monthly passes. It is important to note that neither the Metro Breez nor the Shuttle-Bus ZOOM have regional transit routes that use the Maine Turnpike between Exit 44 and Exit 53.

Bus ridership is dependent on multiple factors, including travel cost, travel time, service, frequency, convenience, the availability of parking at the destination and other personal factors such as vehicle availability and driving capacity. Discussions with regional transit providers helped identify practicable system improvements for these regional bus services. These were assimilated into the PACTS Travel Demand Model used to forecast regional bus ridership. The model provided transit ridership forecasts for all local and regional bus providers, as well as measures such as VMT and VHT.

Two key service and operations assumptions were made for the assessment of Alternative 5a, as described in the sections below.

It was assumed for this alternative that headways along key existing and planned corridors would be reduced to include at least one additional bus during the peak hours. This increased bus frequency resulted in an increased number of passenger trips as forecasted by the PACTS Travel Demand Model. Increased bus passenger trips were then converted to a reduction in vehicle trips based on the PACTS mode share model.

In order to estimate the maximum benefit of this alternative, it was assumed that regional bus service would grow unconstrained and not be limited by infrastructure deficits such as available buses, parking availability, or by failure of implementation of a BRT system. Parking will need to be sizably extended in the future to accommodate additional transit demand identified in this alternative, either through a surface lot to the east or a new parking structure.

As previously discussed, this analysis was conducted assuming increased regional peak hour bus frequency, and reduced travel times with bus rapid transponders. The combination of these improvements would yield a substantial regional increase in bus ridership of 720 new daily transit trips.

However, this substantial increase in ridership would reduce to one trip removed from the Turnpike during the PM Peak Hour from Exit 46-47. This is because the 720 new daily trips would be reduced to a peak hour – approximately 90 (as indicated by the PACTs model), and further reduced to those users who would be removed from the Turnpike. In terms of regional transit, the majority of public transit users would alternately travel on either I-295 and other east-west arterials, with trips originating and culminating in or around the densely populated and employed downtown Portland area. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.37). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

It should be noted that this increased number of trips does provide a reduction in VHT and VMT throughout the region, and is not impeded by legal or policy driven obstacles. The improvements could be implemented within a relatively short time frame; however, there are currently no funding sources for improvements.

The capital costs to add buses to accommodate increased peak hour headways and a bus rapid transit transponder system was estimated to be approximately $3 million in 2017 dollars. With these additional buses and the transponder system, the additional operating and maintenance costs for this alternative would be approximately $1.7 million per year.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- 0.1% reduction in regional vehicle hours traveled (VHT);
- 0.2% reduction in regional vehicle miles traveled (VMT);
- 0.2 % reduction in vehicle emission pollutants;
- 9% increase in transit ridership;
- No potential wetland impacts;
- No legal or policy obstacles to implementation; and
- Can be implemented within a short timeframe.

The key impacts and challenges of Alternative 5 – Local Bus Service are the following:

- A volume to capacity ratio (v/c) that is still greater than one (1.37) on the Maine Turnpike.

6.5.5 Alternative 5b - Public Transportation: New or Improved Local Bus Service

This alternative assesses the potential for new or improved local bus services to reduce demands on the Maine Turnpike between Exits 44 and 53. Local bus providers included in this alternative are Greater Portland METRO and City of South Portland Bus Service. In this alternative, these bus systems were evaluated to determine the effects on:

- Local bus system ridership with practicable system improvements including more frequent service (reduced bus headways), and implementation of a bus rapid transit type system (reduced bus travel times) along key corridors; and
- Vehicular demand on the Maine Turnpike in the Portland Area.

The Metro contains eight routes (shown in Figure 6-7) in the Greater Portland Area. Rides range in price from $1 - $1.50 one-way, with 10-punch, day, and monthly pass options. In addition to these existing Metro Routes, two new routes are planned for Augusta in 2018:

- the Husky Line with service to Gorham, University of Southern Maine (USM) campuses, and downtown Portland; and
- the Blue Line with service from Westbrook to the Maine Mall Area.

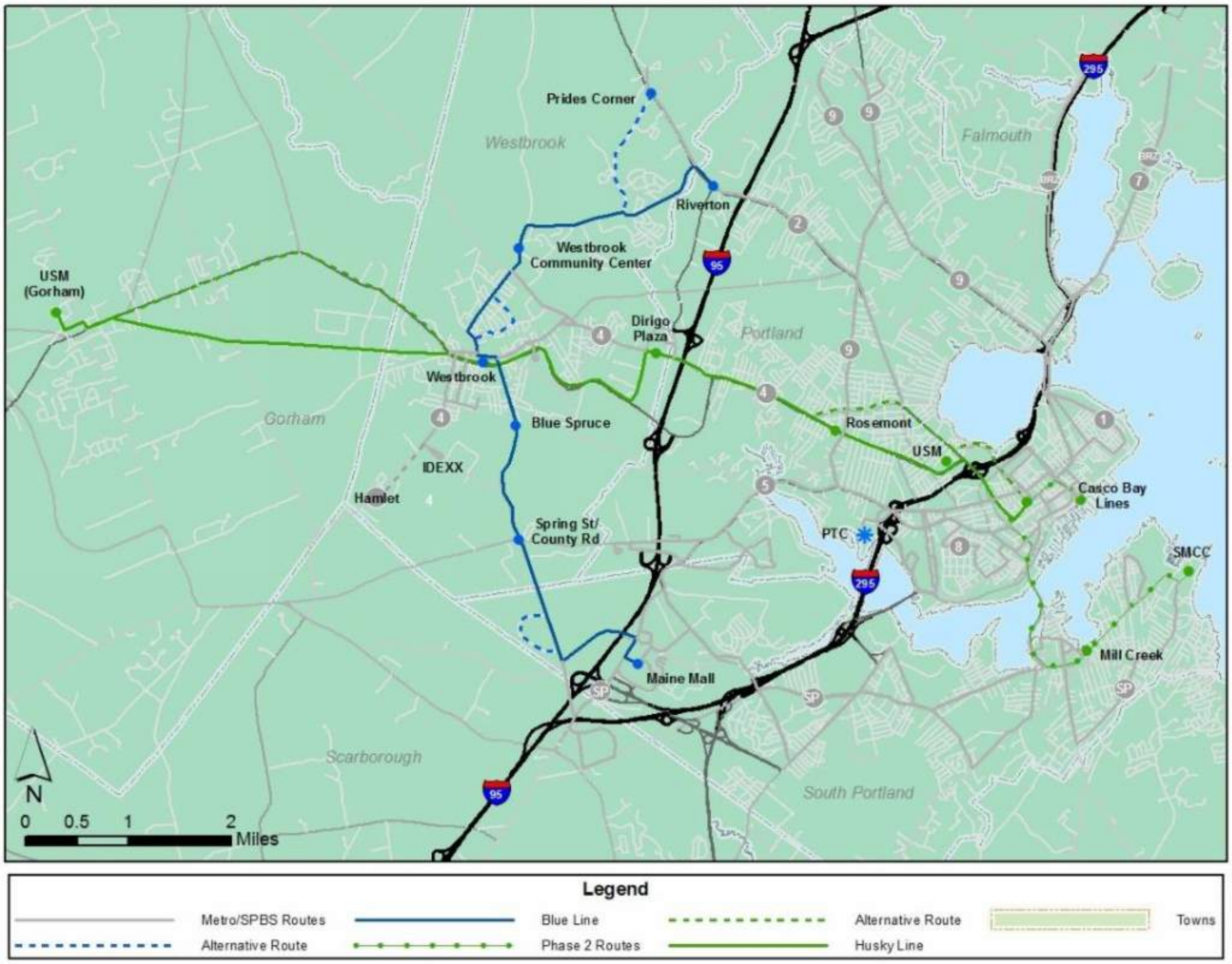

Figure 6-7: Metro Bus Routes

There are three bus routes set by the City of South Portland Bus Service as shown in Figure 6-8. Routes begin to the west from the Mall Area, continuing east to Southern Maine Community College (SMCC), and to the north onto the Portland Peninsula. Full priced fares are $1.50 with discounts and options for 10-ride and monthly passes.

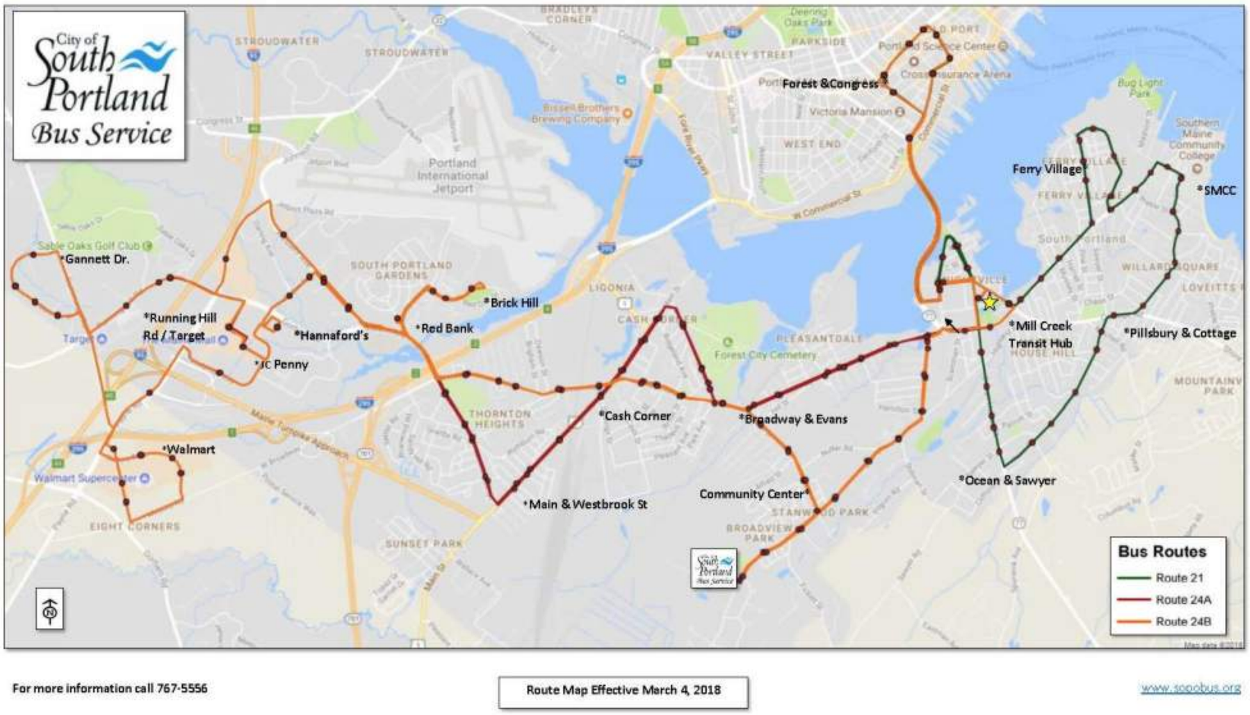

Figure 6-8: City of South Portland Bus Service Routes

While the Portland Metro and South Portland Bus Service both provide transfer opportunities, no local transit routes use the Maine Turnpike between Exit 44 and 53.

Bus ridership is dependent on multiple factors, including travel cost, travel time, service, frequency, convenience, the availability of parking at the destination, and other personal factors such as vehicle availability and driving capacity. Discussions with local transit providers helped identify practicable system improvements for these local bus services. These were assimilated into the PACTS Travel Demand Model used to forecast local bus ridership. The model provided transit ridership forecasts for all local and regional bus providers, as well as measures such as VMT and VHT.

Three key service and operations assumptions were made for the assessment of Alternative 5b, as described in the sections below.

Increased Bus Frequency

Currently, headways for local bus service range from 15 to 60 minutes during peak operating periods. It was assumed for this alternative that headways along key existing and planned corridors would be reduced to 15 minutes[34]. This increased bus frequency resulted in an increased number of passenger trips as forecasted by the PACTS Travel Demand Model. Increased bus passenger trips were then converted to a reduction in vehicle trips based on the PACTS mode share model.

[34] Local Transit Meeting, 26 February 2018, Greater Portland Council of Governments

Bus Rapid Transit Transponder System

To improve the efficiency of the local bus service, the implementation of a Bus Rapid Transit (BRT) type transponder system was assumed. A BRT system provides reduced travel times for local bus systems because the transponder gives buses priority at signalized intersections. It was assumed that the BRT transponder system would provide a ten percent reduction in travel times for buses along key corridors, a reduction consistent with similar transponder type systems at signalized intersections.

Transit Infrastructure

In order to estimate the maximum benefit of this alternative, it was assumed that local bus service would grow unconstrained and not be limited by infrastructure deficits such as available buses, parking availability, or by failure of implementation of a BRT system. Modernization of the Metro fare collection system is planned.

As previously discussed, this analysis was conducted assuming two new planned Portland bus routes, increased local bus frequency, and reduced travel times with bus rapid transponders. The combination of these improvements would yield a substantial regional increase in bus ridership of 2,590 new transit trips per day.

However, this substantial increase in ridership would reduce to three trips being removed from the Turnpike during the PM Peak Hour from Exit 46-47. This is because the 2,590 new daily trips would be reduced to a peak hour – approximately 410 as indicated by the model – and further reduced to those users who would be removed from the Turnpike.

In terms of local and regional transit, the majority of public transit users would alternately travel on either I-295 and other east-west arterials, with trips originating and culminating in or around the densely populated and employed downtown Portland area. Based on this data, the estimated number of vehicles that could be reduced from the peak hour traffic on the Maine Turnpike in the Portland area is approximately 3 vehicles. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.37). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

Additionally, it should be noted that this alternative is not impeded by legal or policy driven obstacles. The improvements could be implemented within a relatively short time frame; however, there are currently no funding sources for improvements beyond the two new Metro Bus Routes.

The capital costs to add buses to accommodate 15 minute was estimated to be approximately $7 million in 2017 dollars. With these additional buses and the transponder system, the additional operating and maintenance costs for this alternative would be $2 million per year.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- 30% increase in transit ridership;
- No potential wetland impacts;
- No legal or policy obstacles to implementation; and
- Can be implemented within a short timeframe.

The key impacts and challenges are the following:

- A volume to capacity ratio (v/c) that is still greater than one (1.37) on the Maine Turnpike; and
- Could reduce toll revenue.

6.5.6 Alternative 5c - Public Transportation: New I-95 Corridor Regional Bus

Currently, all regional bus service for the Greater Portland region provides service directly into and out of downtown Portland. METRO Breez provides bus service from Brunswick, Freeport, and Yarmouth into downtown Portland and the Portland Transportation Center (PTC), while the Shuttlebus ZOOM and Intercity bus provides bus service from Biddeford, Saco, and Old Orchard Beach to the Maine Mall and Downtown Portland.

One region that is not currently served by regional bus are the areas immediately adjacent to the Maine Turnpike between Exits 45 (Maine Mall) and Exit 48 (Riverside Street/Outer Brighton Avenue). During the April 2018 PAC meeting, it was suggested that a new, regional bus service be evaluated that would serve this region – both from the south and north.

Alternative 5c assesses the potential for new regional bus service along I-95 to reduce demands on the Maine Turnpike between Exits 44 and 53. The potential new regional bus service would consist of two separate routes, the southerly route would run from Biddeford/Saco to the I-95 Portland area between Exits 45-48, and the northerly route would run between Gray/West Falmouth to the I-95 Portland area exits 48-45.

Specifically, each regional bus route would stop at the following locations:

- Southern Route: This route would run from Maine Turnpike Exit 32 (Biddeford) and Exit 36 (Saco) Park and Ride lots to the I-95 Portland area with stops at Exit 45 (Maine Mall), Exit 46 (Unum/ Outer Congress Street), Exit 47 (Rand Road) and Exit 48 (Westbrook Crossing). All stops are intended to connect to existing local bus networks.
- Northern Route: This route would run from Maine Turnpike Exit 63 (Gray) and Exit 53 (West Falmouth) Park and Ride lots to the I-95 Portland area with stops at Exit 48 (Westbrook Crossing), Exit 47 (Rand Road), Exit 46 (Unum/ Outer Congress Street) and Exit 45 (Maine Mall). All stops are intended to connect to existing local bus networks.

The I-95 Corridor Regional bus routes and stops are shown in Figure 6-9.

It was assumed that both the I-95 Corridor Regional bus routes would run with 15-minute headways during peak periods and would provide connections to the following METRO and South Portland bus routes[35]:

- Via Exit 47 (Rand Road) and Exit 48 (Westbrook Crossing): METRO Husky Line & METRO Route 4
- Via Exit 46 (Unum/ Outer Congress Street): METRO Route 5
- Via Exit 45 (Maine Mall): South Portland Bus Route 24, METRO Route 5, and METRO Route 3

[35] METRO and South Portland Bus routes were also assumed to run with 15-minute headways as defined in Alternative 5b

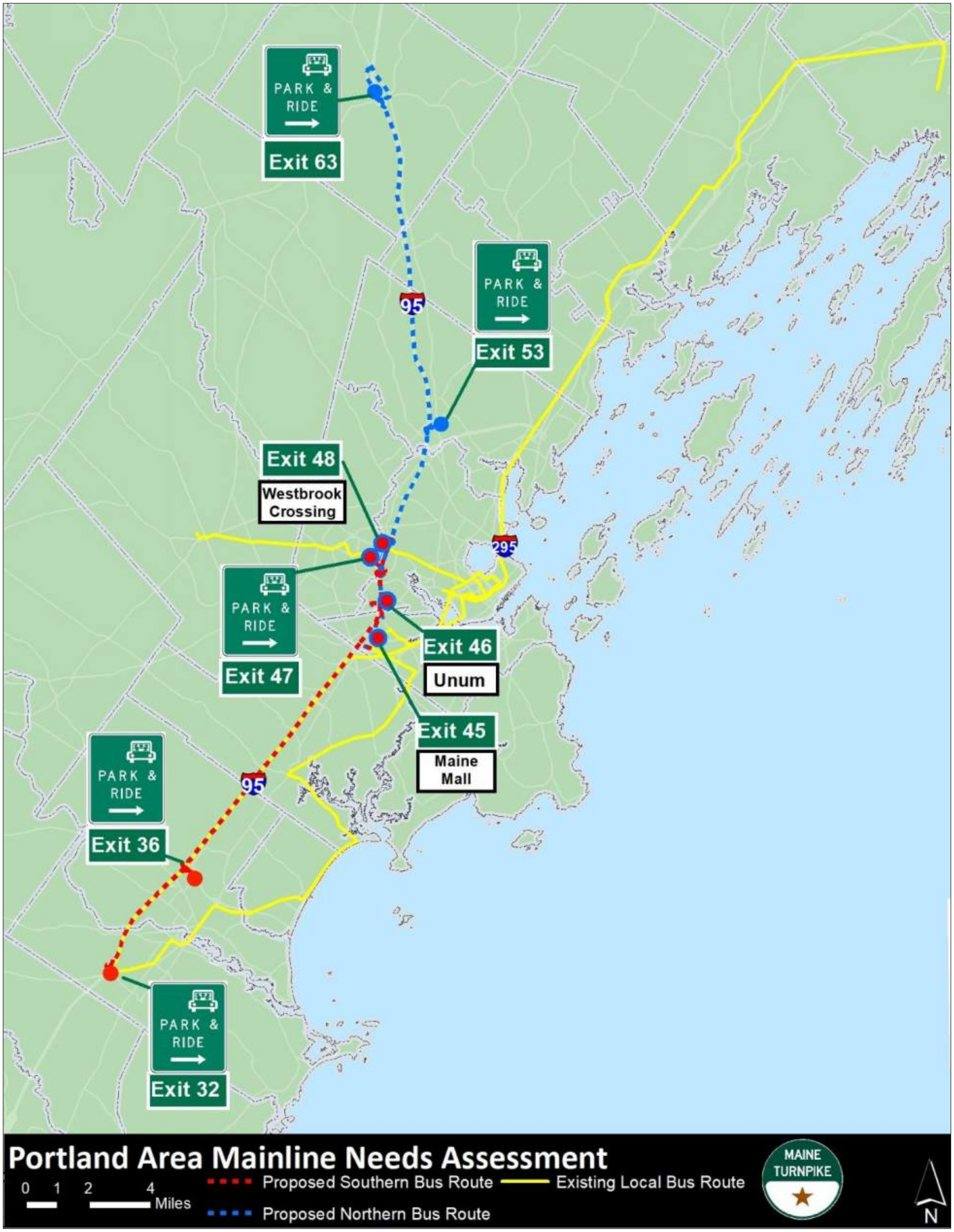

Figure 6-9: Proposed I-95 Regional Corridor Bus Routes

Input from METRO helped identify key assumptions for this regional bus service. This alternative was evaluated using the PACTS Travel Demand Model which helped forecast regional bus ridership and reduction in travel demand along the Maine Turnpike and connecting roadways. The model provided transit ridership forecasts for all local and regional bus providers, as well as measures such as VMT and VHT, and transit ridership estimates.

In order to estimate the maximum benefit of this alternative, it was assumed that the regional bus service would not be limited by infrastructure deficits such as available buses, staff, or parking availability. The following were among the improvements included during this assessment:

- Parking: Park and Ride lot expansion was estimated for all lots that showed greater than 50% occupancy rates in addition to infrastructure such as bus benches and shelters; and
- Buses: 60-foot buses were assumed on the regional portion of the route and 40-foot buses to the local route.

As previously discussed, this analysis was conducted assuming a new regional bus route from Biddeford and Saco from the south and Gray from the north to stops in the Portland area along I-95. According to the PACTS Model, this new bus service would yield a substantial regional increase in bus ridership of 430 new peak hour transit trips with a reduction of 108 trips from the Turnpike.

It should be noted that this increase in bus service does provide a reduction in vehicle hours traveled (VHT) and vehicle miles traveled (VMT) throughout the region, and is not impeded by legal or policy driven obstacles. The bus service could be implemented within a relatively short time frame; however, there are currently no funding sources identified for a new regional bus service.

