August 29, 2024

Subject: Gorham Connector Project
2021 Traffic Forecast and Analysis Summary

Dear Reader:

Enclosed is the 2021 Gorham Connector Traffic Forecasts and Analysis Summary. The data and assumptions within this report were developed to support an early evaluation of the project's financial feasibility and benefits.

While the 2021 Gorham Connector Traffic Forecasts and Analysis Summary offers an initial assessment of the traffic forecasts for, and benefits of, the Gorham Connector project, it's important to note that the data and assumptions were completed early in the project and the report remains in draft form pending further project development, including additional data collection, engineering, environmental agency consultation, and public input. An updated traffic report will be released once completed.

As is industry practice for traffic analyses, completing this report required assumptions regarding features of a proposed roadway such as the road configuration, alignment, toll rates, construction costs, and traffic demand forecasts. These assumptions should be regarded as preliminary and based on the information available at the time. These preliminary assumptions were made contingent upon further study, data collection, engineering analysis, environmental assessments, and public input, among other factors.

Notably, the alignment and configuration of any proposed new roadway will be determined based on various factors, including additional engineering evaluation, topographic considerations, property impacts, environmental assessments, public feedback, financial feasibility and mobility and safety benefits.

We also note the travel time savings reported herein are average time savings for all vehicles traveling in the area, not just those traveling along a given widened roadway or new roadway alignment.

An updated traffic forecast report is planned once more information about the project design and its operations are available. Currently, no specific completion date has been established for the updated study. However, delivery of the report would likely occur before filing for environmental permits.

Respectfully,

Peter Merfeld, PE
Acting Deputy Executive Director

Enclosure: 2021 Gorham Connector Traffic Forecasts and Analysis Summary

Maine Turnpike Authority • 2360 Congress Street • Portland, ME 04102 • 207.871.7771

DRAFT

Date

November 2021 (Updated)

June 4, 2021 (Updated)

August 2020 (Original)

Project Correspondence

To

MTA

From

HNTB

Subject

Gorham Connector Traffic Forecasts and Analysis Summary

This memorandum provides a summary of the methodology and results for the development of traffic forecasts and analysis of the Gorham Connector project alternatives. Traffic forecasts and analyses were developed for existing and future conditions for both the no-build and build alternatives identified herein. This memorandum will be incorporated into the overall Maine Turnpike Authority (MTA) Gorham Connector Alternatives Analysis documentation.

1. Historic Travel Demand within the Study Area

An efficient east-west corridor from western Maine to Portland that includes a connection to the interstate highway system is critical to Maine's economy. Regional growth has congested many of the state's commuting corridors, causing traffic to spill onto local roads. Many state routes in this area, such as Routes 22, 25, 112 and 114 and 202, have experienced ongoing traffic congestion for decades resulting in significant safety and mobility deficiencies (Figure 1).

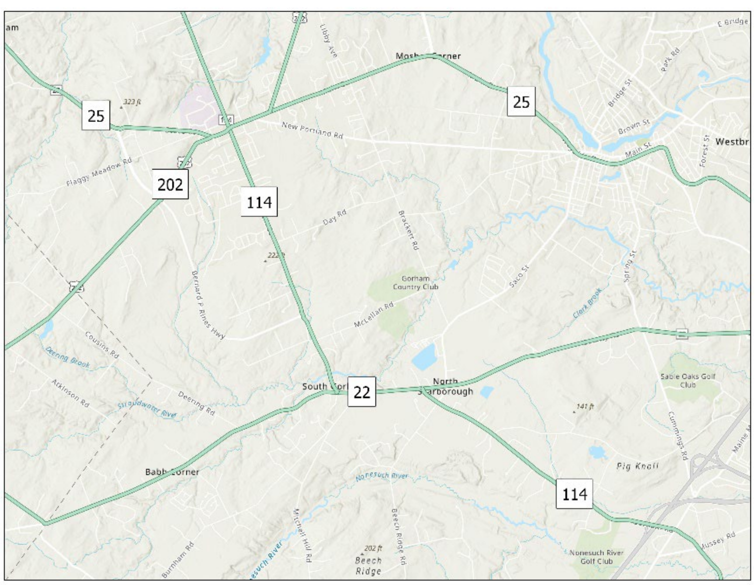

Figure 1 - State Routes 25, 22, 202 and 114 in the Gorham Connector Study Area.

Safety and mobility issues have impacted the economy; goods and services are challenged to move safely and efficiently, and quality of life is impacted as traffic avoids these congested routes during peak travel periods by increasing traffic on local, residential roads ill-designed to accommodate increasing volumes. A key corridor that has been a historic capacity constraint is the section of Route 22 that overlaps with Route 114 in Gorham, also known as "the Overlap" (Figure 2). Despite this section of roadway being part of a key commuting corridor between Portland/South Portland and the fast-growing communities to the west, this major route has seen little change in volumes over the last two decades. This is due to the fact that this section of roadway reached capacity in the early 1990s, resulting in significant and persistent congestion and safety issues. This has resulted in the shift of traffic to local roads (Figure 3). Using Annual Average Daily Traffic (AADT) data routinely collected by MaineDOT, Figure 3 shows that as day-to-day traffic has steadily increased on the Overlap, more traffic increasingly diverts to local roads, such as Brackett, McLellan, and Day Roads.

Figure 2 - Detail of The Overlap within Project Area.