A new regional bus service as defined for this alternative yielded a substantial regional increase in bus ridership of 430 new transit trips during the peak hour. This will remove 108 vehicles off the Maine Turnpike. Even with this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.34). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 2.1% on the Maine Turnpike;
- An expected reduction of approximately 108 vehicles during the peak hour from Exits 46-47;
- 43% increase in transit ridership;
- Has a Benefit/Cost ratio of 0.56.
- No legal or policy obstacles to implementation; and
- Can be implemented within a short timeframe.

Another key finding from Alternative 5c is the potential for a local, I-95 bus service. The majority of the new transit trips identified for this alternative are forecasted for the Exit 45 to 48 are of both the northern and southern routes. It is recommended that this local, I-95 bus service be further evaluated to determine its potential transportation benefit compared to identified costs.

6.5.7 Alternative 6a - Public Transportation: New or Expanded Commuter Rail Service

Currently in Maine, there is one commuter rail service option, the Downeaster. It is operated by Amtrak and managed by the Northern New England Passenger Rail Authority. Commuter service is provided from Portland south to Boston and from Portland north to Freeport/Brunswick. Based on current projects and studies, the following improvements and new routes were analyzed as part of this alternative (shown in Figure 6-10):

- **Expanded Amtrak Rail Service** including additional trains and track improvements;
- **New Commuter Rail service: Mountain Division** with service to the west as previously evaluated by MaineDOT; and
- **New Commuter Rail Service to Lewiston** with possible future service to Montreal currently being studied by NNEPRA and MaineDOT.

In this alternative, the rail system will be evaluated to determine the effects on:

- commuter rail ridership with practicable system improvements including more available parking, track improvements, and faster service for existing routes in addition to 2 new possible commuter routes; and
- vehicular demand on the Maine Turnpike in the Portland Area.

Currently, the Downeaster has five daily trips from Portland to Boston's North Station during weekdays. There are three daily trips from Portland to Freeport/Brunswick during weekdays. Fares are approximately $50 round trip for Portland to Boston. Increase in number of passengers using commuter rail in the future was estimated based on current ridership numbers[36], planned rail improvements, and improved travel times that would result based on the planned rail improvements. It was assumed that any decrease in travel times from Portland to Boston would result in a corresponding increase in ridership.

[36] Northern New England Passenger Rail Authority, *Annual Report, Fiscal Year 2017, July 1, 2016 – June 30, 2017* (NNEPRA, 2017).

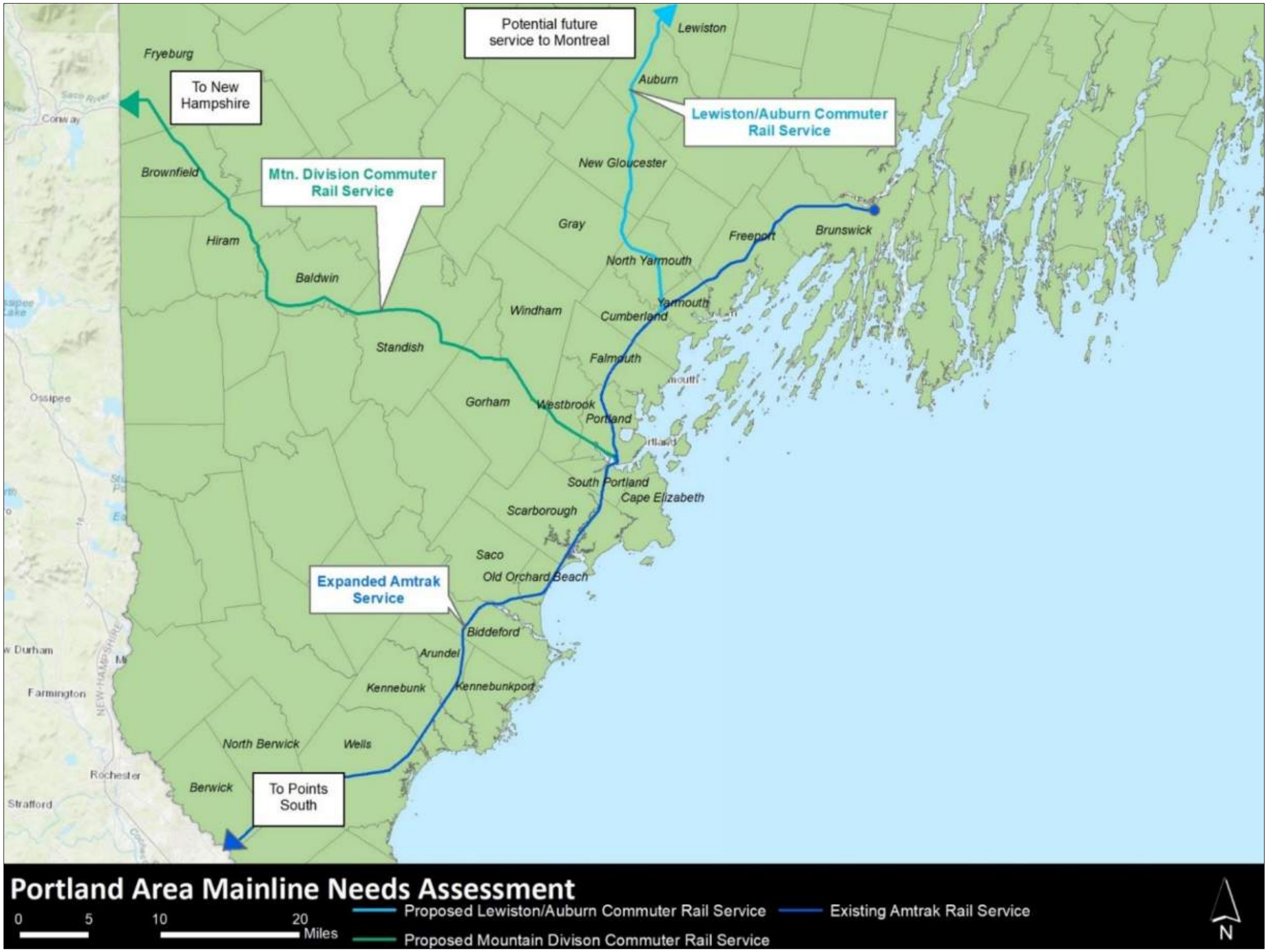

Figure 6-10: Existing and Proposed Commuter Rail Service

Downeaster improvements assumed in this alternative based on information provided by NNEPRA[37] were:

- Reduction in travel times between Boston and Portland of 15 minutes;
- Extension of the siding in Wells and the addition of a second platform;
- Addition of a second boarding track with a center island platform in Portland;
- Completion of the Royal Siding Project by end of 2018, enabling all 5 Downeaster round trips to begin and end in Brunswick (only 3 do currently);
- Additional parking at Portland Transportation Center in conjunction with MaineDOT and Concord Coach Lines (via additional surface parking); and
- Additional peak hour train northbound from Wells into Portland then Freeport/Brunswick. Corresponding train southbound during peak period.

It was assumed that commuter rail ridership would not be limited by infrastructure deficits such as available trains, stations, and tracks. Capital improvement costs identified by NNEPRA and MaineDOT Rail Studies were included in the capital cost estimate for this alternative. In addition, parking is generally at capacity at the Portland Transportation Center. Parking will need to be sizably extended in the future to accommodate additional transit demand identified in this alternative, either through surface lot or parking structure.

Expanded Amtrak Rail Service

Currently, the Downeaster operates five train trips that travel from Portland to Boston. Three of those trips extend to Freeport and Brunswick. To allow more trips north of Portland, the Royal Junction Siding project, which is under construction, will build an additional track that will allow two trains to pass. By the end of 2018, it is assumed that all five train trips will extend to Freeport and Brunswick.

Funding has also been secured for the rehabilitation of the Rockingham Siding located in the town of Newfields, NH. Rehabilitation of this approximately two-mile section of track will increase speeds and improve train operations for the Downeaster, which is expected to increase ridership to Boston. It is expected that the speed could be lowered to from its current 2 hours, 30-minute travel time to 2 hours, 15 minutes – an approximate 11% reduction in travel time. These improved travel times result in similar travel time for rail as to the intercity bus. No additional peak hour trains between Portland and Boston were assumed, as this was not identified by NNEPRA, although a potential train traveling in the opposite direction during peak hours has been discussed.

It was assumed that the reduction in travel time would result in a corresponding increase in commuter rail ridership. Table 6-6 identifies current, future forecasted, and additional ridership forecasts based on improved travel times.

[37] March 1, 2018 and March 5, 2018 emails from Patricia Quinn/NNEPRA to PAM Study team re: Downeaster improvements and ridership/schedule details.

Table 6-6: Estimates of 2040 Annual, Daily, and Peak Hour Commuter Rail Ridership

	Estimated 2040 Annual Ridership[38]	Estimated 2040 Summer Weekday Ridership	Estimated 2040 Summer Peak Hour Ridership
Amtrak Downeaster[39] w/o Improvements	1,076,400	1,765	201
Amtrak Downeaster with Improvements *(North Station to Freeport/Brunswick)*	1,196,000	1,960	223
Portland to Lewiston/Auburn	95,900	390	63
Mountain Division	81,750	330	147

Also shown in Table 6-6, projected 2040 Downeaster summer weekday ridership would increase from approximately 1,760 riders to 1,960 or 11%. Peak hour ridership would increase from approximately 201 to 223 riders. Using Portland area US Census data, this would result in an estimated additional 15 peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53.

Service to Lewiston/Auburn

Ridership forecasts from MaineDOT's 2011 Intercity Feasibility Study[40] were used to forecast future peak hour ridership from Portland to Lewiston/Auburn region. The 2011 Intercity Feasibility Study estimated that up to 46,000 trips per year (2015) would use transit to commute from the Lewiston/Auburn area to Portland and points south. This assumed three roundtrip trains from Portland to Lewiston/Auburn each weekday. By 2040, this would result in almost 400 weekday riders and approximately 60 peak hour riders each way from Portland to Lewiston/Auburn. Table 6-6 provides 2040 daily and peak hour ridership estimates from Portland to Lewiston/Auburn.

Using American Commuting Survey data from the US Census[41], this would result in an estimated five peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53. This is due to the vast majority of trips being destined to/from Portland Transportation Center, resulting in minimal trip reduction on the Maine Turnpike.

Use of the Mountain Division Rail Route

MaineDOT's 2007 Mountain Division Rail Study[42] ridership forecasts were used to determine future peak hour ridership to Standish and Windham along the Mountain Division line. The Study estimated that approximately 90 trips per peak period could use transit to commute from Standish and Windham along

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[38] Assumes 3% per year increase.
[39] North Station/Boston to Freeport/Brunswick.
[40] Maine Department of Transportation, *Portland to Lewiston/Auburn & Montreal Intercity Passenger Rail Feasibility Study* (MaineDOT, August 2011).
[41] https://www.census.gov/data/tables/time-series/demo/commuting/commuting-flows.html.
[42] Maine Department of Transportation, *Mountain Rail Division Rail Study, Report on Potential Uses and Implementation Costs* (MaineDOT, December 2007).

the Mountain Rail line to Portland. This would increase to approximately 150 trips by 2040. Table 6-6 provides 2040 daily and peak hour ridership estimates from Standish/Windham to Portland.

From the American Commuting Survey data from the US Census, this would result in an estimated six peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53. Again, this is due to the vast majority of trips being destined to/from Portland, resulting in minimal trip reductions on the Maine Turnpike.

In Summary, the estimated number of vehicles that could be reduced from the peak hour traffic on the Maine Turnpike in the Portland area with new and expanded commuter rail service is 26 – less than 1 % of the peak hour traffic between Exits 46 and 47. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.36). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

The alternative is not without benefit regionally however, while the peak hour ridership removes relatively small numbers of vehicles from the Turnpike between Exits 44 and 53, there would be substantial annual ridership increases for each of the proposed rail improvements:

- Downeaster Improvements: approximately 120,000 additional riders per year;
- Portland to Lewiston/Auburn Route: approximately 100,000 riders per year; and
- Mountain Division Route: approximately 80,000 riders per year.

Capital Costs for the new/expanded Commuter Rail Service would be approximately $208 million in 2018 dollars and includes the following elements:

- Cost to rehabilitate the Rockingham Siding to improve travel times - $1.6 million;
- Cost to build Royal Junction Siding to improve travel times - $9.4 million;
- Costs to add another train to Brunswick/Freeport - $2 million;
- Cost to build the Lewiston/Auburn commuter rail line - $100-$250 million;
- Cost to build the Mountain Division commuter rail line - $42 million; and
- Costs to add another train to Brunswick/Freeport - $2 million.

Operation and Maintenance Costs for the new/expanded Commuter Rail Service would be approximately $17.2 million and includes the following elements:

- Additional operating and maintenance costs for adding another train trip to Brunswick/ Freeport – $7.3 million;
- Additional operating and maintenance costs for a Lewiston/Auburn commuter rail line – $5.9 million; and
- Additional operating and maintenance costs for a Mountain Division commuter rail line – $4 million.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- 0.5% reduction in regional vehicle mile traveled (VMT);
- 0.3% reduction in regional vehicle hours traveled (VHT);
- 23% increase in transit ridership; and
- Reduction in NOx (-0.5%) and HC (-0.4%), improving air quality.

The key impacts and challenges are the following:

- A volume to capacity ratio (v/c) that is still greater than one (1.36) on the Maine Turnpike;
- Potential wetland impacts; and
- Potential for lost revenue on Maine Turnpike.

6.5.8 Alternative 6b - Local Commuter Rail Service

Operated by Amtrak and managed by the Northern New England Passenger Rail Authority, the current intercity rail service in Maine is the Downeaster. Commuter rail service in the region is provided from Portland south to Boston and from Portland north to Freeport/Brunswick. This alternative evaluates a potential local commuter rail service that can run along existing or previously operated rail lines. Based on current projects and studies, the following local new routes were analyzed as part of this alternative:

- **New Commuter Rail Service: Mountain Division** with local service from the Portland Transportation Center to Westbrook utilizing the Mountain Division rail line;
- **New Commuter Rail service: West Falmouth** with local service from the Portland Transportation Center to the Exit 53 area in West Falmouth utilizing the existing Pan Am rail line; and
- **New Commuter Rail Service: Biddeford/Saco** with service from the Portland Transportation Center to Biddeford and Saco utilizing existing Amtrak rail.

This alternative will be evaluated to determine the effects on:

- Commuter rail ridership associated with the rail line extensions mentioned above and practicable system improvements including more available parking and track improvements; and
- Change in vehicular demand on the Maine Turnpike in the Portland Area.

Figure 6-11 shows the two potential new local commuter rail service lines and the addition of rail service to Biddeford/Saco. It was assumed that commuter rail ridership would not be limited by infrastructure deficits such as available trains, tracks, parking, etc. Capital improvement costs identified by NNEPRA and MaineDOT Rail Studies were included in the Capital Cost Estimate for this alternative. Because parking is generally at capacity at the Portland Transportation Center, parking will need to be sizably extended in the future to accommodate additional transit demand identified in this alternative. While possible parking improvements can be made through additional surface lot area or a new parking structure, capital costs of this alternative include expansion through additional surface lot area.

Commuter rail improvements assumed:

- For all alternatives:
    - Additional surface area parking at Portland Transportation Center in conjunction with Concord Coach Lines; and
    - Increased local and regional transit headways consistent with other alternatives evaluated.

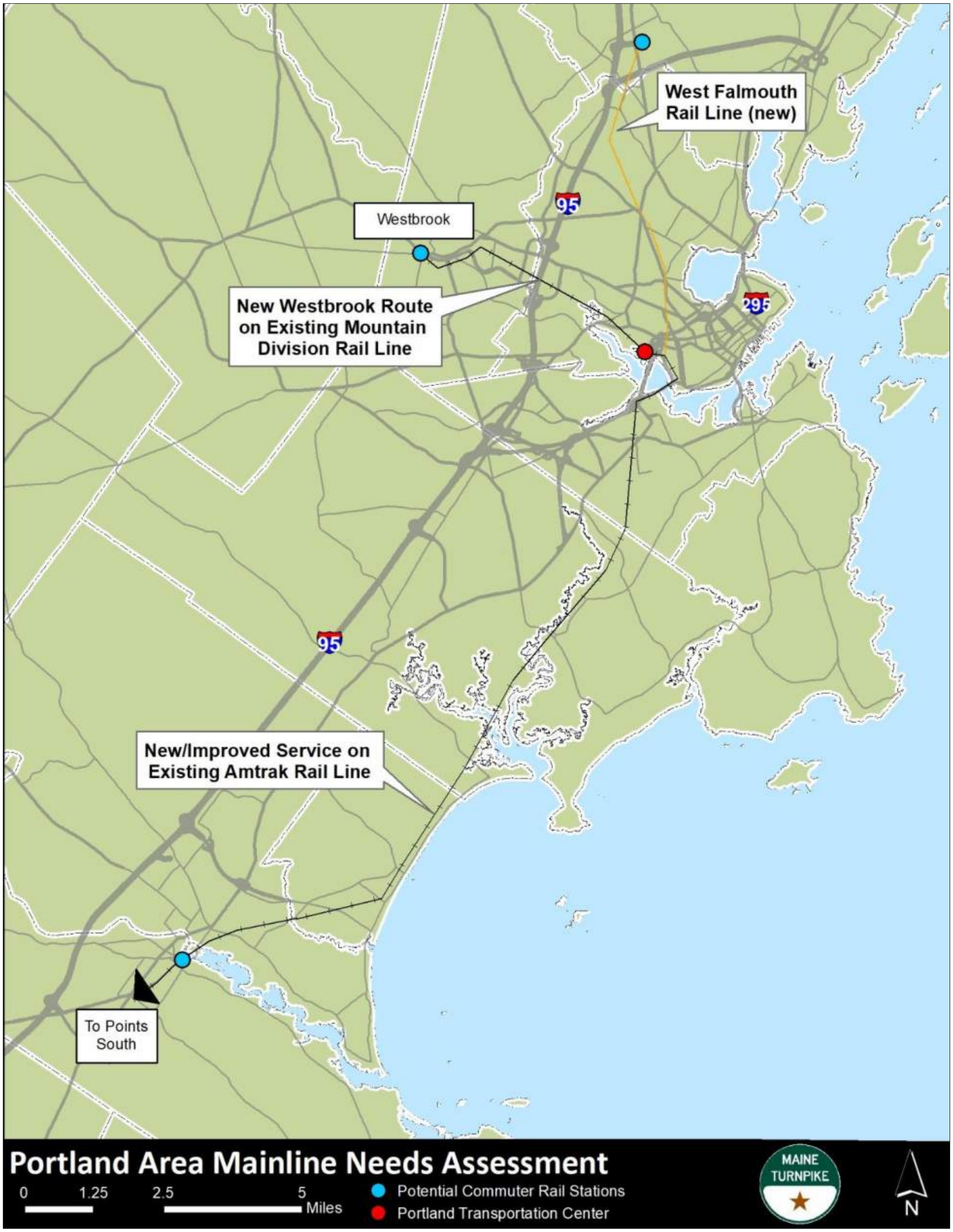

Figure 6-11: Proposed Local Commuter Rail

- For service to Westbrook:
  - Construction of two stations on the Mountain Division Line – one at Main Street, one at Larrabee Road;
  - Upgrades to the existing Mountain Division rail line; and
  - A new engine and passenger car.
- For service to West Falmouth:
  - Construction of a station with associated park and ride lot at a site in West Falmouth; and
  - A new engine and passenger car.
- For service to Biddeford:
  - A new engine and passenger car.

The local commuter rail assumptions were assimilated into the PACTS Travel Demand Model used to forecast regional transit ridership assuming improvements to local and regional systems outlined in **Alternative 5**. The model provided transit ridership forecasts for all local and regional bus and rail providers, as well as measures such as vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT).

The **Portland to Westbrook** line showed the greatest success of the local commuter rail alternatives. The PACTS Travel Demand Model estimated approximately 356 transit trips per day and 40 transit trips in the peak hour as a result of a local commuter rail line from Westbrook to Portland. This assumed that the trains were operating with 30-minute headways during the peak hours each weekday. This additional transit usage would result in an estimated 42 peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53.

From **Portland to West Falmouth**, the PACTS Travel Demand Model estimated approximately 82 transit trips per day and 10 transit trips in the peak hour as a result of a local commuter rail line from West Falmouth area to Portland. This additional transit usage would result in an estimated 11 peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53.

From **Portland to Biddeford**, the PACTS Travel Demand Model estimated approximately 35 transit trips per day and two transit trips in the peak hour as a result of the addition of local commuter rail service from Biddeford to Portland. This additional commuter rail service is anticipated to generate limited ridership because the regional bus service, ZOOM, is faster and goes directly to downtown Portland (instead of the Portland Transportation Center). This additional transit usage would result in an estimated two peak hour vehicles removed from the Maine Turnpike between Exits 44 and 53, meaning every trip taken from Biddeford would likely reduce a trip from the Turnpike.

The estimated total number of vehicles that could be reduced from the peak hour traffic on the Maine Turnpike in the Portland area with new and expanded commuter rail service is 55 – about 2% of the peak hour traffic between Exits 46 and 47. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.35). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

Capital Costs for the new/expanded Commuter Rail Service would total approximately $68.5 million in 2018 dollars and include the following elements:

- Cost to build the Mountain Division commuter rail line to Westbrook - $2.6 million;
- Cost to build the commuter rail line to West Falmouth - $19.4 million;
- Cost to add local commuter rail service to Biddeford – $12.2 million; and
- Additional Capital Cost: Cost to increase local and regional service headways - $11 million.

Operation and Maintenance Costs for the new Commuter Rail Service would be approximately $9 million and include the following elements:

- Additional operating and maintenance costs for a Westbrook commuter rail line via Mountain Division – $0.9 million;
- Additional operating and maintenance costs for a West Falmouth commuter rail line – $1.3 million;
- Additional operating and maintenance costs for additional local commuter rail service to Biddeford - $3.1 million; and
- Additional Operating and Maintenance Cost: Cost to increase local and regional service headways - $3.7 million.