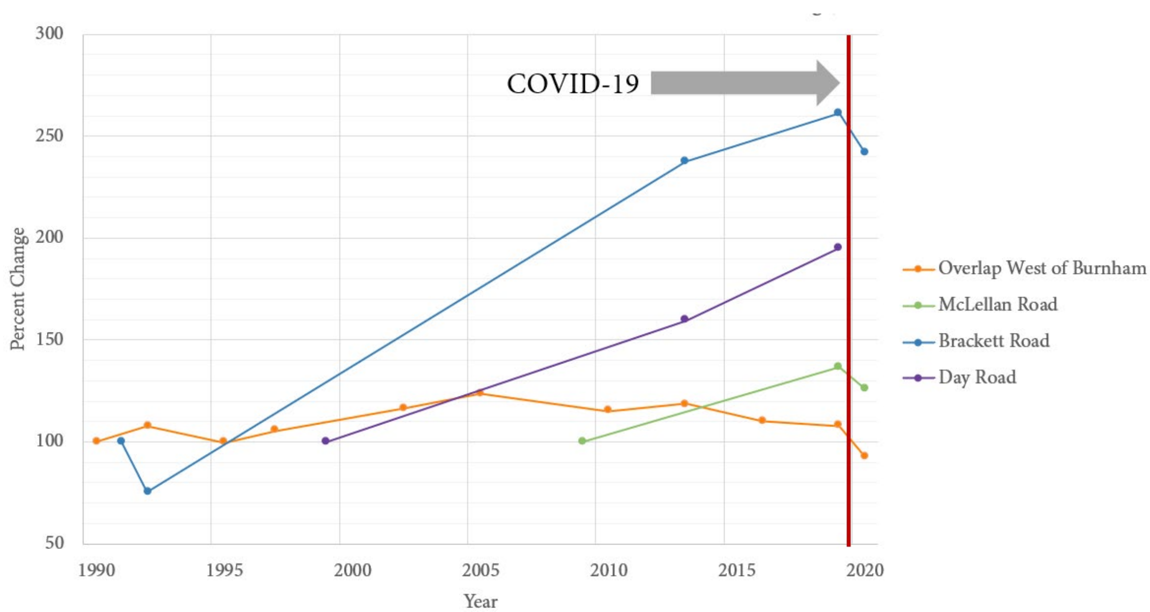

Figure 3 – Gorham Historical Annual Average Daily Traffic (AADT) on the Overlap of Routes 114 and 22 and Brackett Road in Gorham, Maine from 1982 to 2020 (MaineDOT).

2. Data Collection

Existing and recently available traffic data was gathered to support development of the traffic forecasts and analysis. Traffic counts and data were collected within the municipalities of Gorham, Scarborough, South Portland, and Westbrook, consistent with the Study Area for the Gorham Connector. Primary data sources are as follows.

a. Primary Data Sources

MTA authorized HNTB to gather automatic traffic recorder (ATR) and peak period turning movement count (TMC) data in October of 2019 at the locations included in Table 1.

Table 1 – Automatic Traffic Recorder Turning Count Locations.

ATR Locations	Intersection TMC Locations
Route 22/County Road west of Route 114/South Street	County Road & Gorham Road
Route 22/County Road east of Burnham Road	County Road & Saco Street
Route 22/County Road east of Spring Street	Gorham Road, Saco Street, and Beech Ridge Road
Route 22/County Road east of Saco Street	Gorham Road & Running Hill Road
Route 114/Gorham Road northwest of Running Hill Road	Gorham Bypass & South Street
Running Hill Road east of Spring Street	County Road, South Street & Blue Ledge Road
Running Hill Road east of Route 114/Gorham Road	County Road & Burham Road
Route 114/Gorham Road southeast of Running Hill Road	Gorham Road & Payne Road
Spring Street north of Route 22/County Road	Gorham Road & Payne Road
Spring Street south of Thomas Drive	Route 22 & Spring Street
Route 114/Gorham Road southeast of Running Hill Road	None
Spring Street south of Running Hill Road	None
Route 114/South Street north of Route 112	None
Route 114/South Street north of Washburn Dr/McLellan Road	None

b. Additional Data Sources

HNTB also used turning movement count data collected by the Maine Department of Transportation (MaineDOT) for a Scarborough Development project. This data included raw volumes, pre-development, and post-development peak hour turning movement counts for that project's study area, which included several intersections within the Gorham Connector Study Area.

c. Future Volume Development

All traffic data gathered was summarized and provided to support calibration of the Portland Area Comprehensive Transportation System (PACTS) Travel Demand Model (TDM) specifically for the Gorham Connector forecasts. The PACTS TDM and forecasting process are described in Section 4 of this memorandum.

3. Alternatives Evaluated

Consultation with federal regulatory and resource agencies during and following the 2012 Gorham East-West Corridor Study (2012 Study) confirmed that the MTA should thoroughly evaluate widening of existing roadways along with new roadway alternatives. As a result, three transportation improvement scenarios were evaluated in this alternatives analysis: no-build (NB); widen existing roadways (WR); and new roadways (NR). These alternatives are described below and shown in Figure 4.

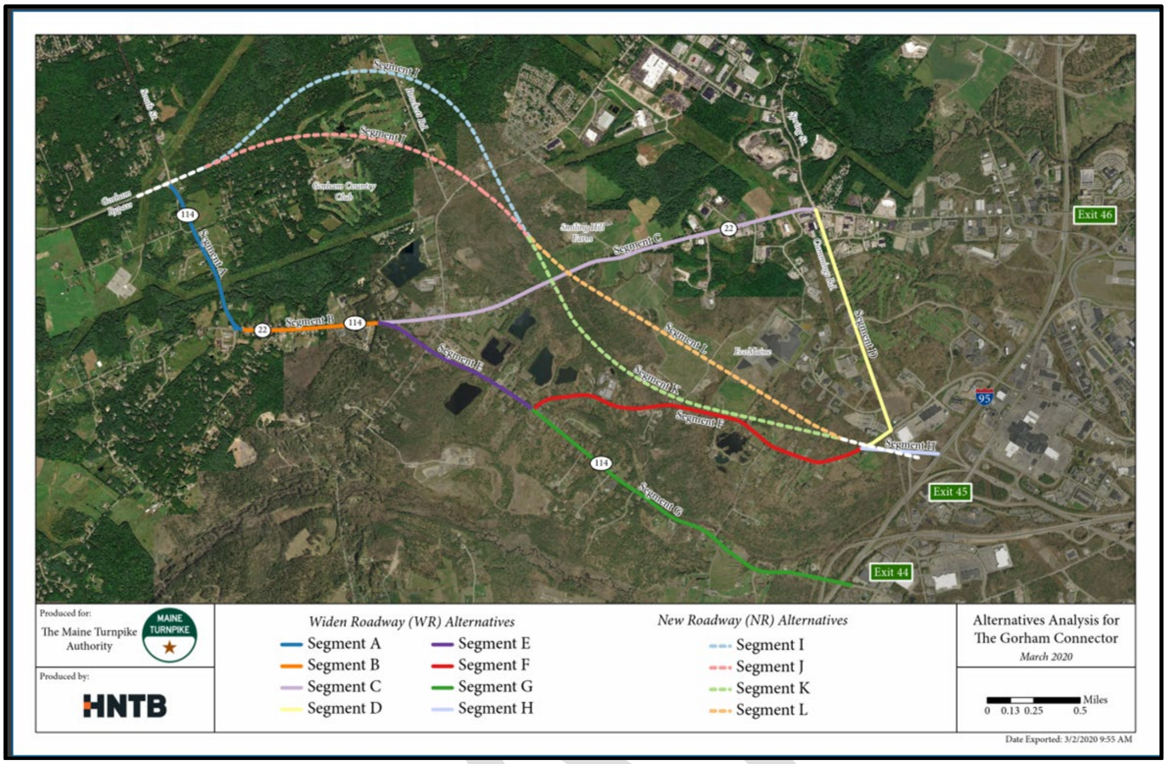

Figure 4 – Map of Alternatives Evaluated.

a. **No Build (NB).** By default, the first alternative advanced to a detailed evaluation in an alternatives analysis is the "no action" or no-build alternative. The no-build alternative assumes that other funded and approved projects as well as management and maintenance of transportation facilities will continue to occur in the project vicinity.

Evaluations were performed for the existing conditions, for the 2030 opening year, and future 2050 design year no build alternatives.

b. **Widen Roadways (WR).** Three existing routes with widened roadways to provide additional capacity for users traveling from the roundabout at the Gorham Bypass to the Maine Turnpike were analyzed (Figure 4).

- WR-1 – Widen 114: Widen existing Route 114 from the roundabout to Exit 44 (WR-1 consists of Segments, A, B, E, and G);
- WR-2 – Widen Running Hill Road: Widen Route 114 from the roundabout to Exit 45 via Running Hill Road (Segments A, B, E, F, and H); and
- WR-3 – Widen Spring Street: Widen Route 114 from the roundabout to Exit 45 via Route 22 and Spring Street (Segments A, B, C, D, and H).

Evaluations were performed for each of the WR alternatives for future 2050 design conditions as each of the alternatives has a unique path and endpoints.

c. **New Roadways (NR).** For the new roadway alternatives, the evaluation area was divided into two zones. The first zone covering from the roundabout at the Gorham Bypass to Route 22 and the second zone covering from Route 22 to Exit 45. In zone 1, two potential segments were evaluated for a new road alignment. One which avoids the existing Gorham Country Club golf course and a second which minimizes the number of parcels impacted. To move vehicles from Route 22 to Exit 45, two potential segments were evaluated: one located south of the landfill cells at the Eco Maine landfill facility and a second bisecting closed landfill cells and following the most direct alignment from Route 22 to Exit 45. Possible combinations of these segments yield four new roadway alignments to be considered as follows.

- NR-1: New roadway alignment from the roundabout at the Gorham Bypass north of the Gorham Country Club to Route 22, and between EcoMaine landfill cells to Exit 45 on the Maine Turnpike (Segments I and L);
- NR-2: New roadway alignment from the roundabout at the Gorham Bypass north of the Gorham Country Club to Route 22, and from Route 22 south of EcoMaine to Exit 45 on the Maine Turnpike (Segments I and K);
- NR-3: New roadway alignment from the roundabout at the Gorham Bypass across the northern nine holes of the Gorham Country Club to Route 22, and between EcoMaine landfill cells to Exit 45 on the Maine Turnpike (Segments J and L); and
- NR-4: New roadway alignment from the roundabout at the Gorham Bypass across the northern nine holes of the Gorham Country Club to Route 22, and from Route 22 south of EcoMaine's landfill cells to Exit 45 on the Maine Turnpike (Segments J and K).

Due to the limited variance in traffic forecasts for each of the NR alignments and that the connections to existing roadways for all alternatives are similar, only NR-4 was evaluated for future 2050 design conditions.

Additional NR alignment variations, holding the same connections points, are expected to be evaluated as the study progresses. If updates are anticipated to significantly change traffic results, the analyses will be updated accordingly.

4. Travel Demand Forecasting

Traffic forecasts for each alternative were developed using municipal demographic information developed as part of the PACTS TDM. This model estimates current and future vehicular and person travel throughout the PACTS region and examines regional travel. The model reflects the geographic distribution and densities of residential, commercial, governmental, 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 walking) and selection of a travel path (to avoid traffic congestion delays).

Traffic forecasts were developed for fall daily and PM peak hours for each alternative to replicate peak corridor conditions. Historically, fall conditions most closely represent the design hour volume, in this case most closely modeled to the 30th highest hour – an industry standard measure used for traffic volume forecasting. Similarly, PM peak hour turning movement volumes, which historically represent the worst-case scenario, were used for the level of service analysis summarized in Section 7.

5. Existing Safety Conditions

Table 2 identifies the High Crash Locations (HCLs) within the study area for the most recent three-year period (2017-2019). To be classified as an HCL by MaineDOT, a roadway segment or intersection must have eight or more crashes over a three-year period and a Critical Rate Factor (CRF) greater than 1.0. The CRF compares the actual crash rate to similar locations in the state. A CRF greater than 1.0 indicates a higher than average incidence of crashes. Table 2 shows that four intersection locations and four roadway segments within the study area are HCL's. Each of the HCL locations will be evaluated as part of the Alternatives Analysis to determine the effect of the proposed alternative on the current safety condition.

Table 2 – Existing High Crash Location Summary.