New commuter rail service as defined for this alternative yielded a substantial increase in daily rail ridership. This is summarized by each commuter rail line as follows:

- Portland to Westbrook via Mountain Division – approximately 356 riders per weekday.
- Portland to West Falmouth – approximately 82 riders per weekday; and
- Portland to Biddeford – approximately 35 riders per weekday

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 1.5% on the Maine Turnpike;
- An expected reduction of approximately 72 vehicles during the peak hour;
- 0.4% reduction in regional VMT;
- 0.3% reduction in regional VHT;
- 38% increase in transit ridership; and

The key impacts and challenges are the following:

- A volume to capacity ratio (v/c) that is still greater than one (1.35) on the Maine Turnpike;
- Potential wetland impacts; and
- Potential for lost revenue on Maine Turnpike.
- Has a Benefit/Cost ratio of 0.17.

6.5.9 Alternative 7 - Freight Rail Service

Freight is currently moved using four modes of transportation: rail, truck, air, and water. Truck freight is the most common, with approximately 86 percent of the tonnage moved within the state of Maine being transported by trucks[43]. This alternative focused on the possibility of converting freight movement by truck to freight movement by rail. Truck trips greater than 500 miles are good candidates for possible conversion to rail[44]. However, other factors must also be taken into consideration, including freight content and time-of-delivery requirements. In this alternative, the freight rail system was evaluated to determine the effects on:

- Current number of truck trips greater than 500 miles, and the viability of converting them to freight rail assuming practicable improvements; and
- Future truck trips from the Maine Turnpike within the Portland study area.

To determine the potential truck freight that can be converted to freight rail, the potential market of commercial vehicles that may be able to shift to other modes was estimated. The estimated commercial truck traffic during the 2040 PM peak hour on the Maine Turnpike between Exits 46 and 47is 3%. The number of commercial vehicle trips that travel greater than 500 miles was determined from the information in the 2010 Origin and Destination Study[45]. In the peak hour, approximately 5%, or 7 trucks are estimated to make trips longer than 500 miles, which represents the potential market that may divert to freight rail.

The total potential number of commercial vehicle trips that could be converted to freight rail is a maximum of 13 trips during the peak hour. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.36). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

It was assumed that improved freight rail infrastructure (double track, intermodal facilities) was in place to accommodate this volume of new freight traffic and that the type of goods, timing and costs would be compatible for conversion. Figure 6-12 shows the existing and potential freight rail lines. The capital costs to add additional infrastructure to accommodate increased freight rail in terms of implementing the Mountain Division Line is $31.3 million. The additional operating costs for the additional infrastructure is $8.8 million.

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[43] MaineDOT, *Maine Integrated Freight Strategy, Final Report* (Cambridge Systematics, November 2017)
[44] Massachusetts Institute of Technology, *Rail Services in New England* (Center for Transportation Studies, April 1992)
[45] Maine Turnpike Authority, *2010 Origin - Destination Survey Summary Report* (HNTB Corp., June 2011)

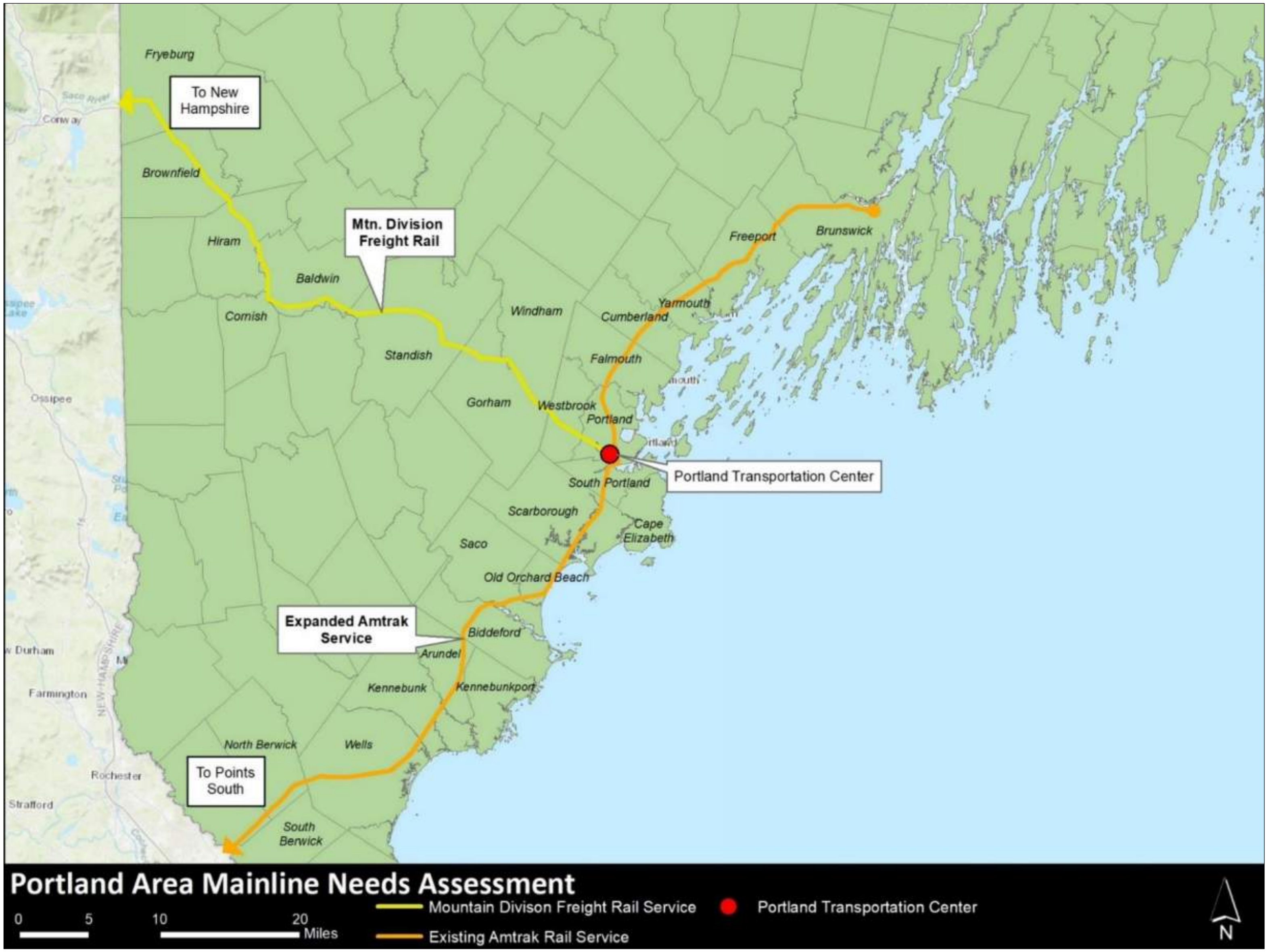

Figure 6-12: Existing and Potential Freight Rail Line

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- 0.6% reduction in regional VMT;
- 0.4% reduction in regional VHT;
- Reduction in NOx (-0.6%) and HC (-0.5%), improving air quality;
- No legal or policy obstacles to implementation; and
- Has a Benefit/Cost ratio of 1.8.

The key impacts and challenges are the following:

- A volume to capacity ratio (v/c) that is still greater than one (1.36) on the Maine Turnpike;
- Potential wetland impacts;
- No capital and operations/maintenance cost funding viability; and
- Potential toll revenue loss.

Alternative 8 - Land Use Scenario

Aligning transportation and land use decisions is difficult, mostly because the decisions for each are made in different ways. The backbone of the transportation system – roads, interchanges, rail, transit, airports – are regionally connected and are funded and maintained primarily by State and Federal funds. Land use decisions, on the other hand, are typically made one at a time, and are driven by local control. These decisions are largely in the hands of individual property owners and local officials.

Numerous studies, but locally and nationally, have shown that planned changes in land use patterns using the 4 D's (density, distance, diversity, design) can result in both a reduction in travel demand and an increase in transit ridership. While previously noted that land use is primarily under control of municipalities, recent efforts as part of a regional partnership known as *Sustain Southern Maine*[46], funded by the U.S. Department of Housing and Urban Development (HUD) and administered by GPCOG, have sought to address the decentralization of urban centers that lead to such critical issues as rising personal transportation costs, limited transportation options, and lack of diverse and affordable housing. The *Sustain Southern Maine* work focused on identifying centers of opportunity throughout the region - areas where an existing level of density and/or commercial activity could, with the appropriate zoning, act as a catalyst to increase growth within a more contained area. These denser, village-like centers would then lend themselves to be part of a more efficient public transit system.

Currently, land use in the Greater Portland region is dominated by low-density development. Figure 6-13 shows the identified land use patterns for the 17 PACTS region communities.

For Alternative 8, the Study Team assessed the benefits of an alternative pattern of growth and development that was originally identified and quantified under the Gorham East-West Corridor Study[47].

The key component of this alternative consists of:

- Allocation of current population and employment forecasts into specific growth areas within the PACTS region previously identified in the Gorham East-West Corridor Study[48]. These allocations were based on a modified distribution of population and employment growth designated as the Urban and Rural form. These growth areas served as a starting point for the identified centers of opportunity in *Sustain Southern Maine.*

Evaluation of Alternative 8 is based on the approach followed under the Gorham East-West Corridor Study and is consistent with the approach used to create multiple pilot centers in *Sustain Southern Maine*.

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[46] http://sustainsouthernmaine.org/about-us/
[47] Maine Turnpike Authority, *Gorham East-West Corridor Feasibility Study*, (HNTB, March 2010)
[48] Ibid.

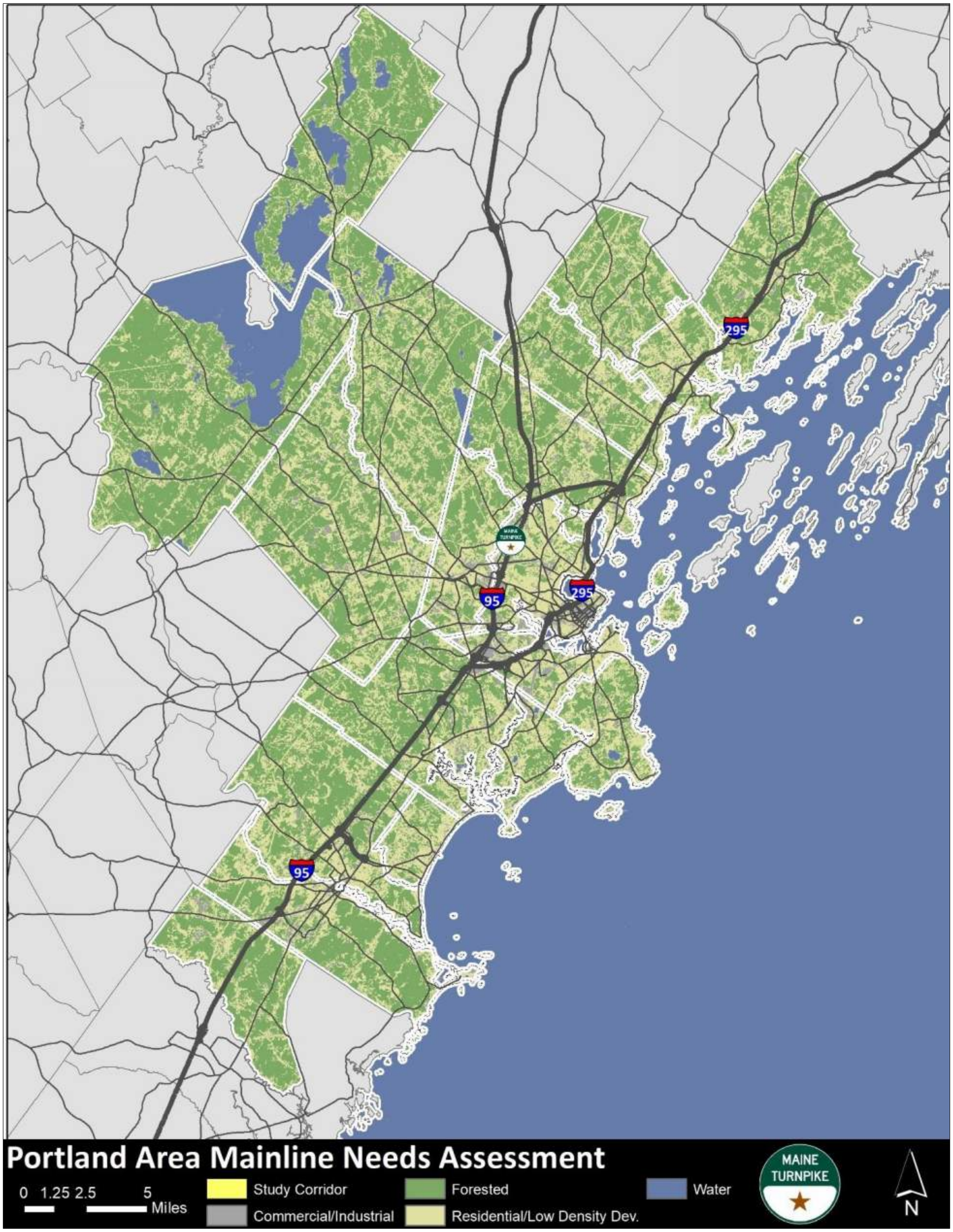

Figure 6-13: Land Use Patterns

In order to estimate the maximum potential benefit, future distribution of job, population, and dwelling unit growth identified as the Urban and Rural form as part of the Gorham East-West Corridor Study,[49] was used as the demographic base for the PACTS Travel Demand Model. This allocation of jobs, population, and dwelling unit growth compared to the current, low density form trends is shown in Table 6-7 below.

Table 6-7: Distribution of Growth[50] - Current Low-Density Form vs. Urban and Rural Form

	Targeted Shares of Regional Growth		
	Urban Communities	**Inner Suburbs**	**Outer Suburbs**
Job Growth: current low-density trend	66% (16,500)	30% (7,400)	4% (1,000)
Job Growth: Urban and Rural form	65% (16,200)	30% (7,400)	5% (1,300)
Population Growth: current low-density form	5% (3,500)	61% (39,400)	34% (21,600)
Population Growth: Urban and Rural form	34% (21,900)	49% (31,800)	17% (10,800)
Dwelling Unit Growth: current low-density form	9.5% (3,300)	52% (18,200)	38.5% (13,400)
Dwelling Unit Growth: Urban and Rural form	35% (12,200)	45% (15,700)	20% (7,000)

As seen from Table 6-7, there would be a sizable increase in population and dwelling unit growth in the Urban communities under the Urban and Rural form. Conversely, there would be a notable decrease in population and dwelling unit growth in the Inner and Outer Suburbs. Distribution of job growth was not assumed to change by any notable measure.

Using this Urban and Rural form distribution, the PACTS Travel Demand Model was run with current job, population, and housing growth to determine the transportation impacts/benefits and increases in transit ridership for the Maine Turnpike and non-Turnpike roadways, as well as increased transit ridership.

It should be noted that, while the quantified benefits of improved land use are identified here and in numerous other studies locally and nationally, the needed land use change would be sizable and the timetable to implement unknown. Achieving the needed shifts in population and housing growth identified in Table 6-7 by Year 2040 will be unlikely and require aggressive municipal land use change.

Implementation of planned land use to achieve the identified distribution of growth as defined for this alternative yielded a substantial regional increase in bus ridership of 225 new transit trips during the peak hour. This will remove 92 vehicles off the Maine Turnpike. Even with this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.34). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

[49] Ibid, page 3-5 and 3-6
[50] Years 2009-2035

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 1.8% on the Maine Turnpike;
- A peak hour demand reduction of 92 vehicles on the Turnpike;
- A reduction of 60 miles of roadway in the region that are near or over capacity;
- Potential increase in transit ridership of 23%;
- Significant reduction in NOx (-4.1%) and HC (-4.3%), improving air quality;
- Has a Benefit/Cost ratio of 1.72; and
- Timeframe to implement is unknown. Local municipalities would need to adopt aggressive land use and zoning changes.

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6.6 Transportation System Alternatives

TSM strategies use the capacity of transportation infrastructure without increasing its physical size. TSM techniques are typically used in the context of roadways and may include changes to traffic signals, such as signal coordination or introducing ramp metering. The TSM alternatives evaluated for the PAM Study are:

- Ramp Metering
- HOV/HOT lanes
- Reversible Lane

TSM strategies can also include intelligent Transportation Systems (ITS) and enforcement. These TSM strategies were not specifically analyzed for the PAM Study but are discussed in Section 5-9, Alternatives Considered but not Analyzed.

6.6.1 Alternative 9a - Ramp Metering

A ramp meter is a traffic signal placed on an on-ramp that turns green for a few seconds and then red for a few seconds. The signals generally allow between one to three vehicles through per green light. This creates breaks in the line of entering vehicles, which can improve traffic conditions on the mainline of the freeway. Ramp metering is used across the country to control the traffic entering a freeway. States that use ramp meters include Washington, California, North Carolina, Minnesota, Arizona, and Nevada.

To analyze this alternative, the Study Team assumed that ramp meters would be placed on appropriate ramps and lanes would be added to those ramps where needed based on best practices. The Study Team also performed a traffic simulation analysis with the software VISSIM to determine the traffic signal timing that would be needed to restrict an adequate amount of ramp traffic so that the mainline would operate under-capacity.

Currently, there is no national engineering standard for ramp meter warrants. (A warrant is a description of the conditions that need to be in place in order to install a specific traffic device, i.e., a certain amount of traffic is required before a traffic signal is "warranted.") However, some states have adopted their own set of warrants. For this analysis, the ramp meter warrants of the Nevada Department of Transportation[51] were used to determine at which ramps to place a ramp meter, as their warrants included those for traffic volume thresholds. Specifically, the traffic volume warrant was used to determine which locations were appropriate for the placement of a ramp meter. That warrant threshold, for a freeway section with two mainline lanes in one direction, is 2,650 vehicles per hour (vph); with three mainline lanes in one direction it is 4,250 vph.

The California Ramp Meter Design Manual[52] states that "ramp meters have practical lower and upper output limits of 240 and 900 [vehicles per hour] per lane, respectively. Ramp meter signals set for flow

[51] Nevada Department of Transportation, *Managed Lanes and Ramp Metering Manual, Part 2: Implementation Plan* (Jacobs Engineering Group Inc., December 2013)

[52] Traffic Operations Program, Design and Local Programs, and Department of California Highway Patrol, *Ramp Meter Design Manual* (January 2000)

rates outside this range tend to have high violation rates and cannot effectively control traffic.” Therefore, on-ramps with less than 240 vehicles were not selected for a ramp meter installation. Further, on-ramps with more than 900 vehicles were assumed to need two ramp lanes to accommodate ramp meter volumes.

VISSIM is a behavior-based traffic simulation model. It is a reliable and widely used engineering tool to assess complex traffic flows that involve extensive merging, diverging, and weaving. VISSIM models were set up using different signal timing scenarios to determine the throughput of traffic on the chosen ramps. These throughput numbers were then used to determine the traffic reductions that could be attained from ramp metering.

Traffic Impact Analysis

In the design hour analysis, ramp meter locations were assumed with a goal of limiting the on-ramp traffic to the point where the mainline traffic would be under capacity. Table 6-8 and Table 6-9 show the forecasted design hour traffic on the Maine Turnpike and the resulting reductions due to ramp meters. The outlined boxes represent the mainline traffic volume that is most overcapacity. Shaded rows represent the mainline sections of roadway. The other rows represent the on and off-ramps. The ramp reductions are shown for those locations that would need a ramp meter because they are upstream of the Maine Turnpike mainline section with the highest peak hour traffic volume.