Location Type	Node	Location	Crashes	CRF
Intersection	15620	South Street/Washburn Drive/McLellan Road	8	1.34
Intersection	15619	County Road/South Street/ Blue Ledge Road	31	1.03
Segment	15612 to 60692	Route 114 between New Road to Laurel Ridge Road	20	1.09
Intersection	15611	Route 114/Payne Road	42	1.19
Segment	66237 to 15611	Route 114 between Hannaford Store and Payne Road	8	2.83
Segment	15610 to 66237	Route 114 between Mussey Road and Hannaford Store	14	1.14
Intersection	16412	Cummings Road/Payne Road	46	1.13
Segment	66048 to 15049	Spring Street between Portland Glass and Thomas Drive	13	1.29

6. Mobility Analysis and Results

Any of the identified build alternatives would add roadway capacity to the region. The new roadway alternatives would add roadway capacity through the connection of a new facility from the end of the Gorham Bypass to Exit 45. The widen roadway alternatives add roadway capacity by adding a lane in each direction to existing principal routes, including Route 114, Route 22 and Running Hill Road.

Changes in mobility for the no-build and each of the build alternatives was measured in two ways: 1) volume changes along key routes within the region, and 2) changes in Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) within the communities and region through which the alternatives travel.

a. Roadway Volume Change Summary

There is significant travel between Greater Portland and the communities to the west. Mobility between these two areas will be enhanced with the addition of roadway capacity along some of the most congested sections of roadway. With the addition of roadway capacity, new or widened roadways are anticipated to experience increases in traffic, while other parallel or competing routes are anticipated to experience decreases in traffic. Also, additional roadway capacity will likely result in increased traffic within the study area as regional traffic shifts from current routes to roadways with additional capacity, saving overall travel time. A key benefit from additional roadway capacity in congested areas will be the reduction of traffic on local and neighborhood streets as traffic no longer seeks to bypass more congested sections.

Figures 5, 6, 7, and 8 are PM peak hour volume change maps developed for the four build alternatives – WR-1, WR-2, WR-3, and the NR. Volume changes were compared against future 2050 PM peak hour no-build volumes for study area roadways.

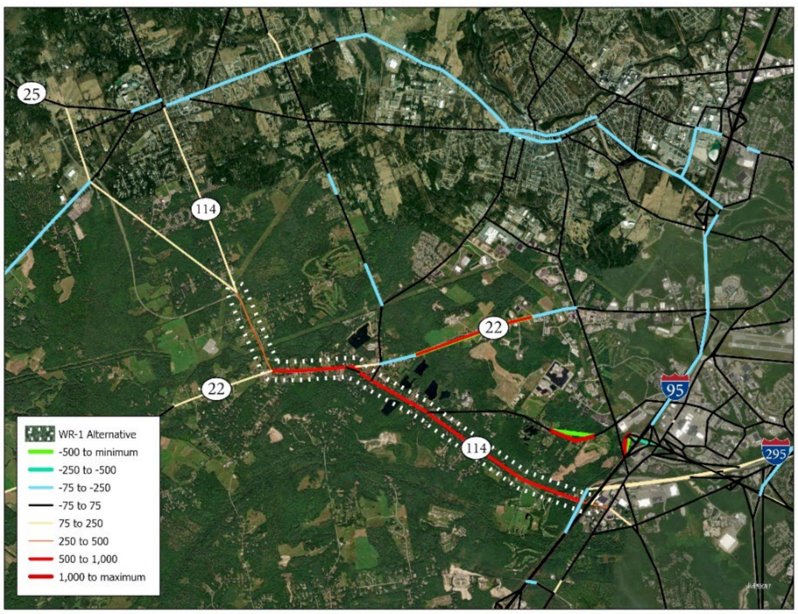

Figure 5 - WR-1 Alternative Volume Change Map – 2050 PM Peak Hour.

As shown in Figure 5, WR-1 provides PM Peak hour benefit to select east-west arterial roadways within the Study Area, including Routes 22 and 25. Local area roadways also experience volume reductions, including Day Road, McLellan Road, Longfellow Road, and Broadturn Road. Traffic volumes increase significantly on the widened sections of Route 22 and 114 from the Gorham roundabout to I-295. Roadways connecting to the widened sections also show a volume increase, including on Route 22, the Gorham Bypass, and I-295.

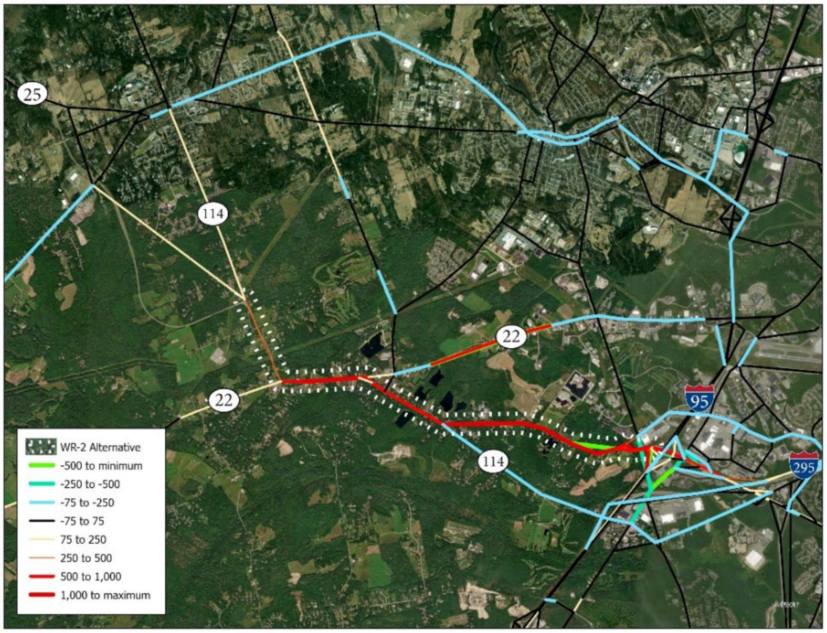

Figure 6 - WR-2 Alternative Volume Change Map – 2050 PM Peak Hour.

As shown in Figure 6, WR-2 results in PM Peak hour benefits similar to the WR-1 alternative on select east-west arterial roadways within the Study Area, including Routes 22 and 25, and the southeastern section of Route 114 from Running Hill Road to Payne Road. Local area roadways also benefit, including Day Road, McLellan Road, Longfellow Road, and Broadturn Road. Traffic increases significantly along the widened sections of Routes 22, 114, and Running Hill Road from the Gorham roundabout to Exit 45. Roadways connecting to the widened sections also show a traffic volume increase, including Route 22, the Gorham Bypass, and I-295.

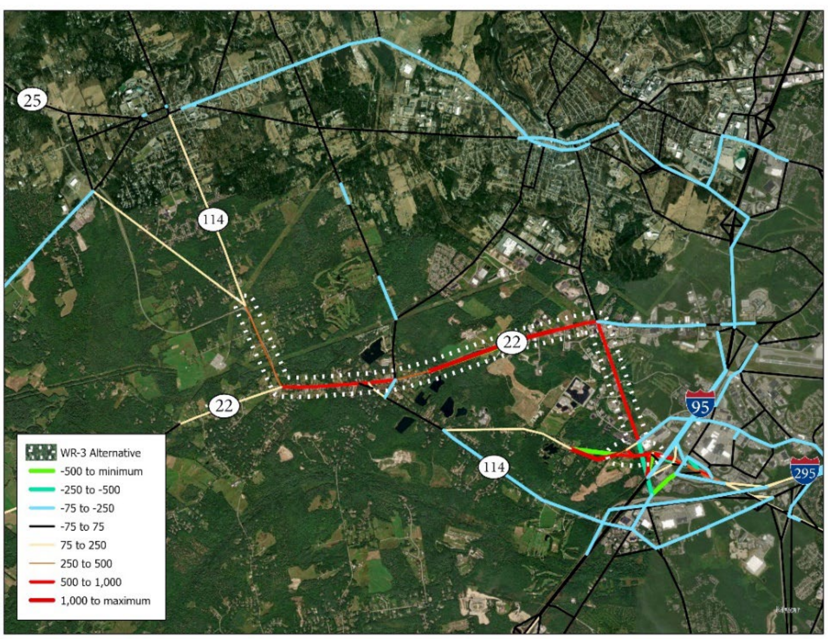

Figure 7 - WR-3 Alternative Volume Change Map – 2050 PM Peak Hour.

As shown in Figure 7, WR-3 results in PM Peak hour benefits similar to other WR alternatives on select east-west arterial roadways within the Study Area, including Route 25 and the southeastern section of Route 114 from Running Hill Road to Payne Road. Local area roadways also benefit, including Day Road, McLellan Road, Longfellow Road, and Broadturn Road. Traffic increases significantly on the widened sections of Routes 22, 114, and Spring Street. Traffic also increases along Running Hill Road from Route 114 to Exit 45. Roadways connecting to the widened sections also show an increase, including Route 22, the Gorham Bypass, and I-295.

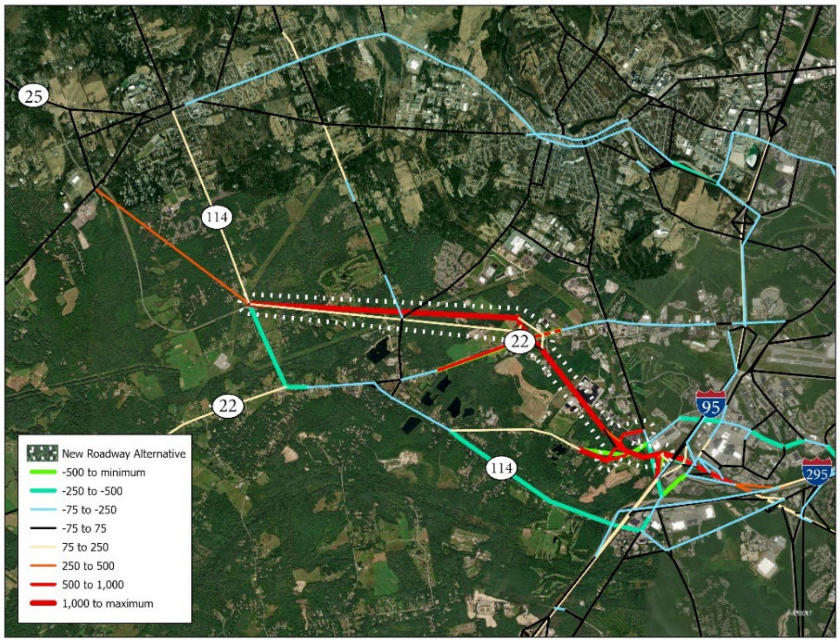

Figure 8 - NR-4 Alternative Volume Change Map – 2050 PM Peak Hour.

Figure 8 depicts NR-4 PM Peak hour benefits similar to those of the WR alternatives on select east-west arterial roadways within the Study Area, including Route 25 and the southeastern section of Route 114 from Running Hill Road to Payne Road as the majority of traffic diverts to NR-4 from the west Local area roadways also benefit, including Day Road, McLellan Road, Longfellow Road, and Broadturn Road. Traffic volumes generated for the new roadway increase along Running Hill Road from Route 114 to Exit 45 due to the presence of a new interchange connection for NR-4 near the intersection of Running Hill Road and Spring Street/Cummings Road. Roadways connecting to the NR-4 also show an increase, including Route 22, the Gorham Bypass, and I-295. Volumes on the overlap show a decrease, as does most of Route 114.

Based on the volume maps provided in Figures 5 through 8, the following findings result from comparing each of the alternatives:

- Compared to other widen roadway alternatives, WR-2 provides the greatest level of benefit in the form of volume reduction to the majority of Study Area roads. Volume reductions are noted on Route 25 in Gorham, Westbrook Arterial, and local roads, such as Day Road and McLellan Road.
- Compared to the other widen roadway alternatives, WR-1 draws the greatest volume of traffic to the widened section of roadway along Routes 22 and 114 .