Table 6-8: AM Design Hour Traffic with Ramp Meters

	2040 Traffic	2040 with Ramp Meters	Ramp Reduction		2040 Traffic	2040 with Ramp Meters	Ramp Reduction
Exit 36 NB on	2,499	1,443	1,056	**Exit 36 SB off**	906	811	
Exits 36-42	6,047	4,991		**Exits 36-42**	3,506	3,139	
Exit 42 NB off	505	416		**Exit 42 SB on**	312	312	
Exit 42 NB on	496	402	94	**Exit 42 SB off**	332	294	
Exits 42-44	6,038	4,976		**Exits 42-44**	3,526	3,120	
Exit 44 NB off	1,687	1,390		**Exit 44 SB on**	1,165	1,165	
Exits 44-45	4,351	3,586		**Exits 44-45**	2,360	1,955	
Exit 45 NB off	1,557	1,283		**Exit 45 SB on**	402	402	
Exit 45 NB on	687	687		**Exit 45 SB off**	1,262	1,001	
Exits 45-46	3,482	2,990		**Exits 45-46**	3,221	2,554	
Exit 46 NB off	1,065	915		**Exit 46 SB on**	236	236	
Exit 46 NB on	310	310		**Exit 46 SB off**	1,581	1,228	
Exits 46-47	2,727	2,386		**Exits 46-47**	4,566	3,547	
Exit 47 NB off	623	545		**Exit 47 SB on**	605	402	203
Exit 47 NB on	380	380		**Exit 47 SB off**	257	204	
Exits 47-48	2,484	2,221		**Exits 47-48**	4,218	3,349	
Exit 48 NB off	760	680		**Exit 48 SB on**	923	660	263
Exit 48 NB on	321	321		**Exit 48 SB off**	636	519	
Exits 48-52	2,044	1,862		**Exits 48-52**	3,931	3,208	
Exit 52 NB off	510	464		**Exit 52 SB on**	823	516	307
Exit 52 NB on	178	178		**Exit 52 SB off**	374	324	
Exits 52-53	1,712	1,575		**Exits 52-53**	3,482	3,016	
Exit 53 NB off	598	550		**Exit 53 SB on**	1,191	725	466

Table 6-9: PM Design Hour Traffic with Ramp Meters

	2040 Traffic	2040 with Ramp Meters	Ramp Reduction		2040 Traffic	2040 with Ramp Meters	Ramp Reduction
Exit 32 NB on	1,460	1,032	428	**Exit 32 SB off**	1,761	1,487	
Exits 32-36	5,471	5,044		**Exits 32-36**	5,771	4,874	
Exit 36 NB off	1,225	1,129		**Exit 36 SB on**	916	916	
Exit 36 NB on	962	725	238	**Exit 36 SB off**	1,774	1,446	
Exits 36-42	5,208	4,639		**Exits 36-42**	6,629	5,404	
Exit 42 NB off	530	472		**Exit 42 SB on**	703	516	187
Exit 42 NB on	517	362	155	**Exit 42 SB off**	479	395	
Exits 42-44	5,195	4,529		**Exits 42-44**	6,405	5,283	
Exit 44 NB off	1,761	1,535		**Exit 44 SB on**	2,514	1,787	727
Exits 44-45	3,434	2,994		**Exits 44-45**	3,890	3,496	
Exit 45 NB off	1,104	962		**Exit 45 SB on**	908	721	187
Exit 45 NB on	1,638	1,032	606	**Exit 45 SB off**	762	709	
Exits 45-46	3,968	3,064		**Exits 45-46**	3,744	3,484	
Exit 46 NB off	357	276		**Exit 46 SB on**	758	601	156
Exit 46 NB on	1,307	804	503	**Exit 46 SB off**	572	552	
Exits 46-47	4,917	3,592		**Exits 46-47**	3,558	3,434	
Exit 47 NB off	612	447		**Exit 47 SB on**	462	402	60
Exit 47 NB on	282	282		**Exit 47 SB off**	203	199	
Exits 47-48	4,587	3,427		**Exits 47-48**	3,299	3,231	
Exit 48 NB off	935	698		**Exit 48 SB on**	972	904	68
Exit 48 NB on	494	494		**Exit 48 SB off**	392	392	
Exits 48-52	4,147	3,223		**Exits 48-52**	2,719	2,719	

The Portland Area Comprehensive Transportation System (PACTS) Travel Demand Model was run with the traffic volume restrictions shown in Table 6-8 and Table 6-9 to determine the traffic impacts on the Portland area roadways for 2040. The traffic impacts identified included changes in traffic volumes on I-95 and key arterials, and changes in vehicle miles travelled (VMT) and vehicle hours travelled (VHT) for the Portland area.

Installing ramp meters and limiting traffic onto the Maine Turnpike provided benefits to safety and mobility on the Maine Turnpike, but negatively impacted off-Turnpike roadways and intersections. A summary of key transportation findings includes:

- Improved safety benefits on the Maine Turnpike through anticipated reduction in traffic volumes on the Maine Turnpike;
- Improve mobility with improved LOS and V/C ratios on all sections of the Maine Turnpike between Exits 44 and 53; and
- Adverse impacts to off-Turnpike roadways, notably traffic queues on the ramps that spill back to the toll plazas and to the roadways and intersections immediately adjacent to the Maine Turnpike between Exits 32 and 53. (Figure 6-14 shows a VISSIM simulation of ramp meter installation at the Exit 48 Southbound on-ramp which shows queues from the ramp meter extending through the toll plaza.) Specifically, the following ramps are expected to have a queue greater than 1500 feet in one or both design hours:
    - Exit 36 NB on
    - Exit 42 NB on and SB on

- Exit 44 SB on
- Exit 45 NB on
- Exit 46 NB on
- Exit 47 SB on
- Exit 48 SB on
- Exit 52 SB on
- Exit 53 SB on

Figure 6-14: VISSIM Simulation of a Ramp Meter Installation at Exit 48 Southbound On-Ramp

Installing ramp meters on selected on-ramps in the Portland study area could decrease the traffic volumes on the Maine Turnpike by over 1,300 vehicles in the design hour to under capacity thresholds.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 32.4% on the Maine Turnpike;
- A peak hour demand reduction of 1,327 vehicles on the Maine Turnpike;
- Has a viable funding source; and
- Can be implemented in a short timeframe.

The key impacts and challenges are the following:

- Increase of 20 miles of off-Turnpike roadway near or over capacity due to vehicles diverting off the Maine Turnpike due to delays caused by ramp meters;
- 1.0% increase in regional vehicle hours traveled (VHT);
- Increase in NOx (+0.1%) and HC (+0.3%), reducing air quality; and
- Potential wetland impacts.

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6.6.2 Alternative 9b - Implement HOV/HOT Lanes from Exits 44 to 53

High-occupancy vehicle (HOV) lanes are restricted traffic lanes reserved at peak travel times or longer for the exclusive use of vehicles with a driver and one or more passengers. These often include carpools, vanpools, and transit buses. The normal minimum occupancy level is either two or three occupants. HOV lanes are typically created to increase average vehicle occupancy with the goal of reducing traffic congestion and related air pollution.

High-occupancy toll (HOT) lanes are restricted traffic lanes that are available to HOVs without charge; other vehicles are required to pay a toll that varies according to the time of day or according to real-time traffic conditions. Although numerous HOT lanes are operating in the United States today, none are operating parallel to an existing conventional toll facility. The concept of charging all customers a base toll, while designating an additional lane solely for HOVs and for single-occupancy vehicles (SOVs) willing to pay a higher toll, is untested in this country. This alternative would also create social justice issues with higher tolls being charged for patrons using the dedicated, additional lane.

As noted, no HOT lanes currently exist within conventional toll facilities in the United States. However, many of the components identified above can be observed at various facilities throughout the country. Some comparable facilities are identified below.

The concept of variable tolling is commonly applied at various managed lane facilities. Variable tolling by time of day or in response to real-time traffic conditions approach is employed on managed lanes on State Route 91 in Orange County, I-25 in Denver, the Katy Freeway in Houston, I-66 near Washington, D.C., I-495 on the Capital Beltway, I-95 in Miami, I-15 in Utah, I-15 in San Diego, I-580 in Alameda County, CA, and I-10/I-110 in Los Angeles.

Here, in looking at both HOVs and HOTs, the Study Team assumed that the Maine Turnpike would be widened to three lanes in each direction. Roadway widening alternatives are typically construction-based alternatives that require a fair amount of capital investment, including right-of-way acquisition. They sizably increase the throughput capacity (number of vehicles that can travel) of the roadway.

The Study Team assessed the potential results of converting an additional lane in each direction to either HOV or HOT usage from Exit 44 in Scarborough to Exit 53 in West Falmouth. They key components of this alternative would consist of:

- Widening the mainline of the Maine Turnpike for approximately nine miles to provide a three-lane cross section in each direction with similar improvements as identified in Alternative 12 in terms of bridges, toll plazas, and local roadway intersections; and
- No barrier (either physical or painted) separating the HOV/HOT lane, which would allow maximum utilization. This absence is not typical of most HOV/HOT facilities, which usually have a barrier or distance separation.

The analysis of this alternative is based upon evaluation of other HOV and HOT facilities throughout the United States, combined with an estimation of potential HOV and HOT users from MTA data. Key assumptions for this analysis are as follows:

- The HOV/HOT lanes would be created by adding a third lane in each direction of travel. The far-left lane in each direction would be designated as either the HOV or HOT lane. Usage of the HOV lanes would be restricted to high-occupancy vehicles, typically defined as either 2+ (e.g. 2 or more people in the vehicle, including the driver) or 3+. Carpools, vanpools, and transit buses comprise much of the HOV lane usage during commuting periods.

- Usage of the HOT lanes would be restricted to two groups of users:
  - *High-occupancy vehicles, or HOVs*. An HOV lane typically requires either 2+ (e.g. 2 or more people in the vehicle, including the driver) or 3+ occupants.
  - *Single-occupancy vehicles (SOVs) that are willing to pay a toll*. The toll would be related to the level of usage of the road—the higher the usage, the greater the toll (in order to manage the demand). This toll would be added to the "base toll" assessed to all users of the Maine Turnpike.
- Access to the HOV/HOT lane would be open. Vehicles would be free to move in and out of HOV/HOT lane at any point. This feature is important because if access to the lane were too restrictive—that is, if the lane were limited to vehicles traveling *through* the region that either met the occupancy criteria or were willing to pay a toll—then the pool of potential users could be extremely small.

Findings – HOV Lanes

Using data from the MTA Origin and Destination Survey from 2010[53], the following HOV usage was estimated for both 2+ and 3+ occupants. This data is shown in Table 6-10.

Table 6-10: HOV Usage on the Maine Turnpike

HOV Level	Weekday Usage (Mon.-Thurs.)	Friday Usage	Weekend Usage
2 or more occupants	37.2%	55.8%	69.9%
3 or more occupants	13.1%	16.7%	27.3%

The potential market for the HOV 2+ lane is greater than or equal to one third of the traffic volume, as demonstrated by Table 6-10. Since the demand for the HOV 2+ lane (one lane of three) is more than one third of the traffic volume, the benefit of an HOV 2+ lane could be diminished.

Conversely, an HOV 3+ lane would be under-utilized for all conditions, which would result in a better opportunity for free-flowing traffic (which is the intent of an HOV lane) but would also result in traffic congestion in the remaining general travel lanes.

This alternative would provide an opportunity for buses traveling through the region to gain a travel time advantage. The Study Team estimated that the number of buses that travel through the Study Area during the design hour to be less than 20. Bus utilization of the HOV lane would most likely be limited to charter buses i.e. busses making longer trips passing thru the study corridor. Local busses and even regional busses tend to make shorter trips along the Maine Turnpike and may not utilize the HOV lane.

[53] Maine Turnpike Authority, *2010 Origin - Destination Survey Summary Report* (HNTB Corp., June 2011)

Findings – HOT Lanes

Implementing an HOT lane on the Maine Turnpike between Exits 44 and 53 would be an immense effort. Although numerous HOT lanes are operating in the United States today, none are operating parallel to an existing conventional toll facility. The concept of charging all customers a base toll, while designating an additional lane solely for HOVs and for SOVs willing to pay a higher toll, is untested in this country. While possible, implementation of HOT lanes is not practical for the following reasons:

- On a per-lane basis, the levels of traffic on the Maine Turnpike in the study area are much lower than the levels observed on existing HOT facilities in the United States. This indicates that the amount of revenue to be generated by this proposed HOT lane would likely be very low. The cost to build and operate such an HOT lane would almost certainly be much greater than the revenue that it would generate.
- Given that an HOT lane would not be self-sustaining, the only way to build and operate the lane would be to finance it with existing toll revenue. The notion of charging SOVs to build a lane that they are not permitted to use (unless they pay a premium) raises equity questions.
- The task of raising revenue and managing traffic is more effectively done by managing tolls on all lanes, rather than focusing solely on a single express lane.

In short, implementing an HOT lane on the Maine Turnpike between Exits 44 and 53 is not practical. It would likely be an expensive venture that would not be the most effective means of providing quality service in an equitable fashion. A separate white paper, titled *The Potential Feasibility of an HOV/HOT lane on the Maine Turnpike*[54], has been prepared to further evaluate this topic in more detail.

Summary of Findings

The construction of one third lane per direction to create an HOT/HOV lane on the Maine Turnpike would create additional roadway capacity. Therefore, this alternative does address identified capacity issues on the Maine Turnpike.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 25.9% on the Maine Turnpike;
- An increase in Maine Turnpike roadway capacity;
- A reduction of 13.1 miles of roadway in the region that are near or over capacity;
- 0.3% reduction in regional VHT;
- This alternative has a viable funding source;
- Has a Benefit/Cost ratio of 3.2; and
- Meets the study purpose.

The key impacts and challenges are the following:

- 0.2% increase in regional VMT;

[54] March 2018, HNTB

- 17 acre increase of Impervious pavement in Urban Impaired Stream Watersheds;
- Potential wetland Impacts;
- Obstacles to implementation, including Maine State law that prohibits a surcharge on tolls based on time of day; and
- Timeframe to implement is unknown due to the Maine State law.

6.6.3 Alternative 9c - Reversible Lanes from Exits 44 to 53

A Reversible Lane is a general use lane, constructed in the median of the freeway. The orientation of the lane can be configured to serve traffic in the peak direction. During periods in which northbound traffic is heaviest, the lane would be oriented in the northbound direction, thus providing an additional general purpose lane for northbound traffic. The same lane then would have its direction reversed relatively quickly (e.g. an hour or less) to serve peak traffic in the southbound direction when southbound traffic is the heaviest. A Reversible Lane is different from a Zipper Lane in that it does not require a moveable barrier machine to create an additional general use lane. Reversible lanes are used where right-of-way is available, whereas a Zipper lane is used on roadways with limited or no additional right-of-way. The Reversible Lane concept assumed as part of this analysis for the Maine Turnpike is similar to the concept employed on Route 3 in Boston and I-30 in Dallas. Other locations where reversible lanes are in use include San Diego-Coronado Bridge, Golden Gate Bridge, Lee Roy Selmon Expressway in Tampa, and I-95 Express Lanes in Northern Virginia.

The general concept of the Reversible Lane is that it provides a barrier-separated additional lane in the peak direction of travel. The number of access points into the Reversible Lane would be limited. Figure 6-15 provides a schematic overview of the Reversible Lane.

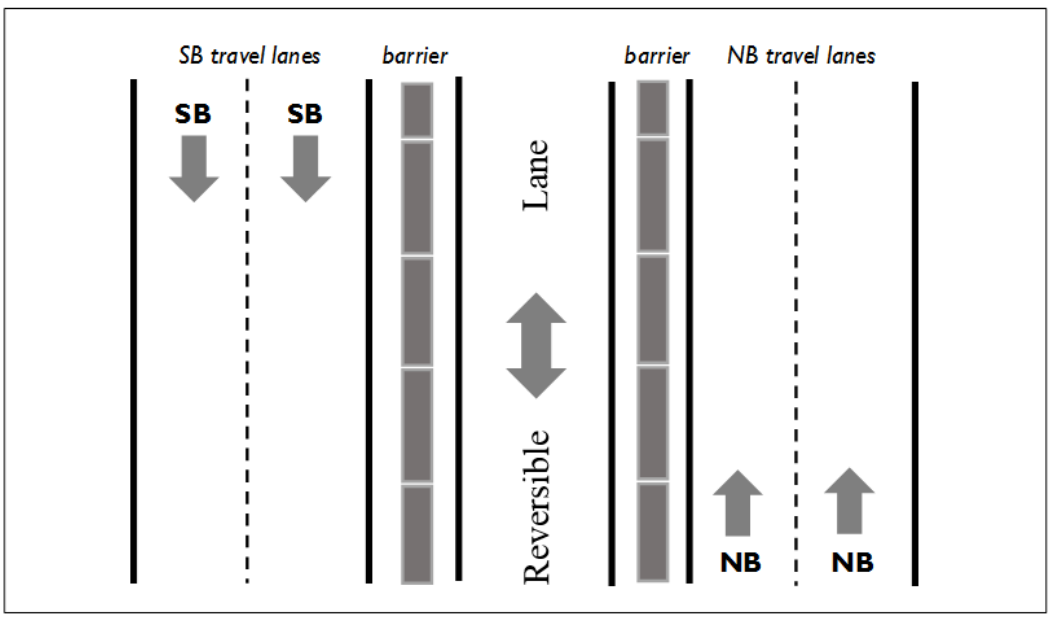

Figure 6-15: Reversible Lane Schematic

This alternative assumes that the Maine Turnpike would be widened with one additional lane that would serve both directions. Because the additional lane would be in the middle between the opposing directions of the Maine Turnpike, the footprint of this lane would need to be placed to avoid existing bridge piers, which may alter the alignment of the Maine Turnpike in certain areas or require bridge re-construction.

The Study Team assessed the potential utilization of constructing and operating a Reversible Lane that could be constructed between the northbound and southbound lanes for use in each direction from Exit 44 in Scarborough to Exit 53 in West Falmouth. They key components of this alternative would consist of:

- Widening the mainline of the Maine Turnpike for approximately nine miles in one direction to provide a three-lane cross section in the median of the Maine Turnpike, with similar improvements as identified in Alternative 12 in terms of bridges, toll plazas, and local roadway intersections;
- Access to the Reversible Lane for northbound vehicles would be at some point south of Exit 44;
- Access to the Reversible Lane for southbound vehicles would be at some point north of Exit 53; and
- One additional access point was assumed between Exits 48 and 52 based on the available distance and no interchange access within this section of the Maine Turnpike.

The analysis of this alternative was based upon evaluation of other Reversible Lane facilities throughout the United States, combined with an estimation of potential Reversible Lane utilization based on Maine Turnpike interchange to interchange traffic data. Key assumptions for this analysis were as follows:

- The full length of the Reversible Lane in the study area would operate in the same direction during a given time period, either northbound or southbound. The Reversible Lane would <u>not</u> have the capability of serving northbound traffic for one portion of the corridor and southbound traffic for a separate portion of the corridor; and
- For safety purposes, the Reversible Lane is barrier separated with limited access and egress points as noted previously. Consequently, it is intended to serve vehicles that are making longer-distance trips through the corridor, rather than serving shorter distance trips within the corridor.

The Reversible Lane concept assumed as part of this analysis is similar to the concept employed on Route 3 in Boston and I-30 in Dallas. Due to the limited access, some groups of users would be unable to use the Reversible Lane. For example:

- Any northbound driver wishing to exit the Maine Turnpike between Exits 45 and 48 would not be able to use the lane, since the first egress point is north of Exit 48;
- Any southbound driver entering at Exit 52 would be unable to use the Reversible Lane unless the destination was Exit 42 or south; and
- All drivers whose origin and destination is between Exits 45 and 53 would be unable to use the lane.

Traffic volumes in the design hours were reviewed to estimate the extent to which the Reversible Lane would impact traffic flows. Figure 6-16 summarizes the projected NB peak-hour traffic flows through the corridor in the year 2040.

As Figure 6-16 illustrates, the peak NB volume is 4,917 vehicles per hour between Exits 46 and 47. It is important to note that in this peak hour the Reversible Lane would be used for the northbound direction, but the southbound direction south of Exit 46 is over capacity. This figure demonstrates the unique traffic characteristics of the Maine Turnpike. The Maine Turnpike has high commuter traffic heading to points south of Portland, and high tourist traffic northbound on Friday afternoons.

Figure 6-17 summarizes the projected SB peak-hour traffic flows through the corridor in the year 2040, and illustrates that peak SB volume is 4,566 vehicles per hour between Exits 46 and 47. It is important to note that in this peak hour the Reversible Lane would be used for the southbound direction, but the northbound direction south of Exit 45 is substantially over capacity.

However, using information from the 2010 Origin and Destination Study[55], it is estimated that 300 to 500 of these vehicles are destined to connect to I-295 in South Portland. These vehicles are simply using the NB off-ramp Exit 45 to bypass the exit toll at Exit 44. If these vehicles were to shift from the Exit 45 NB-off ramp to the Exit 44 NB-off ramp, the NB volume between Exits 44 and 45 would be more manageable.

Using data from current MTA interchange to interchange traffic data, the Reversible Lane usage was estimated. The analysis suggests that a Reversible Lane could provide significant congestion relief during peak periods in the near term until 2035. However, traffic volumes will be near capacity from 2024 through 2035 resulting in undesirable levels of service (LOS E/F). After Year 2035, an additional general purpose lane would need to be added to accommodate traffic safely and at an appropriate level of service as demand will exceed capacity.

More information regarding Reversible Lanes is included in a separate white paper entitled *The Reversible Lane: The congestion-reduction potential of a single reversible lane*[56].

The construction of a Reversible Lane on the Maine Turnpike will create additional roadway capacity. However, the extra lane can only be used by the peak direction of traffic and by 2035 it will not be able to accommodate the expected peak hour traffic. This alternative is considered to be a short-term fix and would require the addition of a third lane in the non-peak direction by 2035. Additionally, there would be higher throw-away cost due to the amount of pavement required for the Reversible Lane.

Two challenges of this alternative are snow storage and incident management. Currently, the MTA uses the medians for snow storage. Therefore, the design and implementation of this alternative would need to accommodate snow storage for all lanes of traffic. Incident management will also be an issue as access to the reversible lane will be limited, which adds difficulty and time for clearing incidents.