- NR-4 provides the greatest level of benefit through volume reduction on the majority of existing roads within the Study Area as compared to all alternatives. This occurs primarily because there is greater additional capacity available for the volume of traffic in the NR alternatives as compared to the WR alternatives. NR-4 also provides significant benefit to the Overlap, with a reduction of over 100 peak hour vehicles as compared to no-build.

b. Intersection Volume Change Summary

Similar to roadway volume change, addition of roadway capacity is anticipated to result in increases at intersections along or adjacent to widen or new roadway alternatives, while other parallel intersections are anticipated to experience decreases in traffic. A key benefit from new roadway capacity is the reduction of volumes at intersections that are or will be operating at poor levels of service.

Table 3 shows PM peak hour volume changes for the four build alternatives – WR-1, WR-2, WR-3, and NR-4 compared against future 2050 PM peak hour no-build volumes for study area intersections.

Table 3 – Summary of Intersection Volumes and Deltas by Alternative – 2050 PM Peak Hour.

	Alternative								
	No Build	WR-1		WR-2		WR-3		NR-4	
Intersection	**Total Volume**	**Total Volume**	**Delta to No-Build**	**Total Volume**	**Delta to No-Build**	**Total Volume**	**Delta to No-Build**	**Total Volume**	**Delta to No-Build**
Gorham Connector and Route 114	1,954	2,529	575	2,581	627	2,498	544	2,776	822
Route 22 and Route 114 (West)	2,424	3,565	1,141	3,605	1,181	3,532	1,108	2,256	(168)
Route 22 and Burnham Road	2,376	3,767	1,391	3,820	1,444	3,712	1,336	2,259	(117)
Route 22 and Route 114 (East)	2,257	3,682	1,425	3,736	1,479	3,626	1,369	2,186	(71)
Route 22 and Saco Street	1,946	2,033	87	2,037	91	2,885	939	1,863	(83)
Route 22 and Spring Street	3,791	3,658	(133)	3,613	(178)	4,946	1,155	3,612	(179)
Route 114 and Beech Ridge	2,234	3,535	1,301	3,725	1,491	2,310	76	2,163	(71)
Route 114 and Running Hill Rd	1,661	2,955	1,294	3,206	1,545	1,743	82	1,610	(51)
Route 114 and Payne Road	3,861	4,398	537	3,499	(362)	3,778	(83)	3,482	(379)
Running Hill Rd and Gorham Conn Ramps	843	-	-	3,276	-	2,210	-	2,150	-
Spring Street and Running Hill Road	3,319	3,452	133	4,065	746	4,586	1,267	3,839	520
Payne Road and Cummings Road (north)	4,662	4,635	(27)	3,851	(811)	3,983	(679)	4,077	(585)
I-295 and Route 114 Interchange Ramps	-	2,325	-	-	-	-	-	-	-
Intersection Totals	**31,328**	**40,534**	**9,206**	**41,014**	**9,686**	**39,809**	**8,481**	**32,273**	**945**

Based on the volumes provided in Table 3, the following findings result from comparing each of the alternatives:

- Each of the widen roadway alternatives significantly increase intersection volumes throughout the study area, ranging from approximately 8,500 for WR-3 to 9,700 vehicles for WR-2 in the 2050 PM peak hour. This will require significant modifications to these intersections, such as additional through lanes and longer turning lanes, to accommodate the increase in volumes, as well as possible right of way acquisitions.
- NR-4 maintains the same approximate total intersection volume as the NB alternative, but reduces volumes at nine out of 11 intersections in the study area. Increases are shown at only the Gorham Connector and Route 114 and Spring Street and Running Hill Road intersections. which are at or near points of access to the new roadway. These intersections experience increases as traffic diverts to access the new roadway.
- NR-4 reduces traffic volumes at two current high crash intersections – Route 114 and Payne Road and Payne Road and Cummings Road. Reduced traffic volumes are likely to result in fewer crashes.

c. Vehicle Miles Traveled/Vehicle Hours Traveled (VMT/VHT) Summary

VMT and VHT are key mobility measures of effectiveness that provide insight on how and where traffic flows under the evaluated alternatives. Significantly congested roadways can result in notable increases in VMT and VHT: VMT due to the additional distance motorists will travel to avoid congested areas and VHT for the additional amount of time required to complete a trip from an origin to a destination through the same congested areas.

With the addition of roadway capacity, changes in both in VMT and VHT are anticipated. Here's what these changes indicate:

- An increase in VMT along Maine Turnpike and the new roadway with a reduction in VMT on local and neighborhood streets: traffic is shifting to the greater capacity and more efficient routes designed to accommodate higher volumes of vehicles.
- A decrease in VHT on all roadways: additional capacity created relieves congestion. This is a strong indicator of a reduction in greenhouse gases.

Tables 4 and 5 summarize VMT and VHT, respectively, by alternative for the Towns of Gorham, Scarborough and Westbrook, which are the municipalities through which all of the alternatives run. Percentage values are PM peak hour comparisons to the 2050 No-Build.

Table 4 – Summary of VMT by Alternative – 2050 PM Peak Hour.

	VMT - PM Peak Hour				VMT - Percent Change			
Alt. Name	Turnpike & Freeway	Major & Minor	Collector & Local	Total	Turnpike & Freeway	Major & Minor	Collector & Local	Total
No-Build	52,354	111,981	62,253	226,588	-	-	-	-
NR	61,206	109,834	59,992	231,032	16.9%	-1.9%	-3.6%	2.0%
WR-1	52,401	116,288	60,777	229,466	0.1%	3.8%	-2.4%	1.3%
WR-2	52,248	116,262	60,247	228,757	-0.2%	3.8%	-3.2%	1.0%
WR-3	52,356	115,403	60,539	228,298	0.0%	3.1%	-2.8%	0.8%

Peak hour VMT increases for each of the build alternatives over the no-build due to the additional distance motorists will travel to avoid congestion and reduce overall travel time (Table 4). While VMT increases for each build alternative, VMT is reduced for the major/minor and collector/local roadway classifications under the new roadway (NR-4) alternative only. This is a positive outcome as NR-4 is shifting traffic away from congested and local roadways to those roadways that are designed to handle higher speed, higher volume traffic. NR-4 also reduces the greatest volume of traffic on major/minor and collector/local roadways. By extrapolating the PM peak hour totals using a peak hour to daily factor of 10%, NR-4 is estimated to reduce traffic on major/minor and collector/local roadways within Gorham, Scarborough, and Westbrook by approximately 16 million miles annually over the no-build and by 22 million miles annually over the most effective widen roadway alternative.

Table 5 – Summary of VHT by Alternative – 2050 PM Peak Hour.

Alt. Name	VHT - PM Peak Hour				VHT - Percent Change			
	Turnpike & Freeway	Major & Minor	Collector & Local	Total	Turnpike & Freeway	Major & Minor	Collector & Local	Total
No-Build	892	4,028	2,011	6,931	-	-	-	-
NR	1,044	3,730	1,865	6,639	17.0%	-7.4%	-7.3%	-4.2%
WR-1	873	3,924	1,900	6,697	-2.1%	-2.6%	-5.5%	-3.4%
WR-2	872	3,921	1,876	6,669	-2.2%	-2.7%	-6.7%	-3.8%
WR-3	875	3,943	1,889	6,707	-1.9%	-2.1%	-6.1%	-3.2%

VHT decreases for each of the build alternatives over the no-build (Table 5) due to two primary factors: 1) reduced congestion in this region resulting from additional roadway capacity, and 2) a more direct path for motorists traveling to and from each origin and destination. The greatest reduction in VHT occurs for NR-4, with an approximately 10% additional decrease in when compared to the other alternatives evaluated. This decrease on the major/minor and collector/local roadways is of particular note. By extrapolating the PM peak hour totals using a peak hour to daily factor of 10%, NR-4 is estimated to reduce VHT overall on all Gorham, Scarborough, and Westbrook roadways by over 900,000 hours annually over the no-build alternative, and more than 100,000 hours annually over the most effective widen roadway alternative.

7. Traffic Operations Analysis and Results

PM peak hour traffic operations (typically the peak hour of the day) were analyzed with Synchro version 10 software to provide a high-level comparison of the intersections within the study area. Synchro is a macroscopic analysis and optimization software application that utilizes Highway Capacity Manual methodologies to assign metrics for signalized intersections, unsignalized intersections and roundabouts.

In Tables 7 through12, traffic operation analyses for each alternative are compared using two measures of effectiveness: level of service (LOS) and overall intersection delay (seconds of delay per vehicle) for intersections common to each alternative in the Study Area (Table 6). Intersections listed below and shown in Figure 9 were included in the PM peak hour traffic operations analysis.

Table 6 – Intersections Common to Alternatives Evaluated.

Intersection Location	Intersection Location
Gorham Bypass at Route 114	Route 22 at Spring Street
Route 22 at Route 114 West	Cummings Road at Running Hill Road
Route 22 at Burnham Road	Payne Road at Cummings Road
Route 22 at Route 114 East	Payne Road at Route 114
Route 22 at Beech Ridge Road	Route 22 at Southbound Interchange
Route 114 at Beech Ridge Road	Route 22 at Northbound Interchange
Route 115 at Running Hill Road	Running Hill Road Interchange

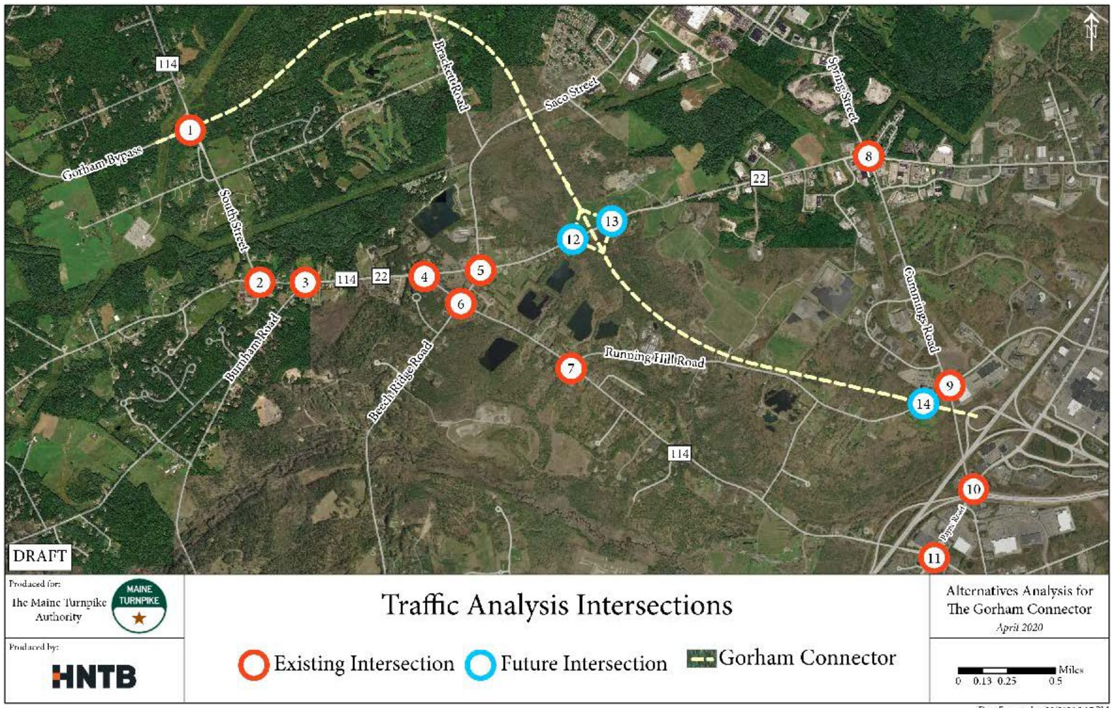

Figure 9 – Study Area Intersections.