[55] Maine Turnpike Authority, *2010 Origin - Destination Survey Summary Report* (HNTB Corp., June 2011)
[56] March 2018, HNTB

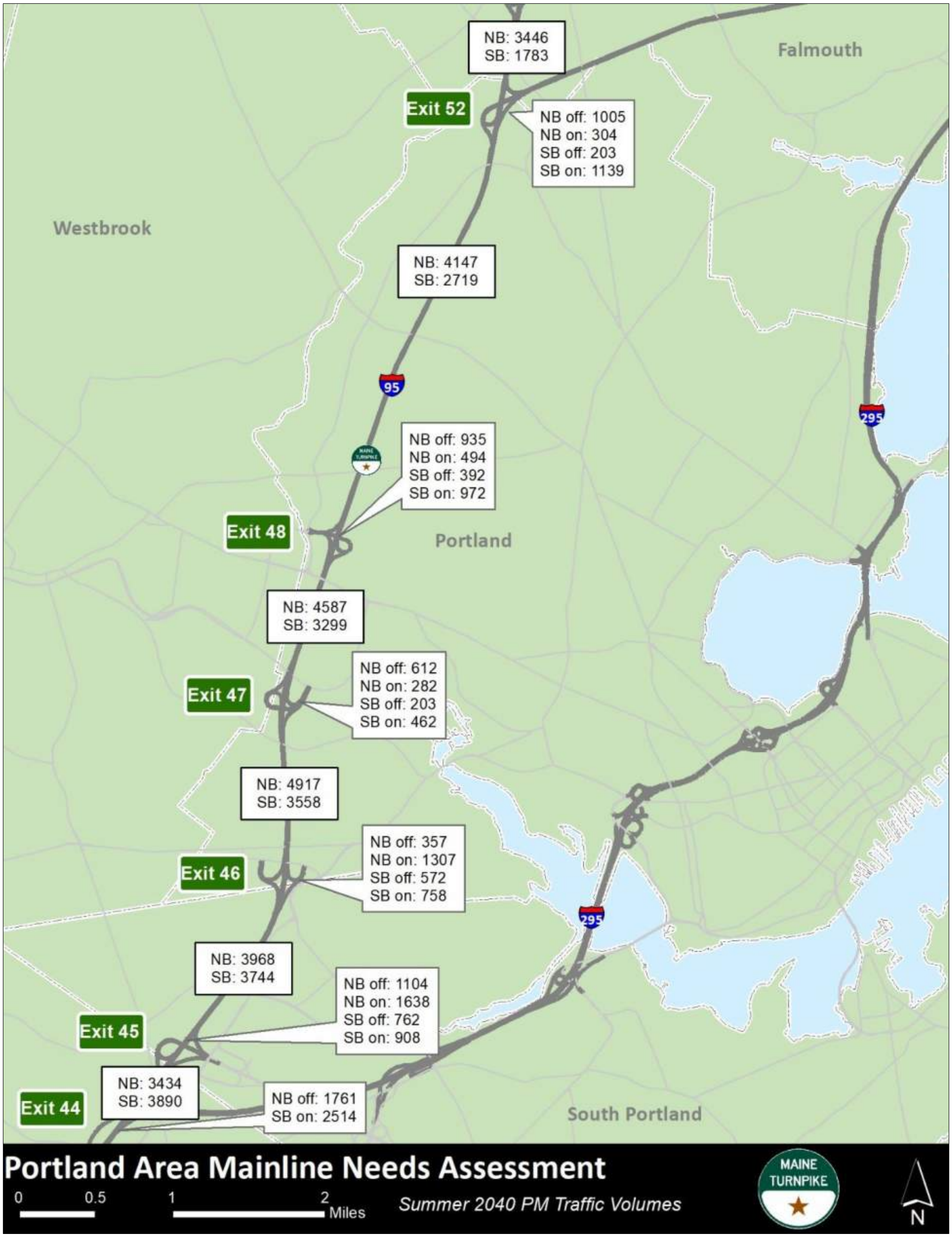

Figure 6-16: Projected 2040 NB Peak-Hour Traffic (Summer PM)

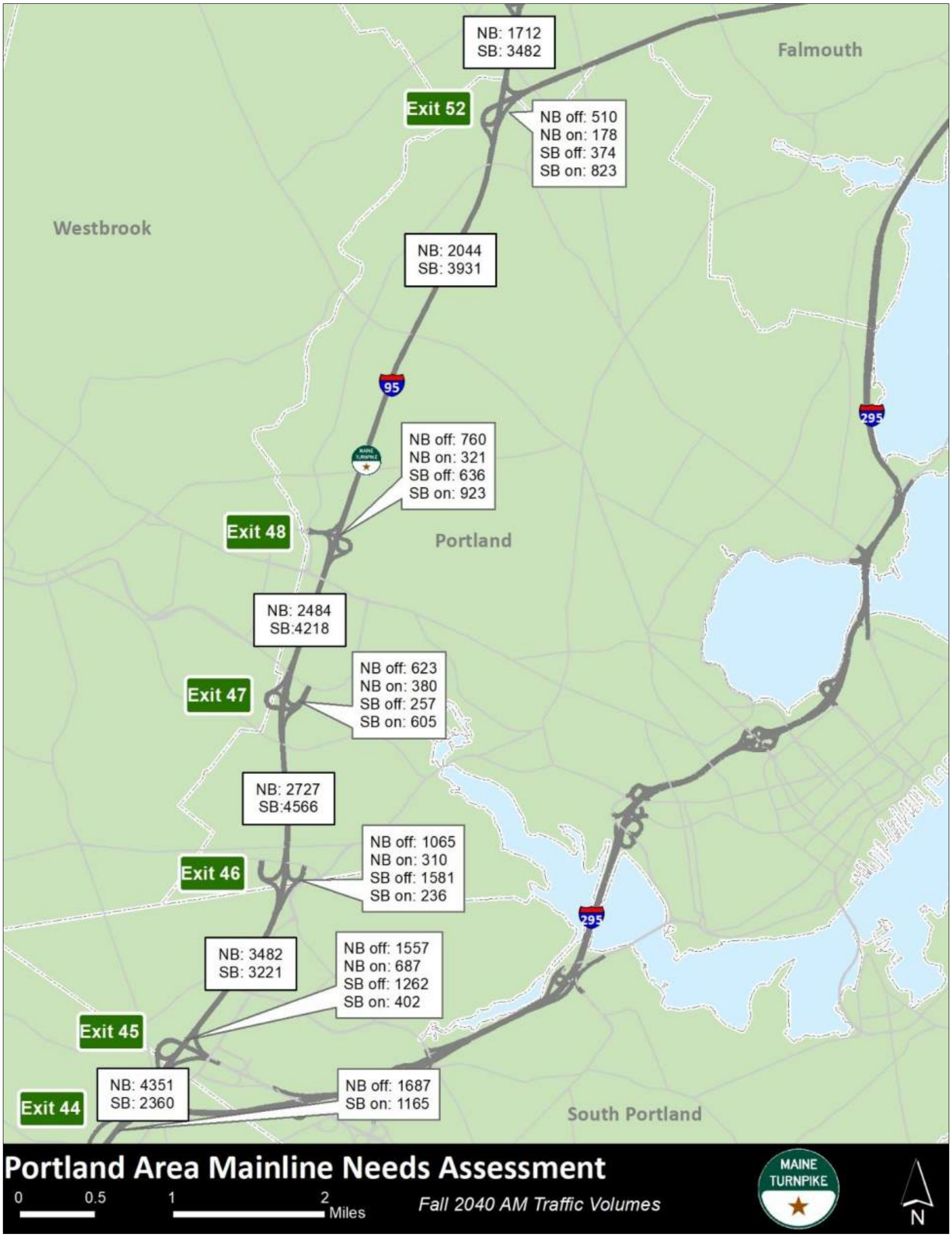

Figure 6-17: Projected 2040 SB Peak-Hour Traffic (Fall AM)

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Anticipated crash rate reduction of 25.3% on the Maine Turnpike in the peak direction;
- An increase in Maine Turnpike roadway capacity in the peak direction;
- A reduction of 7 miles of roadway in the region that are near or over capacity;
- 0.3% reduction in regional vehicle hours traveled (VHT);
- Has a viable funding source;
- Can be implemented in a short timeframe; and
- Has a Benefit/Cost ratio of 3.0.

The key impacts and challenges are the following:

- No capacity increase to the off-peak travel direction;
- Segments still near or exceeding capacity on off-peak;
- 0.2% increase in regional vehicle miles traveled (VMT); and
- Potential wetland impacts.

6.7 Capacity Alternatives

Capacity alternatives are those that add physical capacity to transportation infrastructure. This can be in the form of an additional roadway lane that increases the throughput capacity of a roadway. Capacity alternatives also require sizeable capital cost. The capacity alternatives evaluated for the PAM Study are:

- Widen I-295 to three general purpose lanes in each direction;
- Widen I-295 to three general purpose lanes in each direction with tolls; and
- Widen I-95 to three general purpose lanes in each direction.

6.7.1 Alternative 10 - Widening I-295 to Three Lanes in Each Direction

Roadway widening alternatives are typically construction alternatives that require a fair amount of capital investment, including right-of-way acquisition. They sizably increase the throughput capacity of the roadway. Because of increasing congestion and safety concerns on I-295[57], an alternative to widen I-295 was evaluated. This alternative assessed the impacts of widening I-295 to three general purpose lanes in each direction from I-95 Exit 44 in Scarborough to I-295 Exit 11 in Falmouth. Figure 6-18 shows the project limits. The key components of this alternative would consist of:

- Widening I-295 for approximately 11 miles to provide a three-lane cross section in each direction;
- Reconstruction of an estimated 27 bridges including the Fore River Bridge and Tukey's Bridge; and
- Reconstruction of any side road underpasses and existing drainage structures not already designed for additional mainline lanes.

The analysis of this alternative followed a methodology that is based on engineering standards and practices. Factors in the analysis included forecast year, design hours, traffic growth, roadway capacity analysis, Travel Demand Model, and traffic impact analysis using the PACTS Regional Travel Demand Model. This model is a regionally accepted tool that estimates the amount of traffic on the road as well as likely travel routes in the region based on socio-economic factors. The model provides information on travel by vehicles on all the roadways in the study area, providing information on VMT and VHT. The PACTS Travel Demand Model was run with a widened I-295 to determine the traffic impacts on the Portland area roadways for 2040.

The analysis showed that widening I-295 through Greater Portland would provide mixed transportation impact results. A summary of key transportation findings includes a/an:

- Reduction in traffic on Maine Turnpike as thru-traffic headed to/from I-295 north of Portland shifts to I-295;
- Significant reduction in miles of roadway in the PACTS region near or over capacity; and
- Increase in VMT as traffic seeks to travel on I-295.

[57] MaineDOT 2018 I-295 Corridor Update from Scarborough to Brunswick

Widening of I-295 to three general purpose lanes was found to decrease the traffic volumes on the Maine Turnpike. However, under projected volumes from the Travel Demand Model, the Maine Turnpike would still be over capacity with this alternative in 2040 (1.31). Therefore, this alternative does not address the identified capacity issues on the Maine Turnpike.

The capital costs to widen I-295 one additional lane in each direction between Exits 44 and Exit 11 in Falmouth was estimated to be approximately $241.6 million in 2018 dollars. With these additional miles, the additional operating and maintenance costs for this alternative would be $600,000 annually.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- An expected 4.2% decrease in the number of crashes on the Turnpike;
- A peak hour demand reduction of 211 vehicles on the Turnpike;
- A reduction of 21.8 miles of roadway in the region that are near or over capacity;
- 0.2% reduction in VHT; and
- Has a Benefit/Cost ratio of 3.0.

The key impacts and challenges of this alternative are:

- A volume to capacity ratio (v/c) that is still greater than one (1.31) on the Maine Turnpike;
- 0.3% increase in regional VMT;
- Increase in NOx (+0.2%) and HC (+1.0%), reducing air quality;
- 9 acre increase of impervious pavement in Urban Impaired Stream Watersheds;
- Potential wetland impacts;
- This alternative has no viable funding source;
- Obstacles to implementation include MaineDOT's jurisdiction over I-295. This project is not currently in MaineDOT's long range plan for widening; and
- Potential for lost revenue on the Maine Turnpike.

6.7.2 Alternative 11 - Widening I-295 to Three Lanes in Each Direction with Tolls

Roadway widening alternatives are typically construction alternatives that require a fair amount of capital investment, including right-of-way acquisition. They sizably increase the throughput capacity of the roadway. Because of increasing congestion and safety concerns on I-295[58], an alternative to widen I-295 was evaluated. This alternative assessed the impacts of widening I-295 to three general purpose lanes in each direction from I-95 Exit 44 in Scarborough to I-295 Exit 11 in Falmouth. Figure 6-18 shows the project limits. The key components of this alternative would consist of:

- Widening I-295 for approximately 11 miles to provide a three-lane cross section in each direction;
- Reconstruction of 27 bridges including the Fore River Bridge and Tukey's Bridge;
- Reconstruction of any side road underpasses and existing drainage structures not already designed for additional mainline lanes; and
- Construction of two tolling locations – at/near Fore River Bridge and at/near Tukey's Bridge.

The toll rate structure for placing tolls on I-295 was assumed to be an open barrier system. Because of the number and geometry of the existing interchanges on I-295 in the Portland area, it would be cost effective to consider two tolling points at the major bridges in Portland instead of at every entrance (like the Maine Turnpike in the Portland area). The tolling locations that were assumed for this analysis are shown in Figure 6-19. The drawback to this tolling structure is that some local trips on I-295 would not be tolled. A toll rate was set by calculating the weighted rate per mile on the Turnpike in the Portland area. This rate per mile was then applied to I-295. The resulting passenger vehicle toll for each tolling location was estimated to start at $1.10 for a passenger vehicle.

The analysis of this alternative followed a methodology that is based on engineering standards and practices. Factors in the analysis included forecast year, design hours, traffic growth, roadway capacity analysis, Travel Demand Model, and traffic impact analysis using the PACTS Regional Travel Demand Model. The model is a regionally accepted tool that estimates the amount of traffic on the road as well as likely travel routes in the region based on socio-economic factors. The model provides information on travel by vehicles on all the roadways in the study area, providing information on VMT and VHT.

The PACTS Travel Demand Model was run with a widened I-295 with two tolling locations to determine the traffic impacts on the Portland area roadways for 2040.

Widening of I-295 to three general purpose lanes and tolling it was found to *increase* the traffic volumes on the Maine Turnpike. Under projected volumes from the Travel Demand Model, the Maine Turnpike would be over capacity with this alternative in 2040 (1.47). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

[58] MaineDOT 2018 I-295 Corridor Update from Scarborough to Brunswick

Figure 6-18: I-295 Widening Project Limits

Figure 6-19: I-295 Widening with Tolling Project Limits

The capital costs to widen I-295 one additional lane in each direction with two tolling locations between Exits 44 on the Maine Turnpike and Exit 10 was estimated to be approximately $246.6 million in 2018 dollars. With these additional miles, the additional operating and maintenance costs for this alternative would be $800,000 annually.

This alternative was evaluated against several Measures of Effectiveness (MOEs) which are summarized in the Evaluation Summary Matrix. The key benefits from that matrix for this alternative are as follows:

- Additional Toll Revenue of $17.8 million annually from I-295, and potential additional toll revenue on the Maine Turnpike from additional traffic on I-95; and
- Has a Benefit/Cost ratio of 1.2.

The key impacts and challenges are the following:

- An expected 6.8% increase in the number of crashes on the Turnpike;
- An additional peak hour demand of 378 vehicles on the Turnpike;
- An increase in the volume to capacity ratio (v/c) to 1.47 on the Maine Turnpike;
- 0.4% increase in regional VMT to avoid tolls;
- 1.9% increase in regional VHT to avoid tolls;
- 9 acre increase of impervious pavement in Urban Impaired Stream Watersheds;
- Potential wetland impacts;
- This alternative has no viable funding source;
- Obstacles to implementation – would require approval from the Federal Highway Administration;
- Timeframe to implement is unknown due to federal regulations restricting tolls on a roadway built with federal money; and
- Does not address Portland Area Mainline Needs Assessment Study Purpose.

6.7.3 Alternative 12 - Widen Maine Turnpike to Three-Lanes in Each Direction from Exits 44 to 53

Roadway widening alternatives are typically construction-based alternatives that require a fair amount of capital investment, including right-of-way acquisition. They sizably increase the throughput capacity (number of vehicles that can travel) of the roadway.

For Alternative 12, the Study Team assessed the impacts of widening the Maine Turnpike from two to three general-purpose lanes in each direction from Exit 44 in Scarborough to Exit 53 in West Falmouth. Figure 6-20 identifies the Maine Turnpike widening project limits. The key components of this alternative would consist of:

- Widening the mainline for about nine miles to provide a three-lane cross section in each direction;
- Reconstruction of several bridges including the Stroudwater River, Maine Central Railroad, and Warren Avenue bridges; and
- Reconstruction of any side road underpasses and existing drainage structures not already designed for additional mainline lanes.

Roadway Capacity Analysis

The capacity (maximum traffic flow) on the mainline sections of the Maine Turnpike was evaluated using the traffic engineering procedures outlined in the Highway Capacity Manual[59], which sets forth nationally and regionally accepted guidelines for the road capacity evaluation of freeways and other roadways.

Design hour traffic volumes for the Year 2040 were input into Highway Capacity Software to determine LOS. The traffic volumes, the comparison of the traffic volumes to roadway capacity and the levels-of-service are shown in Table 6-11 and Table 6-12.

Table 6-11: NB PM Design Hour Volume, Level of Service, and V/C Ratios

		Northbound PM Design Hour Volume					
		2040 No Action			2040 Alternative 12		
Location	**Capacity**	**Volume**	**v/c**	**LOS**	**Volume**	**v/c**	**LOS**
Exits 44 to 45	5400	3434	0.95	E	3434	0.64	C
Exits 45 to 46	5400	3969	1.1	F	3969	0.74	D
Exits 46 to 47	5400	4919	1.37	F	4919	0.91	E
Exits 47 to 48	5400	4588	1.27	F	4588	0.85	D
Exits 48 to 52	5400	4147	1.15	F	4147	0.77	D
Exits 52 to 53	5400	3446	0.96	E	3446	0.64	C

[59] Transportation Research Board, *Highway Capacity Manual* (Transportation Research Board, 2010)

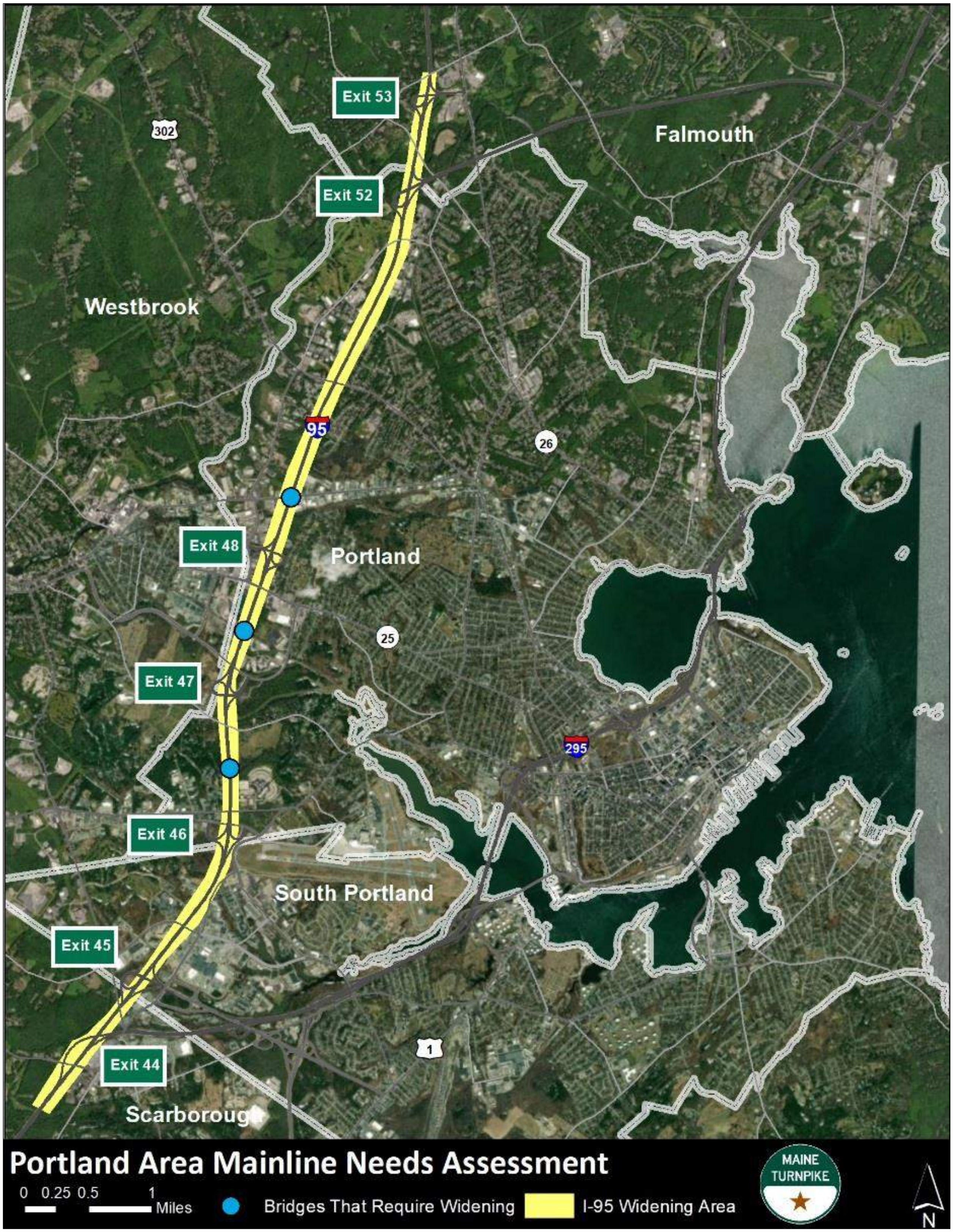

Figure 6-20: Turnpike Widening Project Limits

Table 6-12: SB AM Design Hour Volume, Level of Service, and V/C Ratios

		Southbound AM Design Hour Volume					
		2040 No Action			2040 Alternative 12		
Location	**Capacity**	**Volume[60]**	**v/c**	**LOS**	**Volume**	**v/c**	**LOS**
Exits 52 to 53	5400	3482	0.97	E	3482	0.64	C
Exits 48 to 52	5400	3932	1.09	F	3932	0.73	B
Exits 47 to 48	5400	4219	1.17	F	4219	0.78	C
Exits 46 to 47	5400	4566	1.27	F	4566	0.85	D
Exits 45 to 46	5400	3,222	0.9	E	3,222	0.60	D
Exits 44 to 45	5400	2,363	0.66	C	2,363	0.44	C

As shown in the tables, all of the mainline sections would operate under capacity in 2040 under Alternative 12. All sections, except for the NB section between Exits 46 and 47, would operate at LOS D or better. The section between Exits 46 and 47 NB would operate at LOS E in 2040.

It should be noted that the traffic levels of service shown in Table 6-11 and Table 6-12 reflect the impacts of the traffic demand for that section of roadway only. Traffic congestion can impact downstream roadway segments. For example, in the No Action Condition, the southbound segment of the Turnpike between Exits 52 and 53 could be an F due to impacts upstream. Likewise, the southbound segment of the Turnpike between Exits 63 and 53 could be an E or F due to impacts from traffic congestion on the segment between Exits 52 and 45.

For Alternative 12, the PACTS Regional Travel Demand Model was used to forecast changes in the amounts of traffic within the PACTS region on roads as well as likely travel routes in the region based on socio-economic factors. The model provides information on travel by vehicles and transit on all the roadways in the study area, providing information on vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT).

Widening of the Maine Turnpike to three general purpose lanes was found to address the capacity constraints of the Maine Turnpike. Under projected volumes from the Travel Demand Model, the Maine Turnpike would be under capacity in 2040 (0.91 or less). Therefore, this alternative does address identified capacity issues on the Maine Turnpike.

[60] Some SB volumes are higher during the PM peak hour, specifically south of Exit 46. However, generally the SB peak volumes occur during the AM peak hour.

The key findings for this alternative are as follows:

- An expected 29.3% reduction in crashes on the Maine Turnpike;
- An increase in Maine Turnpike roadway capacity;
- A reduction of 13.6 miles of roadway in the region that are near or over capacity. This will maintain adequate capacity on interstate system, keeping vehicles on interstate rather than local roads;
- Has a viable funding source;
- Can be implemented in a short timeframe;
- Has a Benefit/Cost ratio of 3.9;
- 17 acre increase of impervious pavement in Urban Impaired Stream Watersheds;
- Potential wetlands impacts; and
- Does address Portland Area Mainline Needs Assessment Study Purpose.

6.8 Combination Alternatives

As part of the PAC process, PAC members requested that specific alternatives be combined for evaluation. These alternatives were deemed by the PAC to have the greatest potential to address the PAM Study Purpose. The Combination Alternatives evaluated for the PAM Study are:

- Alternative 13, which combines Alternative 2 (TDM), Alternative 4 (Interstate Bus), Alternative 5a (Regional Bus), Alternative 5b (Local Bus), and Alternative 8 (Land Use); and
- Alternative 14, which combines Alternative 2 (TDM), Alternative 4 (Interstate Bus), Alternative 5a (Regional Bus), Alternative 5b (Local Bus), Alternative 8 (Land Use), and Alternative 12 (Widen I-95).

6.8.1 Alternative 13 – Combined Alternative: TDM, Interstate, Local and Regional Bus, and Land Use

This Combined Alternative was developed from recommendations from the Public Advisory Committee (PAC). This combined alternative includes several individual alternatives that were examined separately as part of the PAM Study. This Combined Alternative includes the following individual alternatives:

- Alternative 2 – New/Expanded Transportation Demand Management (TDM) Programs
- Alternative 4 – Public Transportation: New or Improved Interstate Bus Service
- Alternative 5a – Public Transportation: Improved Regional Bus Service
- Alternative 5b – Public Transportation: New or Improved Local Bus Service
- Alternative 8 – Land Use

For Alternative 2, TDM programs provide tools to commuting travelers to reduce the demand for transportation, i.e., reduce the number of vehicles on the road. These tools include ride share programs, park and ride lots, and work from home opportunities.

For Alternative 4, the primary interstate bus providers in the Study Area are Concord Coach Lines and Greyhound. Both Concord Coach Lines and Greyhound provide interstate bus service from Maine to Boston and New York. In this alternative, practicable system improvements were made including increased service and additional transit infrastructure (including buses and parking).

For Alternative 5, regional bus providers included in this alternative are the ZOOM Bus (Biddeford - Portland) and the METRO Breez (Portland - Brunswick). In this alternative, improvements including more frequent service, and implementation of a bus rapid transit type system along key corridors were included.

Local bus providers included in this alternative are Greater Portland METRO and City of South Portland Bus Service. In this alternative, more frequent service and implementation of a bus rapid transit type system along key corridors were included.

For Alternative 8, an alternative land use pattern of growth and development that was originally identified and quantified under the Gorham East-West Corridor Study[61] was used. This land use provided allocation

[61] Maine Turnpike Authority, *Gorham East-West Corridor Feasibility Study*, (HNTB, March 2010)

of current population and employment forecasts into specific growth areas within the Portland Area Comprehensive Transportation System (PACTS) region[62]. These allocations were based on a modified distribution of population and employment growth designated as the Urban and Rural form.

The approach for each individual alternative in the Combined Alternative 13 are described below.

New/Expanded Transportation Demand Management (TDM) Programs

Rideshare data was collected from rideshare services such as GoMaine[63] as well as from major area employers. Historic utilization data for the PACTS area park and ride lots provided by the MTA and MaineDOT[64] was analyzed to determine the capacity for additional carpool/vanpool use. Data from the US Census[65] and the United States Department of Labor was gathered and analyzed to determine trends in the portion of the workforce that is working from home. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 2 – New/Expanded Transportation Demand Management (TDM) Programs.**

Public Transportation: New or Improved Interstate Bus Service

Potential increases in interstate bus ridership were estimated using two methods – estimating passengers from Concord Coach Line plans for increasing service, and estimating passengers from information in the 2011 Interstate Feasibility Study for ridership from the Lewiston/Auburn area to Portland and points south. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 4 – Public Transportation: New or Improved Interstate Bus Service.**

Public Transportation: Improved Regional Bus Service

Discussions with regional transit providers helped identify practicable system improvements for the regional bus services. These improvements included additional parking improvements to the Portland Transportation Center, the implementation of a Bus Rapid Transit system, and additional buses to allow for increased service. The resulting increased frequency and decreased travel times were incorporated into the PACTS Travel Demand Model used to forecast regional bus ridership. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 5a – Public Transportation: Improved Regional Bus Service.**

Public Transportation: New or Improved Local Bus Service

Discussions with local transit providers helped identify practicable system improvements for the local bus services. These improvements included additional buses and the implementation of a Bus Rapid Transit system to allow for increased local bus service. The resulting increased frequency and decreased travel times were incorporated into the PACTS Travel Demand Model used to forecast local bus ridership. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 5b – Public Transportation: New or Improved Local Bus Service.**

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[62] Ibid.
[63] GoMaine is the State of Maine rideshare program currently sponsored by MaineDOT and the Maine Turnpike Authority, www.gomaine.org.
[64] Maine Department of Transportation Park n' Ride Utilization Study, 2011.
[65] United States Census Data, American Community Survey 5-Year Estimates, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

Land Use

The analysis of this alternative follows a methodology that is based on the approach followed under the Gorham East-West Corridor Study. Future distribution of job, population, and dwelling unit growth identified as the Urban and Rural form as part of the Gorham East-West Corridor Study,[66] was used as the demographic base for the PACTS Travel Demand Model. Using this Urban and Rural form distribution, the PACTS Travel Demand Model was run with current job, population, and housing growth to determine the transportation impacts/benefits and increases in transit ridership for the Maine Turnpike and non-Turnpike roadways, as well as increased transit ridership for Year 2040. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 8 – Land Use Scenario.**

The estimated number of vehicles that could be reduced from the peak hour traffic on the Maine Turnpike in the Portland area with the Combined Alternative is 107. With this reduction, the volume to capacity ratio would still be greater than one in 2040 (1.34). Therefore, this alternative does not address identified capacity issues on the Maine Turnpike.

The key findings for this alternative are as follows:

- Anticipated crash rate reduction of 2.1% on the Maine Turnpike;
- An expected reduction of approximately 107 vehicles during the peak hour;
- 4.6% reduction in regional VMT, and a 4.7% reduction in regional VHT;
- Increases Portland area transit ridership by an estimated 416 trips;
- A reduction of 60.3 miles of roadway in the region that are near or over capacity;
- 4.5% reduction in vehicle emission pollutants;
- Has a Benefit/Cost ratio of 3.12;
- Has potential wetland impacts; and
- Timeframe to fully implement is unknown, primarily for land use. Local municipalities would need to adopt aggressive land use and zoning changes.

[66] Maine Turnpike Authority, *Gorham East-West Corridor Feasibility Study*, (HNTB, March 2010)

6.8.2 Alternative 14 - Combined Alternative: TDM, Interstate, Local and Regional Bus, and Land Use with Widened Turnpike from Exit 44 to 53

This Combined Alternative was developed from recommendations from the Public Advisory Committee (PAC). This combined alternative includes several individual alternatives that were examined separately as part of the PAM Study. This Combined Alternative includes the following individual alternatives:

- Alternative 2 – New/Expanded Transportation Demand Management (TDM) Programs
- Alternative 4 – Public Transportation: New or Improved Interstate Bus Service
- Alternative 5a – Public Transportation: Improved Regional Bus Service
- Alternative 5b – Public Transportation: New or Improved Local Bus Service
- Alternative 8 – Land Use
- Alternative 12 – Widen Turnpike to Six Lanes

For Alternative 2, TDM programs provide tools to commuting travelers to reduce the demand for transportation, i.e., reduce the number of vehicles on the road. These tools include ride share programs, park and ride lots, and work from home opportunities.

For Alternative 4, the Primary Interstate Bus providers in the study area are Concord Coach Lines and Greyhound. Both Concord Coach Lines and Greyhound provide interstate bus service to Boston and New York and to Lewiston/Auburn. In this alternative, the Concord and Greyhound bus systems were evaluated to determine the potential effects of practicable system improvements including increased service and additional transit infrastructure.

For Alternative 5a, regional Bus providers included in this alternative are the ZOOM Bus (Biddeford - Portland) and the METRO Breez (Portland - Brunswick). In this alternative, these bus systems were evaluated to determine the potential effects of practicable system improvements including more frequent service, and implementation of a bus rapid transit type system along key corridors.

For Alternative 5b, local bus providers included in this alternative are Greater Portland METRO and City of South Portland Bus Service. In this alternative, these bus systems were evaluated to determine the potential effects of practicable system improvements including more frequent service, and implementation of a bus rapid transit type system along key corridors.

For Alternative 8, the Study Team assessed the benefits of an alternative land use pattern of growth and development that was originally identified and quantified under the Gorham East-West Corridor Study[67]. Allocation of current population and employment forecasts into specific growth areas within the PACTS region identified in the Gorham East-West Corridor Study[68]. These allocations were based on a modified distribution of population and employment growth designated as the Urban and Rural form.

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[67] Maine Turnpike Authority, *Gorham East-West Corridor Feasibility Study*, (HNTB, March 2010)

[68] Ibid.

For Alternative 12, roadway widening alternatives are typically construction-based alternatives that require capital investment including engineering costs, wetland mitigation, and right-of-way acquisition. The impacts of widening the Maine Turnpike from two to three general-purpose lanes in each direction from Exit 44 in Scarborough to Exit 53 in West Falmouth are included in this alternative.

The approach for each individual alternative in the Combined Alternative 14 are described below.

New/Expanded Transportation Demand Management (TDM) Programs

Rideshare data was collected from rideshare services such as GoMaine[69] as well as from major employers. Historic utilization data for the PACTS area park and ride lots provided by the MTA and MaineDOT[70] was analyzed to determine the capacity for additional carpool/vanpool use. Data from the US Census[71] and the United States Department of Labor was gathered and analyzed to determine trends in the portion of the workforce that is working from home. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 2 – New/Expanded Transportation Demand Management (TDM) Programs.**

Public Transportation: New or Improved Interstate Bus Service

Potential increases in interstate bus ridership were estimated using two methods – estimating passengers from Concord Coach Line plans for increasing service, and estimating passengers from information in the 2011 Interstate Feasibility Study for ridership from the Lewiston/Auburn area to Portland and points south. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 4 – Public Transportation: New or Improved Interstate Bus Service.**

Public Transportation: Improved Regional Bus Service

Discussions with regional transit providers helped identify practicable system improvements for the regional bus services. These improvements included additional parking improvements to the Portland Transportation Center, the implementation of a Bus Rapid Transit system, and additional buses to allow for increased service. The resulting increased frequency and decreased travel times were incorporated into the PACTS Travel Demand Model used to forecast regional bus ridership. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 5a – Public Transportation: Improved Regional Bus Service.**

Public Transportation: New or Improved Local Bus Service

Discussions with local transit providers helped identify practicable system improvements for the local bus services. These improvements included additional buses and the implementation of a Bus Rapid Transit system to allow for increased local bus service. The resulting increased frequency and decreased travel times were incorporated into the PACTS Travel Demand Model used to forecast local bus ridership. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 5b – Public Transportation: New or Improved Local Bus Service.**

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[69] GoMaine is the State of Maine rideshare program currently sponsored by MaineDOT and the Maine Turnpike Authority, www.gomaine.org.
[70] Maine Department of Transportation Park n' Ride Utilization Study, 2011.
[71] United States Census Data, American Community Survey 5-Year Estimates, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

Land Use

The analysis of this alternative follows a methodology that is based on the approach followed under the Gorham East-West Corridor Study. Future distribution of job, population, and dwelling unit growth identified as the Urban and Rural form as part of the Gorham East-West Corridor Study,[72] was used as the demographic base for the PACTS Travel Demand Model. Using this Urban and Rural form distribution, the PACTS Travel Demand Model was run with current job, population, and housing growth to determine the transportation impacts/benefits and increases in transit ridership for the Maine Turnpike and non-Turnpike roadways, as well as increased transit ridership for Year 2040. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 8 – Land Use Scenario.**

Widen Maine Turnpike to Three Lanes in each Direction from Exits 44 to 53

The analysis of this alternative follows a methodology that is based on engineering standards and practices. Factors in the analysis included forecast year, design hours, traffic growth, roadway capacity analysis, Travel Demand Model, and traffic impact analysis. Further descriptions of the assumptions and methodology for the analysis of this alternative is in **Alternative 12 – Widen Maine Turnpike to Three Lanes in each Direction from Exits 44 to 53.**

Widening of the Maine Turnpike to three general purpose lanes plus the traffic demand reduction from the other alternatives was found to address the capacity constraints of the Maine Turnpike. Under projected volumes from the Travel Demand Model, the Maine Turnpike would be under capacity in 2040 (0.89 or less). Therefore, this alternative does address identified capacity issues on the Maine Turnpike.

The key findings for this alternative are as follows:

- An expected 32% reduction in crashes on the Maine Turnpike;
- An increase in Maine Turnpike roadway capacity;
- An expected reduction of approximately 107 vehicles during the peak hour;
- 4.0% reduction in regional VMT, and a 4.7% reduction in regional VHT;
- Increases Portland area transit ridership by an estimated 416 trips;
- A reduction of 65.9 miles of roadway in the region that are near or over capacity;
- 3.9 % reduction in vehicle emission pollutants;
- Has potential wetland impacts;
- 17 acre increase of impervious pavement in Urban Impaired Stream Watersheds;
- Can be readily implemented, except for land use. Timeframe to implement land use is unknown. Local municipalities would need to adopt aggressive land use and zoning changes;
- Has a Benefit/Cost ratio of 3.97; and
- Does address Portland Area Mainline Needs Assessment Study Purpose.

[72] Maine Turnpike Authority, *Gorham East-West Corridor Feasibility Study*, (HNTB, March 2010)

6.9 Alternatives Considered But Not Analyzed

Several potential alternatives were identified by the PAC and Public for consideration. Each of these potential alternatives were evaluated and summarized in a technical paper. However, based on the findings of this evaluation, these alternatives were not specifically analyzed in the same manner as the previously identified alternatives as they were not considered reasonable alternatives to address the Study Purpose. The following alternatives were considered but not analyzed:

- Autonomous Vehicles (Appendix C-1)
- Part-time shoulder use (Appendix C-2)
- Enhanced Driver Information Systems and Enforcement (Appendix C-3)

A detailed description of each of these alternatives are included in the technical papers which can be found in the Appendix to the PAM Study. These technical papers also include a broad evaluation of why these alternatives were not considered reasonable for a more detailed alternatives analysis.

6.10 Summary of Alternatives

Table 6-13 is a matrix that summarizes the alternatives analyzed by each of the 22 MOE's developed for the PAM Study. As seen in Table 6-13, the majority of the alternatives evaluated only partially address Study Purpose and require additional action to meet Study Purpose. The majority of the alternatives also do not fully address mainline peak hour demand. Several alternatives do have a benefit/cost ratio greater than 1.0 and should be further considered, even if not by the Maine Turnpike Authority and outside of the PAM Study. The key findings of the alternatives and their potential impacts on the Maine Turnpike are described below.

If no action is taken (Alternative 1 – No Action) to address the safety and mobility needs along the Maine Turnpike corridor between Exits 44 and 53, the capacity of the roadway will be exceeded on the majority of the mainline sections during the peak hours by 2025, and for all sections by 2040. Key findings of Alternative 1 are:

- Crashes are likely to increase as traffic volumes increase;
- Roadway demand will be exceeded by as much as 1,300 vehicles per hour by 2040 with projected corridor demands anticipated to be up to 37% over capacity. This will likely result in traffic diverting to off-turnpike roadways, not designed to handle through and regional traffic; and
- Alternative does not address Study Purpose.

The TDM alternatives (Alternatives 2 through 8, 10 alternatives) have some limited to moderate positive impact on reducing travel demands on the Maine Turnpike during peak hours. Some TDM alternatives have very positive benefit/cost ratios.

The findings of new/expanded TDM programs (Alternative 2) found that:

- Existing Go Maine rideshare program has had limited success in getting people to carpool/vanpool and use alternative modes.

- Enhanced or expanded TDM programs around the US have achieved reductions as high as 4 to 8 percent.
- A small reduction in peak hour demand of 52 vehicles can be achieved with enhanced TDM programs and expanded park and ride facilities.
- Modest capital ($5.2M) and annual O&M ($1.35M) costs compared to transportation benefits yields a strong benefit/cost ratio of 13.5.
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of Congestion Pricing (Alternative 3) found that:

- Congestion pricing is currently prohibited by law in the State of Maine.
- Congestion pricing implement a 50% surcharge during peak periods to reduce travel demands. This surcharge is consistent with other toll and transportation agencies who currently use congestion pricing as a travel demand strategy.
- Sizeable reduction in peak hour demand of 257 vehicles can be achieved with Congestion Pricing.
- Congestion pricing increases the miles of off-Turnpike roadways that are near or over capacity, and increases vehicle hours traveled, primarily due to traffic diverting from the Maine Turnpike.
- Negative benefit/cost ratio (-93.46)
- Alternative only partially meets Study Purpose and needs additional action.

The findings of new or improved Interstate Bus Service (Alternative 4) found that:

- Alternative looked at additional peak hour bus for Concord Coach lines from Portland to Boston;
- Alternative also looked at additional ridership from recently initiated Lewiston/Auburn to Portland interstate bus from Concord Coach lines;
- A small reduction in peak hour demand of 40 vehicles can be achieved with new and improved interstate bus with additional parking at the Portland Transportation Center. Still results in Maine Turnpike corridor being over capacity (1.36);
- Increases transit trips in the region by 100 new trips;
- Modest capital ($2.1M) and annual O&M ($0.75M) costs compared to transportation benefits yields a strong benefit/cost ratio of 5.75; and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of new or improved Regional Bus Service (Alternative 5a) found that:

- Alternative looked at additional peak hour bus for ZOOM Bus (Biddeford/Saco to Portland) and BREEZ (Brunswick to Portland);
- Alternative also assumed Bus Rapid Transit (BRT) like system and additional transit infrastructure to support additional peak hour buses and ridership (90 additional peak hour transit trips);
- No/limited reduction in peak hour demand (1 vehicle). Still results in Maine Turnpike corridor being over capacity (1.37);

- Modest capital ($3M) and annual O&M ($1.7M) costs compared to transportation benefits yields a strong benefit/cost ratio of 4.9; and
- Alternative does not fully address Study Purpose and needs additional action.

The findings of new or improved Local Bus Service (Alternative 5b) found that:

- Alternative looked at more frequent service (15-minute headways) for Portland METRO and South Portland Bus Service;
- Alternative also assumed Bus Rapid Transit (BRT) like system and additional transit infrastructure to support additional buses and ridership (320 additional peak hour transit trips);
- No/limited reduction in peak hour demand (3 vehicles). Still results in Maine Turnpike corridor being over capacity (1.37);
- Higher capital ($7M) and annual O&M ($2M) costs compared to transportation benefits yields a low benefit/cost ratio of 0.3; and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of a new I-95 Corridor Regional Bus (Alternative 5c) found that:

- Alternative created a new, I-95 corridor regional bus services from Biddeford/Saco (Southern Route) and Gray/West Falmouth (Northern Route) to Exits 45 through 48 on the Maine Turnpike with 15-minute headways;
- Alternative assumed that stops at Exits 45 through 48 would connect to existing Portland METRO and South Portland Bus service routes;
- Alternative identified a strong demand for local, Maine Turnpike corridor transit service between Exits 45 and 48;
- Alternative also assumed Bus Rapid Transit (BRT) like system for connecting local bus service and additional transit infrastructure to support additional buses and ridership (430 additional peak hour transit trips);
- Sizeable reduction in peak hour demand (108 vehicles). Still results in Maine Turnpike corridor being over capacity (1.34);
- Higher capital ($22.5M) and annual O&M ($6.4M) costs compared to transportation benefits yields a low benefit/cost ratio of 0.6. Further analysis could identify potential for Maine Turnpike corridor transit system with positive benefit/cost ratio; and
- Alternative does not fully address Study Purpose and needs additional action.

The findings of new or improved Commuter Rail (Alternative 6a) found that:

- Alternative evaluated three separate commuter rail opportunities: 1) improved Amtrak Downeaster travel times through planned improvements between Portland and Boston, 2) new commuter rail between Lewiston/Auburn and Portland, and 3) new commuter rail between Standish/Windham and Portland along the reactivated Mountain Division line;

- Planned improvements between Portland and Boston and including to Freeport/Brunswick for the Amtrak Downeaster would reduce travel times by 15 minutes, approximately 11%;
- Lewiston/Auburn and Mountain Division ridership and cost information provided from previous studies[73];
- Limited reduction in peak hour demand (26 vehicles). Still results in Maine Turnpike corridor being over capacity (1.36);
- High capital ($258.8M) and annual O&M ($11.9M) costs for all three commuter rail elements compared to transportation benefits yields a low benefit/cost ratio of 0.6. Further analysis could identify greater potential and benefit/cost ratio for improved Amtrak Downeaster alternative; and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of new Local Commuter Rail (Alternative 6b) found that:

- Alternative evaluated three separate local commuter rail opportunities: 1) Westbrook to Portland along a reactivated Mountain Division Line, 2) West Falmouth to Portland along the existing Pan Am rail line, and 3) Biddeford/Saco to Portland along the Amtrak Downeaster line;
- Alternative also assumed local and regional bus head way improvements, Bus Rapid Transit (BRT) like system for connecting local bus service and additional transit infrastructure to support additional ridership (430 additional peak hour transit trips);
- Westbrook to Portland assumed stations in downtown Westbrook and near Exit 47 Park and Ride at Larrabee Road;
- West Falmouth to Portland assumed new park and ride facility and station in West Falmouth;
- Biddeford/Saco to Portland would utilize existing rail line and stations;
- Reduction in peak hour demand (72 vehicles). Still results in Maine Turnpike corridor being over capacity (1.35);
- High capital ($68.5M) and annual O&M ($9M) costs for all three local commuter rail elements compared to transportation benefits yields a low benefit/cost ratio of 0.2. Further analysis could identify greater potential and benefit/cost ratio for local commuter rail service from Westbrook to Portland only. Location of Portland Transportation Center should also be assessed if additional analysis performed; and
- Alternative does not fully address Study Purpose and needs additional action.

The findings of new or improved intermodal freight service (Alternative 7) found that:

- Alternative evaluated potential to convert existing truck trips to rail trips. Truck trips greater than 500 miles are candidates for potential truck to rail conversion;

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[73] Portland to Lewiston / Auburn & Montreal Intercity Passenger Rail Feasibility Study, August 2011, MaineDOT and Mountain Division Rail Study, Report on Potential Uses and Implementation Costs, December 2007, MaineDOT

- Approximately 5% of commercial truck trips along the Maine Turnpike in the Study corridor are greater than 500 miles from Maine Turnpike origin-destination data;
- Limited reduction in peak hour demand (7 vehicles). Still results in Maine Turnpike corridor being over capacity (1.36); and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of a Land Use Scenario (Alternative 8) found that:

- Alternative evaluated potential to reduce travel demand and increase transit trips through identification of centers of opportunity where additional population and employment could be directed. Alternative followed specific allocations identified in the Gorham East-West Corridor Study[74];
- While land use is primarily under control of municipalities, opportunities for advancing centers of opportunity evaluated under regional partnership known as Sustain Southern Maine[75];
- Reduction in peak hour demand (92 vehicles). Still results in Maine Turnpike corridor being over capacity (1.34);
- Sizeable reduction in off-Turnpike miles of roadway near or over capacity due to reduction in travel demand and additional transit trips (225 new trips);
- Due to control of land use by municipalities and strong historic local control, high level of uncertainty for time of implementation; and
- Alternative does not fully address Study Purpose and needs additional action.

In summary, the TDM alternatives evaluated did not reduce peak hour demand sufficiently to address identified capacity constraints on the Maine Turnpike and do not fully meet Study Purpose. Some of these alternatives may be grouped together to have an improved impact, however it is important to remember the market for each TDM alternative potentially overlap, and therefore the potential effectiveness of each is not strictly additive.

The TSM alternatives (Alternatives 9a, 9b, and 9c) have varying effects on reducing travel demands on the Maine Turnpike during peak hours. Some TSM alternatives have positive benefit/cost ratios.

The findings of implementation of ramp metering (Alternative 9a) found that:

- Alternative evaluated the impacts of implementing ramp metering at each of the interchange on-ramps within the Study Area to control the volume of traffic entering the Maine Turnpike;
- Widening of selected on-ramps to two-lanes and extending the acceleration lane length to accommodate ramp metering was also included;
- Alternative was able to reduce peak hour demand sufficiently to address capacity issues (1,327 vehicles). Results in Maine Turnpike corridor being at capacity (1.00);

[74] Gorham East-West Corridor Study, March 2010, Maine Turnpike Authority
[75] http://sustainsouthernmaine.org/about-us

- Sizeable increase in off-Turnpike miles of roadway near or over capacity (+20 miles) due to traffic diverting Maine Turnpike due to ramp metering;
- Increases in VHT and air pollutants due to diverting or queuing traffic; and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of HOV/HOT lanes (Alternative 9b) found that:

- Alternative evaluated implementation of high occupancy vehicle (HOV) and high occupancy toll (HOT) lanes. This is an unconventional alternative as no HOT lanes existing within conventional toll facilities in the United States;
- Assumed that Maine Turnpike would be widened to three-general purpose lanes in each direction to accommodate HOV/HOT lanes;
- HOV 2+ would be a general defacto third lane due to utilization. HOV 3+ would be required for time advantage to HOV's;
- Alternative addresses peak hour demand through addition of third lane. Results in Maine Turnpike corridor being at below capacity (0.85 for HOV lane, 0.94 for general purpose lanes);
- Reduction in off-Turnpike miles of roadway near or over capacity (+13 miles) due to traffic diverting to Maine Turnpike due to additional capacity from local roads;
- Increase in impervious pavement and potential wetland impacts;
- Unconventional nature of alternative makes timeframe to implement unknown; and
- Alternative fully addresses Study Purpose.

The findings of implementing a reversible lane (Alternative 9c) found that:

- Alternative evaluated implementation of a barrier separated, reversible lane constructed in the median of the Maine Turnpike between Exits 44 and 52. During peak periods, peak direction traffic would be allowed to utilize the reversible lane;
- Reversible lane would only be utilized for traffic traveling through the region as the barrier would prevent vehicles from enter or exit between Exits 44 and 52;
- Alternative addresses peak hour demand through addition of reversible lane for the short-term. Results in Maine Turnpike corridor being at below capacity with reversible lane (0.82 for reversible lane and 0.96 for general purpose lanes), but over capacity for non-peak direction (1.08);
- Reduction in off-Turnpike miles of roadway near or over capacity (6.5 miles) due to traffic diverting to Maine Turnpike due to additional reversible lane capacity;
- Increase in impervious pavement and potential wetland impacts;
- Considered short term alternative, but would require nearly 90% of capital cost for two additional lanes due to wide cross section of reversible lane; and
- Alternative does not fully address Study Purpose and needs additional action.

In summary, TSM alternatives have the potential to manage traffic demand on the Maine Turnpike, but either result in increased congestion off-Turnpike, are unique alternatives that may have sizeable legal and public obstacles, or are short-term solutions.

The capacity expansion alternatives (Alternatives 10 through 12) have varying impacts on congestion on the Maine Turnpike.

The analysis of widening I-295 to three general purpose lanes in each direction (Alternative 10) found that:

- Alternative evaluated addition of an additional general purpose lane on I-295 through Portland from Exit 44/Maine Turnpike in Scarborough to Exit 11 in Falmouth, approximately 11 miles;
- MaineDOT is responsible for I-295 and recently published a report that does not recommend widening I-295 due to fiscal constraints;
- Reduction in peak hour demand (211 vehicles). Still results in Maine Turnpike corridor being over capacity (1.31). Reduces off-turnpike roadways near or over capacity;
- Increase in impervious pavement and potential wetland impacts; and
- Alternative does not fully address Study Purpose and needs additional action.

The findings of widening I-295 to three general purpose lanes in each direction (Alternative 11) found that:

- Alternative evaluated addition of an additional general purpose lane on I-295 through Portland from Exit 44/Maine Turnpike in Scarborough to Exit 11 in Falmouth, approximately 11 miles;
- Alternative also assumes addition of two toll plazas along I-295 – one near the Fore River bridge (between Exits 4 and 5) and one near Tukey's bridge (between Exits 8 and 9);
- MaineDOT is responsible for I-295 and recently published a report that does not recommend widening I-295 due to fiscal constraints. Additional tolling likely a public/policy issue;
- Tolling I-295 would be under FHWA jurisdiction and would be done under the tolling pilot program, subject to approval;
- Alternative increases peak hour demand (+378 vehicles). Results in Maine Turnpike corridor being well over capacity (1.47);
- Increase in impervious pavement and potential wetland impacts; and
- Alternative does not meet Study Purpose.

The analysis of widening I-95 to three general purpose lanes (Alternative 12) in each direction found that:

- Alternative evaluated addition of an additional general purpose lane on I-95 through Portland from Exit 44 in Scarborough to Exit 53 in Falmouth, approximately 9 miles;
- Alternative currently identified in MTA's 4-year and 30-year plan;

- Alternative addresses peak hour demand and results in Maine Turnpike corridor being under capacity (0.91). Reduces off-turnpike roadways near or over capacity as traffic diverts from local roads to the Maine Turnpike;
- Increase in impervious pavement and potential wetland impacts;
- Funding has currently been identified by MTA; and
- Alternative fully addresses Study Purpose.

In summary, Alternative 12 was found to address the capacity constraints identified for the Maine Turnpike during peak hours. Widening I-295 was found to sizably reduce travel demand on the Maine Turnpike, but was deemed unlikely to implement due to MaineDOT funding constraints and previously stated public opinion. Widening I-295 with tolls could provide possible funding through FHWA's tolling pilot programs, but would add additional traffic to the Maine Turnpike and further support the need to add capacity.

The combination alternatives (Alternatives 13 and 14) have varying impacts on congestion on the Maine Turnpike.

The findings of combining TDM (Alternative 2), interstate bus service (Alternative 4), regional bus service (Alternative 5a), local bus service (Alternative 5b), and land use (Alternative 8) for Alternative 13 found that:

- Combination of strongest TDM alternatives;
- While land use is primarily under control of municipalities, opportunities for advancing centers of opportunity evaluated under regional partnership known as Sustain Southern Maine[76];
- Reduction in peak hour demand (107 vehicles). Still results in Maine Turnpike corridor being over capacity (1.34);
- Sizeable reduction in off-Turnpike miles of roadway near or over capacity due to reduction in travel demand and additional transit trips (416 new trips);
- Reduction in VMT, VHT and air pollutants;
- Due to control of land use by municipalities and strong historic local control, high level of uncertainty for time of implementation; and
- Alternative does not fully address Study Purpose and needs additional action.

The analysis of combining TDM (Alternative 2), interstate bus service (Alternative 4), regional bus service (Alternative 5a), local bus service (Alternative 5b), and land use (Alternative 8) for Alternative 14 found that:

- Combination of strongest TDM alternatives;

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[76] ibid

- Alternative evaluated addition of an additional general purpose lane on I-95 through Portland from Exit 44 in Scarborough to Exit 53 in Falmouth, approximately 9 miles;
- While land use is primarily under control of municipalities, opportunities for advancing centers of opportunity evaluated under regional partnership known as Sustain Southern Maine[77];
- Reduction in peak hour demand (107 vehicles). Results in Maine Turnpike corridor being under capacity (0.89) due to additional general purpose lane on I-95;
- Sizeable reduction in off-Turnpike miles of roadway near or over capacity due to reduction in travel demand and additional transit trips (416 new trips);
- Reduction in VMT, VHT and air pollutants;
- Due to control of land use by municipalities and strong historic local control, high level of uncertainty for time of implementation; and
- Alternative fully addresses Study Purpose.

In summary, Alternative 13 reduced travel demand, but its primary benefit came from the land use scenario which has a long or unknown implementation period. Alternative 14 was found to fully meet Study Purpose and resulted in the lowest travel demand on the Maine Turnpike. Alternative 14 also contained the land use scenario.

[77] ibid

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Portland Area Mainline Needs Assessment

Alternative Evaluation Matrix: Summary of Measures of Effectiveness (MOEs) compared to Future (2040) No-Build Alternative

7/9/2018

Transportation Measures (A–H)

Category	Alt #	Description of Alternative	A: Safety Benefits on Maine Turnpike	B: Mainline Turnpike Capacity	C: Change in Mainline Turnpike Demand	D: Mainline Turnpike Volume to Capacity Ratio	E: Regional Off-Turnpike Benefits	F: Vehicle Miles Traveled (VMT)	G: Vehicle Hours Traveled (VHT)	H: Change in Transit Ridership
	1	Future No Build (2040 Baseline)	202 crashes (Exits 44-53, 2012-2016)	3600 vehicles per hour by direction currently and in 2040 (LOS F by 2040)	Mainline Peak Demand = 4920 Vehicles[1]	Mainline Peak Demand V/C = 1.37[1]	460 mi (286 mi Near Capacity) (174 mi Over Capacity)	Approximately 930,000 miles[2]	Approximately 23,000 hours[2]	Approximately 1000 Transit Trips[3]
TDM Alternatives	2	New/Expanded Transportation Demand Management (TDM) Programs	Safety Improved (-1.0% reduction)	No Change	-52 vehicles (1.1%)	V/C =1.35	No/Limited Change	Reduction (-0.5%)	Reduction (-0.3%)	No/Limited Change
TDM Alternatives	3	Congestion Pricing on Maine Turnpike	Safety Improved (-5.1% reduction)	No Change	-257 vehicles (5.2%)	V/C =1.30	Increases miles near or over capacity (+9.2 mi)	No/Limited Change	Increase (+0.7%)	No/Limited Change
TDM Alternatives	4	Public Transportation: New or Improved Interstate Bus Service	No/Limited Safety Improvement Change (-0.8% reduction)	No Change	-40 vehicles (0.8%)	V/C =1.36	No/Limited Change	Reduction (-0.1%)	No/Limited Change	Increases (100 new trips) [10%]
TDM Alternatives	5a	Public Transportation: New or Improved Regional Bus Service	No/Limited Safety Improvement Change (-0% reduction)	No Change	-1 vehicle (0.1%)	V/C =1.37	No/Limited Change	Reduction (-0.2%)	Reduction (-0.1%)	Increases (90 new trips) [9%]
TDM Alternatives	5b	Public Transportation: New or Improved Local Bus Service	No/Limited Safety Improvement Change (-0.1% reduction)	No Change	-3 vehicles (0.1%)	V/C =1.37	No/Limited Change	No/Limited Change	No/Limited Change	Increases (320 new trips) [32%]
TDM Alternatives	5c	**Public Transportation: New I-95 Corridor Regional Bus**	Safety Improved (-2.1% reduction)	No Change	-108 vehicles (2.2%)	V/C =1.34	No/Limited Change	Reduction (-0.6%)	Reduction (-0.6%)	Increases (430 new trips) [43%]
TDM Alternatives	6a	Alternative Modes - Expanded Amtrak, New Mountain Division Commuter Rail & New Lewiston Auburn Commuter Rail (See back page for breakdown)	No/Limited Safety Improvement Change (-0.5% reduction)	No Change	-26 vehicles (0.5%)	V/C =1.36	No/Limited Change	Reduction (-0.3%)	Reduction (-0.2%)	Increases (232 new trips) [23%]
TDM Alternatives	6b	**Alternative Modes - New Commuter Rail Service to Westbrook, West Falmouth & Biddeford (See back page for Breakdown)**	Safety Improved (-1.5% reduction)	No Change	-72 vehicles (1.5%)	V/C =1.35	No/Limited Change	Reduction (-0.4%)	Reduction (-0.3%)	Increases (380 new trips) [38%]
TDM Alternatives	7	Freight Transportation - New or improved intermodal freight service	No/Limited Safety Improvement Change (-0.1% reduction)	No Change	-7 vehicles (0.2%)	V/C =1.36	No/Limited Change	Reduction (-0.6%)	Reduction (-0.4%)	No/Limited Change
TDM Alternatives	8	Land Use Scenario	Safety Improved (-1.8% reduction)	No Change	-92 vehicles (1.9%)	V/C =1.34	Reduces miles near or over capacity (-59.9 mi)	Reduction (-4.1%)	Reduction (-4.4%)	Increases (225 new trips) [23%]
TSM Alternatives	9a	Ramp Metering	Safety Improved (-32.4% reduction)	No Change	-1,327 vehicles (27.0%)	V/C =1.00	Increases miles near or over capacity (+20.0 mi)	No/Limited Change	Increase (+1.0%)	No/Limited Change
TSM Alternatives	9b	High-Occupancy Vehicle (HOV)/ High-Occupancy Toll (HOT) Lanes	Safety Improved (-25.9% reduction)	Full Increase in Capacity (5400) [50% increase]	No Change (0%)	HOV/HOT Lane V/C = 0.85 2 Lane V/C= 0.94	Reduces miles near or over capacity (-13.1 mi)	Increase (+0.2%)	Reduction (-0.3%)	No/Limited Change
TSM Alternatives	9c	Reversible Lane	Safety Improved in peak direction (-25.3% reduction) No improvement in off-peak direction	Directional Increase in Capacity 3600 (Off-Peak Direction) [0%] 5400 (Peak Direction) [50%]	No Change (0%)	2 lane V/C = 1.08 (Off-Peak) Reversible lane V/C = 0.82 (Peak) 2-lane V/C = 0.96 (Peak)	Reduces miles near or over capacity (-6.5 mi)	Increase (+0.2%)	Reduction (-0.3%)	No/Limited Change
Highway Capacity Alternatives	10	Widen I-295 to three-lanes in each direction	Safety Improved (-4.2% reduction)	No Change	-211 vehicles (4.3%)	V/C =1.31	Reduces miles near or over capacity (-21.8 mi)	Increase (+0.3%)	Reduction (-0.2%)	No/Limited Change
Highway Capacity Alternatives	11	Widen I-295 to three-lanes in each direction with tolls	Safety Reduced (6.8% increase)	No Change	+378 vehicles (7.7%)	V/C =1.47	No/Limited Change	Increase (+0.4%)	Increase (+1.9%)	No/Limited Change
Highway Capacity Alternatives	12	Widen Turnpike to three lanes in each direction from Exit 44 to 53	Safety Improved (-29.3% reduction)	Full Increase in Capacity (5400) [50% increase]	No Change (0%)	V/C =.91	Reduces miles near or over capacity (-13.6 mi)	Increase (+0.2%)	Reduction (-0.3%)	No/Limited Change
PAC Requested Combinations	13	**TDM, Interstate, Local and Regional Bus, and Land Use (Alternatives 2, 4, 5a, 5b, and 8)**	Safety Improved (-2.1% increase)	No Change	-107 vehicles (2.2%)	V/C =1.34	Reduces miles near or over capacity (-60.3 mi)	Reduction (-4.6%)	Reduction (-4.7%)	Increases (416 new trips) [42%]
PAC Requested Combinations	14	**TDM, Interstate, Local and Regional Bus, and Land Use with Widened Turnpike from Exit 44 to 53 (Alternatives 2, 4, 5a, 5b, 8, and 12)**	Safety Improved (-32% reduction)	Full Increase in Capacity (5400) [50% increase]	-107 vehicles (2.2%)	V/C =.89	Reduces miles near or over capacity (-65.9 mi)	Reduction (-4.0%)	Reduction (-4.7%)	Increases (416 new trips) [42%]
		How Alternative will be Measured	Increase/ decrease in crashes and crash rate based on Highway Safety Manual Methodology	Change in Mainline Turnpike Capacity	Change in Peak Demand on Maine Turnpike between Exits 46 and 47	Resulting Volume/Capacity Ratio on Maine Turnpike between Exits 46 and 47	Number of miles in PACTS region near or over capacity	Change in VMT	Change in VHT	List all applicable social benefits identified
		Evaluation Summary by MOE (green)	Anticipated Safety Improvement > 1%	Full Increase in Turnpike Capacity	Reduction in Peak Demand > -1%	Resulting V/C Ratio < 0.8	Reduces miles near or over capacity >1.0 miles	Reduction in Vehicle Miles Traveled >0.1%	Reduction in Vehicle Hours Traveled >0.1%	Increase in Transit Trips > +1%
		Evaluation Summary by MOE (yellow)	No/Limited Safety Improvement Change (-1% to +1%)	No Change in Turnpike Capacity	No/Limited Change in Peak Demand (-1% to +1%)	Resulting V/C Ratio 0.8 to 1.0	No/Limited Change to miles near or over capacity (-1.0 to 1.0 miles)	No/Limited Change to Vehicle Miles Traveled (-0.1% to 0.1%)	No/Limited Change to Vehicle Hours Traveled (-0.1% to 0.1%)	Decrease in Transit Trips (-1% to +1%)
		Evaluation Summary by MOE (red)	Anticipated Safety Reduction >+1%	Reduction in Turnpike Capacity	Increase in Peak Demand >+1%	Resulting V/C Ratio >1.0	Increases miles near or over capacity >+1.0 miles	Increases in Vehicle Miles Traveled >+0.1%	Increases in Vehicle Hours Traveled >+0.1%	Decrease in Transit Trips >-1%

Environmental Measures (I–L) and Cost/Funding Measures (M–Q)

Alt #	I: Regional Air Quality	J: Change in Regional Impervious Pavement	K: Change in Regional Impervious Pavement within Urban Impaired Stream Watershed	L: Potential Wetland Impacts	M: Initial Capital Cost (2018 Dollars)	N: Capital Funding Viability	O: O&M Cost (2018 Dollars)	P: O&M Funding Viability	Q: Potential Toll Revenue Impacts[8]
1	Approximately 138 ppm of NOx and 66 ppm of HC[4]	Approximately 6,000 acres of existing impervious pavement[5]	Approximately 1600 Acres of existing impervious pavement in urban impaired stream watersheds	Yes or No	N/A	N/A	$0.9M	N/A	Change in Future Revenue
2	NOx (Reduction -0.5%) HC (Reduction -0.4%)	No/Limited Change (+4)	No/Limited Change (0)	Yes	$5.2M	Yes	$1.35M	Yes	Reduced Revenue
3	NOx (No/Limited Change) HC (Increase +0.3%)	No/Limited Change (0)	No/Limited Change (0)	No	$2.6M	Yes	$0.05M	Yes	Additional Revenue
4	NOx (Reduction -0.1%) HC (Reduction -0.1%)	No/Limited Change (0)	No/Limited Change (0)	Yes	$2.1M $40.7M[6]	Uncertain	$0.75M	Uncertain	Reduced Revenue
5a	NOx (Reduction -0.2%) HC (Reduction -0.2%)	No/Limited Change (0)	No/Limited Change (0)	No	$3M	Uncertain	$1.7M	Uncertain	No/ Limited Change
5b	NOx (No/Limited Change) HC (No/Limited Change)	No/Limited Change (0)	No/Limited Change (0)	No	$7M	Uncertain	$2M	Uncertain	Reduced Revenue
5c	NOx (Reduction -0.6%) HC (Reduction -0.6%)	No/Limited Change (0)	No/Limited Change (0)	Yes	$22.5M[9]	Uncertain	$6.4M	Uncertain	Reduced Revenue
6a	NOx (Reduction -0.5%) HC (Reduction -0.4%)	No/Limited Change (0)	No/Limited Change (0)	Yes	$258.8M[7]	Uncertain	$11.9M	Uncertain	Reduced Revenue
6b	NOx (No/Limited Change) HC (Reduction -0.1%)	No/Limited Change (0)	No/Limited Change (0)	Yes	$68.5M	Uncertain	$9.0M	Uncertain	Reduced Revenue
7	NOx (Reduction -0.6%) HC (Reduction -0.5%)	No/Limited Change (0)	No/Limited Change (0)	Yes	$34.4M	No	$2.9M	No	Reduced Revenue
8	NOx (Reduction -4.1%) HC (Reduction -4.3%)	No/Limited Change (0)	No/Limited Change (0)	No	$2.7M	Uncertain	$0.08M	Uncertain	Reduced Revenue
9a	NOx (Increase +0.1%) HC (Increase +0.3%)	No/Limited Change (+5)	No/Limited Change (< +1) [< 1.0%]	Yes	$11.6M	Yes	$0.05M	Yes	No/ Limited Change
9b	NOx (Increase +0.3%) HC (No/Limited Change)	No/Limited Change (+38)	Increase (+17) [+1.1%]	Yes	$162M	Yes	$0.7M	Yes	No/ Limited Change
9c	NOx (Increase +0.2%) HC (No/Limited Change)	No/Limited Change (+28)	Increase (+9) [< 1.0%]	Yes	$137.3M	Yes	$0.6M	Yes	No/ Limited Change
10	NOx (Increase +0.3%) HC (No/Limited Change)	No/Limited Change (+55)	Increase (+9) [+3.0%] Based on 330 Acres within I-295 watershed	Yes	$265.8M	No	$0.6M	No	Reduced Revenue
11	NOx (Increase +0.2%) HC (Increase +1.0%)	No/Limited Change (+55)	Increase (+9) [+3.0%] Based on 330 Acres within I-295 watershed	Yes	$271.3M	No	$0.8M	No	Additional Revenue
12	NOx (Increase +0.2%) HC (No/Limited Change)	No/Limited Change (+42)	Increase (+17) [+1.1%]	Yes	$158.8M	Yes	$0.5M	Yes	Additional Revenue
13	NOx (Reduction --4.5%) HC (Reduction -4.7%)	No/Limited Change (+4)	No/Limited Change (0)	Yes	$21.1M	Uncertain	$5.88M	Uncertain	Reduced Revenue
14	NOx (Reduction -3.9%) HC (Reduction -4.3%)	No/Limited Change (+46)	Increase (+17) [+1.1%]	Yes	$179.9M	Uncertain	$6.38M	Uncertain	Additional Revenue
How Alternative will be Measured	Reduction, No Change, Increase with NOx and HC gradations	Measure of change in impervious pavement compared to regional totals	Measure of change in impervious pavement in urban impaired stream watersheds within I-95 between exits 44-53	Identified for potential wetland impacts due to new infrastructure construction	$ M of 2018 $$	Measure of available funding	$ M of 2018 $$	Measure of available funding	Change in tolling revenue compared to No Build in 2040
Evaluation Summary by MOE (green)	Reduction in both NOx and HC > -0.1%	Decrease in Impervious Acres >=-1%	Decrease in Impervious Acres >=-1%	No		Funding currently identified or available		Funding currently identified or available	Additional Revenue Anticipated
Evaluation Summary by MOE (yellow)	No/Limited Change One or Both NOx and HC (-0.1% to 0.1%)	No/Limited Change (-1% to +1%)	No/Limited Change (-1% to +1%)			No or Limited Funding currently identified		Uncertainty of funding	No/Limited Revenue Change Anticipated
Evaluation Summary by MOE (red)	Increase in both NOx and HC >+0.1%	Increase in Impervious <=1% Acres	Increase in Impervious <=1% Acres	Yes		No Funding currently identified		No Funding currently identified	Reduced Revenue due to capacity constraints

Implementation Measures (R–T) and Summary Measures (U–V)

Alt #	R: Legal/Policy Obstacles	S: Timeframe to Implement	T: Likely Implementation Agency	U: Benefit/Cost	V: Address Study Purpose
1	N/A	N/A	N/A	N/A	No
2	No obstacles	Short implementation period (< 5 yrs)	Maine Turnpike Authority	13.5	Partially - needs additional action to meet Study Purpose
3	Higher obstacles	Unknown or Long Implementation period (> 10 yrs)	Maine Turnpike Authority	-93.46	Partially - needs additional action to meet Study Purpose
4	No obstacles	Short implementation period (< 5 yrs)	Concord/ Greyhound/ Other Intercity bus provider	5.75	Partially - needs additional action to meet Study Purpose
5a	No obstacles	Short implementation period (< 5 yrs)	Regional Bus Provider	4.30	Partially - needs additional action to meet Study Purpose
5b	No obstacles	Short implementation period (< 5 yrs)	Local Bus Provider	0.26	Partially - needs additional action to meet Study Purpose
5c	No obstacles	Short implementation period (< 5 yrs)	Regional Bus Provider	0.56	Partially - needs additional action to meet Study Purpose
6a	Limited Obstacles	Medium implementation period (5 to 10 yrs)	NNEPRA/ Amtrak	0.55	Partially - needs additional action to meet Study Purpose
6b	Limited Obstacles	Medium implementation period (5 to 10 yrs)	NNEPRA	0.17	Partially - needs additional action to meet Study Purpose
7	Limited Obstacles	Medium implementation period (5 to 10 yrs)	MaineDOT	3.88	Partially - needs additional action to meet Study Purpose
8	Limited Obstacles	Unknown or Long Implementation period (> 10 yrs)	Municipalities	1.72	Partially - needs additional action to meet Study Purpose and highly unlikely by 2040
9a	Limited Obstacles	Short implementation period (< 5 yrs)	Maine Turnpike Authority	0.35	Partially - needs additional action to meet Study Purpose
9b	Higher obstacles	Unknown or Long Implementation period (> 10 yrs)	Maine Turnpike Authority	1.24	Fully
9c	Limited obstacles	Short implementation period (< 5 yrs)	Maine Turnpike Authority	1.43	Partially - needs additional action to meet Study Purpose. Addresses study purpose in short-term, but will result in undesirable level of service in non-peak direction in 5 to 10 years.
10	Higher obstacles	Medium implementation period (5 to 10 yrs)	MaineDOT	0.43	Partially - needs additional action to meet Study Purpose
11	Higher obstacles	Unknown or Long Implementation period (> 10 yrs)	MaineDOT	-0.66	No
12	Limited obstacles	Short implementation period (< 5 yrs)	Maine Turnpike Authority	2.80	Fully
13	Limited Obstacles	Unknown or Long Implementation period (> 10 yrs)	Multiple Entities	3.12	Partially - needs additional action to meet Study Purpose
14	Limited Obstacles	Unknown or Long Implementation period (> 10 yrs)	Multiple Entities	3.97	Fully
How Alternative will be Measured	Yes, No, with Detail if needed	Short, medium, long term implementation period	Agency/Entity likely responsible for implementation	B/C ratio	Address Study Purpose
Evaluation Summary by MOE (green)	No obstacles	Short implementation period (< 5 yrs)		B/C > 1.0	Fully Addresses Study Purpose
Evaluation Summary by MOE (yellow)	Limited obstacles	Medium implementation period (5 to 10 yrs)		B/C at 1.0	Partially Addresses Study Purpose
Evaluation Summary by MOE (red)	Higher obstacles	Unknown or Long Implementation period (> 10 yrs)		B/C < 1.0	Does Not Address Study Purpose

Footnotes

1 Mainline vehicle demand NB PM Peak between Exits 46 and 47. Range of volumes between exit 44 and 53 both directions (AM and PM) exceeding capacity by 2040 is approximately 400 to 1300 vehicles
2 Vehicle miles traveled & vehicle hours traveled in PACTS region during PM peak hour
3 Change in transit share during the peak hour using PACTS mode share model
4 2040 regional air quality emission levels are approximately 25% of 2015 air quality emission levels
5 Acres of impervious pavement on roadways in PACTS region
6 Assumes capital cost for buses and a new parking lot vs. capital cost for buses and new parking structure at Portland Transportation Center
7 Includes costs for Amtrak Downeaster siding improvements, new service from Portland to Lewiston/Auburn, and new service for Mountain Division
8 Assumes potential revenue change from a constrained Maine Turnpike in Portland region only.
9 Assumes improvements to park and ride lots, all local bus improvements in alternate 5b, and large capacity buses for regional routes.

DRAFT - SUBJECT TO DISCUSSION

Project Website: www.maineturnpike.com/Projects-Planning/Planning-Projects/PAM.aspx

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7. Summary of Findings and Recommendations

7.1 Introduction

The section of the Maine Turnpike from Exit 44 in Scarborough to Exit 53 in West Falmouth has been the subject of study and evaluation over the past decade or more. Sizeable traffic growth in the early to mid-2000's initially identified this section as potentially requiring actions to address growing safety and capacity issues. The economic decline of the late 2000's and into the early 2010's reduced traffic demand and therefore temporarily eliminated the need to further evaluate these issues.

Current and future traffic growth forecasted for the Maine Turnpike in this section has re-initiated the need to evaluate the issue of highway's capacity and its traffic demand. The 2016 MTA Safety and Capacity Study identified that the majority of the section of the Maine Turnpike between Exits 44 and 53, both northbound and southbound, would need additional capacity within the Study analysis period. This prompted the Maine Turnpike Authority (MTA) to initiate the PAM Study which began in the spring of 2017.

7.2 Overview of Analysis

The purpose of the PAM Study was to compile and assimilate current and past MTA efforts to date that sought to address growing travel demands in the corridor, and identify any other reasonable alternatives to determine how they might address the overall future needs for safety and mobility along this section of the Maine Turnpike. This approach is consistent with the Sensible Transportation Policy Act (STPA) and §1965-B of the MTA's Enabling Act, a 1991 State of Maine law that requires that a full range of reasonable transportation alternatives be evaluated for all significant highway 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. Reasonable transportation alternatives are those that adequately respond to the identified need in the transportation network, are cost effective, and are capable of being implemented within a reasonable time period necessary to meet the transportation deficiency or need.

The Study was conducted in three parts:

- Evaluation of existing conditions
- Evaluation of future conditions
- Identification and evaluation of reasonable alternatives to address transportation deficiency

The evaluation of existing conditions confirmed the findings of the 2016 MTA Safety and Capacity Study but also revealed that traffic was growing a rate greater than previously anticipated. This study found that several sections of the Maine Turnpike between Exits 44 and 53 are currently at marginal (LOS D) or undesirable (LOS E or F) Levels of Service.

The evaluation of future conditions evaluated traffic conditions if conservative 1.5% growth continued over the next 10 to 20 years without additional transportation improvements. Based on the results of this evaluation, this study found that by Year 2025 all sections between Exits 44 and 53 would be at marginal or undesirable levels of service (LOS), with the majority being at LOS E and F. It was also determined that by Year 2040, all sections would be at LOS E or F, many being well over capacity.

The PAM Study initially identified nine reasonable alternatives for evaluation. Through the PAC process established by the MTA for this Study, and through public input and comment, an additional 10 alternatives were identified for evaluation.

7.3 Summary of Alternatives

Alternatives evaluated for the Study fell into one of three categories: TDM alternatives, TSM alternatives, and capacity alternatives. A few reasonable alternatives were combined into a single alternative to evaluate the cumulative effect that could potentially be achieved.

The following lists the 19 alternatives evaluated as part of the Study:

1. Alternative 1 – Future No Action
2. Alternative 2 – Expanded TDM/Rideshare (TDM Alternative)
3. Alternative 3 – Congestion Pricing (TDM Alternative)
4. Alternative 4 – New or Improved Interstate Bus (TDM Alternative)
5. Alternative 5a – Improved Regional Bus (TDM Alternative)
6. Alternative 5b – Improved Local Bus (TDM Alternative)
7. Alternative 5c – New I-95 Corridor Regional Bus (TDM Alternative)
8. Alternative 6a – New or Improved Commuter Rail (TDM Alternative)
9. Alternative 6b – New Local Commuter Rail (TDM Alternative)
10. Alternative 7 – New or Improved Freight Rail (TDM Alternative)
11. Alternative 8 – Land Use Scenario (TDM Alternative)
12. Alternative 9a – Ramp Metering (TSM Alternative)
13. Alternative 9b – High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT) Lanes (TSM Alternative)
14. Alternative 9c – Reversible Lane (TSM Alternative)
15. Alternative 10 – Widen I-295 to three lanes in each direction (Capacity Alternative)
16. Alternative 11 – Widen I-295 to three lanes in each direction and toll I-295 (Capacity Alternative)
17. Alternative 12 – Widen I-95 to three lanes in each direction (Capacity Alternative)
18. Alternative 13 – Alternatives 2, 4, 5a, 5b, and 8 (Combined Alternative)

19. Alternative 14 – Alternatives 2, 4, 5a, 5b, 8, and 12 (Combined Alternative)

7.4 Summary of Findings

In accordance with the STPA and environmental and planning laws and guidance, the Study Team determined that an alternative was "reasonable" if it meets the study purpose (see second paragraph on page ES-1 above), is cost effective, and is capable of being implemented within a reasonable time period.

Using the extensive analysis documented in this report as summarized in the Evaluation Summary Matrix included as Table 6-13 ("the Matrix"), Table ES-4 below further refines the reasonableness of each alternative studied. The "Meets Study Purpose" column below is derived from Column Y of the Matrix, the "Implementable" column is a combination of Columns N, P, and S of the Matrix, and the "Cost Effective" column reflects whether the alternative had a Benefit / Cost ratio of greater than 1.0 as shown in Column U of the Matrix.

Table 7-1: Evaluation of Reasonableness of Alternatives

Alternative		Meets Study Purpose?	Cost Effective?	Implementable?		Reasonable
				Funding	Implementation Period	
1	Future No Action	No	Yes	Viable	--	No
2	Expanded TDM/Rideshare	Partially	Yes	Viable	<5 year	No
3	Congestion Pricing	Partially	No	Uncertain	Unknown/Long	No
4	New or Improved Interstate Bus	Partially	Yes	Uncertain	< 5 years	No
5a	Improved Regional Bus	Partially	Yes	Uncertain	< 5 years	No
5b	Improved Local Bus	Partially	No	Uncertain	< 5 years	No
5c	New I-95 Corridor Regional Bus	Partially	No	Uncertain	< 5 years	No
6a	New or Improved Commuter Rail	Partially	No	Uncertain	5-10 years	No
6b	New Local Commuter Rail	Partially	No	Uncertain	5-10 years	No
7	New or Improved Freight Rail	Partially	Yes	No	5-10 years	No
8	Land Use Scenario	Partially	Yes	Uncertain	Unknown/Long	No
9a	Ramp Metering	Partially	No	Viable	< 5 years	No
9b	High Occupancy Vehicle (HOV)/High Occupancy Toll (HOT)	Fully	Yes	Viable	Unknown/Long	No
9c	Reversible Lane	Partially	Yes	Viable	<5 years	No
10	Widen I-295 to three lanes in each direction	Partially	No	No	5-10 years	No
11	Widen I-295 to three lanes in each direction	No	No	No	Unknown/Long	No
12	Widen I-95 to three lanes in each direction	Fully	Yes	Viable	<5 years	Yes
13	Alternatives 2, 4, 5a, 5b, and 8	Partially	Yes	Uncertain	Unknown/Long	No
14	Alternatives 2, 4, 5a, 5b, 8 and 12	Fully	Yes	Uncertain	Unknown/Long	No

As can be seen, the Study Team found that Alternative 12 – widening the Portland Area Mainline of the Turnpike to 3 lanes in each direction - is the only alternative that fully meets the Study Purpose, is cost effective, and is readily implementable.

7.5 Consistency with Regional and State Documents

The Study Team also reviewed current regional and state documents to determine if the identified alternative that fully met the Study Purpose and definition of a reasonable alternative. For regional documents, the Study Team reviewed the Portland Area Comprehensive Transportation System (PACTS) Destination 2040 Long-Range Transportation Plan[78]. This Plan, for the greater Portland region, is a comprehensive plan outlining strategies and policies for best maintaining the transportation system and safely and efficiently accommodating all modes of transportation. PACTS is the federally mandated Metropolitan Planning Organization (MPO) for the Greater Portland Region, which includes 18 communities and 7 public transportation providers.

A review of Destination 2040 found that:

- The Plan identifies "strategically expanding the existing system with complete multimodal infrastructure to help relieve existing automotive congestion, improve safety, and accommodate increasing transportation demand" (Page 17) through a collaborative effort with PACTS, MaineDOT, and Maine Turnpike Authority;
- The Plan recommends that PACTS "continue to seek assistance from the Maine Turnpike Authority and from federal discretionary funds to maintain and improve our region's transportation system. Look for Maine Turnpike resources to help address congestion in the western Gorham East-West Corridor and in other areas within the "greater turnpike corridor" (Page 23)"; and
- In the section on I-295 and the Maine Turnpike Corridor (Page 34), it is identified that "The Maine Turnpike (I-95) and I-295, managed by the MaineDOT in the PACTS region, are the two most important highways in the region and have been the subject of extensive study and analysis. Destination 2040 maintains previous recommendations to enhance and reinforce the Turnpike as the preferred interstate for traffic traveling through the region and around Portland, and I-295 as the preferred interstate for intra-regional traffic. Destination 2040 recommends additional strategies to address safety, capacity, and operational issues. Some of these recommendations are also in MaineDOT's 2010 I-295 Corridor Study".

The Maine Department of Transportation (MaineDOT) recently updated its I-295 Corridor Study in June of 2018.

A review of the I-295 Corridor Study found that:

- MaineDOT "support the efforts of the Maine Turnpike Authority to increase capacity in the I-95 corridor through Portland and South Portland (Page 94)".

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[78] Destination 2040, PACTS, A Long Range Transportation Plan for the Greater Portland Region, 2016

Based on this review by the Study Team, it is concluded that the proposed widening of I-95 to three lanes in each direction is consistent with both regional and state agencies and their documents.

7.6 Recommendations

Based on the technical analysis and evaluation of existing and future conditions, feedback provided by the Public Advisory Committee and the public, and given the results of the Alternatives Analysis, the Study Team recommends that the MTA proceed as follows.

1. Implement Alternative 12 to Address Safety and Congestion Issues Using a Phased Approach. The Study Team recommends that the MTA implement Alternative 12 to improve safety and reduce congestion by developing a consistent 6-lane highway from Exit 44 to Exit 52 or 53 in a phased approach before levels of service reach unacceptable levels.

   The Study Team recommends that the first phase widen the mainline to three lanes in each direction from Exit 44 in Scarborough to a point just north of Exit 48 in Portland, and should begin as soon as possible. Using the conservative annual growth rate in the Study (1.5%), this first phase needs to be completed prior to 2025.

   The Study Team recommends that the second phase widen the mainline from just north of Exit 48 in Portland to a point near Exit 52 or Exit 53 in West Falmouth before levels of service reach unacceptable levels, to be determined based upon traffic levels and available funding. Using the 1.5% annual growth rate, this second phase should be completed prior to 2030. Actual traffic growth rates could alter the timing of these phases.

2. Turnpike Capacity Preservation Measures. Given the substantial financial investment necessary to widen as recommended above, it is reasonable to preserve this new capacity as long as possible to attempt to slow or avoid the need for a future widening. Accordingly, the Study Team also recommends that the MTA work with partner agencies to prudently pursue the following Turnpike capacity preservation measures:

   a. Transportation Demand Management (TDM). Consistent with the STPA goals of managing transportation demand and system efficiency over the long term, the Study Team recommends that the MTA continue to support and potentially enhance TDM efforts. In particular, the MTA is encouraged to build upon its efforts in the areas of:

      - Employer TDM, including GoMaine;
      - Expansion of park & ride facilities;
      - Continued safety enforcement; and
      - Expansion of ITS initiatives.

   c. Transit. The Study Team recommends that the MTA consider partnering with other state and local agencies, municipalities, and other stakeholders to support a coordinated regional approach to bus and rail infrastructure and service which, pending further analysis, could include a new transit service along the Turnpike corridor, identification of smaller transportation hubs for local or regional buses, perhaps at existing or future MTA park & ride facilities, and assessing the need for additional parking at the Portland Transportation Center.

d. Land Use. The Study Team recommends that the MTA consider prudently supporting local and regional land use initiatives and policies designed to allow robust economic growth in a way that minimizes impacts on highway capacity, the environment and communities. Specifically, the Study Team recommends that the MTA support the efforts of regional planning organizations and the municipalities through which the Turnpike passes between Exits 44 and 53 to develop coordinated and consistent Transit Oriented Development (TOD) plans that promote higher density development in proximity to designated transportation hubs, which may include MTA park and ride facilities.

3. Continue Best Practices to Mitigate Impacts on Protected Resources. Finally, the Study Team recommends that the MTA continue to evaluate its deicing program in an attempt to minimize the impacts that salt and chlorides will place on the watersheds of the four urban impaired streams in the Exit 44 to 53 widening area. The design of the widened highway and vegetation should also consider impacts on protected resources.