To evaluate critical periods of congestion, these models were calibrated based on the fall PM peak-hour observations of the key sections of the Study Area network as opposed to the peak traffic times of each individual roadway and intersection. These fall PM peak hour volumes represent the 30th highest hour traffic volumes which are the industry standard for traffic analysis.

- Delays: Delays reported are those experienced by the average vehicle at each approach measured in seconds per vehicle. Overall intersection delay is the weighted average of the average vehicle at all approaches.
- Level of Service (LOS): LOS describes the operating conditions using a scale of A-F, with LOS A being the best with free flow traffic and LOS F being the worst with numerous stops on a roadway or excessive intersection delays. Roadways and intersections are typically designed to operate at LOS C or D under 20-year projections. The LOS table from the Highway Capacity Manual assigns these letter-grade measures (Table 7).[1]

[1] Transportation Research Board. *Highway Capacity Manual*. Washington, D.C.: 2010.

Table 7 - LOS Delay Thresholds for Signalized and Unsignalized Intersections.

Level of Service (LOS)	Signalized Intersections	Unsignalized Intersection
A	<10 sec	<10 sec
B	10-20 sec	10-15 sec
C	20-35 sec	15-25 sec
D	35-55 sec	25-35 sec
E	55-80 sec	35-50 sec
F	80> sec	>50 sec

Table 8 summarizes results of the Synchro analysis, providing overall intersection delay and corresponding LOS for the Study Area intersections for each of the alternatives evaluated. No-Build analysis was performed for Year 2030 (opening year) and Year 2050 (future design year). For all Year 2050 analysis, optimized intersection timings were used to provide comparative results between the alternatives. If additional volumes caused intersection delays to be failing under an alternative based on forecasted volumes, additional intersection improvements (e.g., additional through and turning lanes, extended storage bays, etc.) were incorporated into the traffic analysis model until acceptable LOS and delay results were achieved. Intersections with additional improvements are highlighted in Table 8.

Table 8 – Study Area Intersection Delay and LOS by Alternative.

Overall Delay (sec.)/LOS	Signalized/ Unsignalized	2030	2050	2050	2050	2050	2050
		No Build	No Build	WR-1	WR-2	WR-3	NR-4
Gorham Bypass @ Route 114	U	9.2/A	19.1/C	28.8/D	30.6/D	27.8/D	44.1/D*
Route 22 @ Route 114 (West)	S	82.9/F	108.8/F	41.1/D	36.1/D	40.5/D	64.4/E
Burnham @ Route 22	U	13.1/B	33.6/D	38.9/D*	40.3/D*	35.9/D*	9.0/A
Route 22 @ Route 114 (East)	S	17.2/B	17.8/B	33.9/C	30.1/C	33.1/C	17.9/B
Beech Ridge /Saco Street @ Route 22	S	86.2/F	146.2/F	61.8/E	73.4/E	30.4/C	61.2/E
Spring Street @ Route 22	S	101.4/F	155.4/F	70.1/E	68.4/E	47.7/D	70.0/E
Beech Ridge Road @ Route 114	S	178.1/F	249.2/F	34.4/C	37.3/D	42.8/D	37.7/D
Route 114 @ Running Hill Road	U	21.8/C	27.7/D	79.8/E*	49.0/D*	41.9/D*	41.3/D
Payne Road @ Route 114	S	84.9/F	146.0/F	34.5/C	68.0/E	68.5/E	73.0/E
Cummings Road @ Running Hill Road	S	119.7/F	172.9/F	78.3/E	39.2/D	51.0/D	58.5/E
Payne Road @ Cummings Road	S	74.0/E	136.2/E	52.3/D	33.5/C	38.7/D	66.0/E

** - converted to signalized intersection under this alternative*

■ - denotes intersections impacted by the project requiring additional improvements to provide reasonable operation. All intersection improvements under WR and NR alternatives assume to be completed by MaineDOT except where directly accessing the new roadway.

Many of the existing Study Area intersections operate at undesirable levels of service under Year 2030 (opening year) conditions, and these conditions result in declining LOS in the analysis area by Year 2050 (future design year) conditions (Table 8). All build alternatives provide improved operations over no-build by providing significant relief to Study Area intersections, primarily for two reasons: 1) traffic volumes are diverted from congested intersections to either the new roadway or widened roadways, and/or 2) additional intersection capacities help improve overall delay and LOS. Each of the WR alternatives require improvements at eight intersections to maintain acceptable LOS, many as part of the additional roadway capacity added. NR-4 provides significant improvements at the majority of intersections by diverting volume from congested areas. The most significant benefit of NR-4 is that it requires improvements at only two existing intersections due to the new roadway. Under NR-4, associated improvements at five intersections with unacceptable LOS would need to occur in either NB or a NR condition even with reduced traffic volumes in the area. For the WR alternatives, each requires that two current unsignalized intersections become signalized to accommodate forecasted volumes and movements. NR-4 requires that only one current unsignalized intersection become signalized. Level of intersection improvements vary by alternative with the WR alternatives typically requiring the greater level of improvement over NR-4, resulting in increased costs and impact.

8. Travel Time Analysis and Results

An effective way to measure mobility benefits associated with each alternative is to assess travel times along the alternative from common origin to a common destination point. Using the PACTS travel demand model, the Year 2050 PM peak hour travel times between two common points was generated for each alternative. The two common points were selected as the common start and end points for all of the build alternatives, serving a significant number of trips traveling east-west through the region: 1) I-295 in Portland immediately north of Exit 1, and 2) the Gorham Bypass immediately west of the roundabout at Route 114. Table 9 provides the total travel time between these two common points traveling away from Portland (south and west) for each alternative during the PM peak hour.

Table 9 – Travel Times by Alternative during the PM Peak Hour.

Alternative	Travel Time Between Two Points (min.)			
	Year			
	2020	2030	2040	2050
No-Build	13.39	13.63	13.87	14.35
WR-1	8.55	8.69	8.84	9.13
WR-2	9.33	9.55	9.77	10.20
WR-3	10.25	10.41	10.56	10.88
NR-4	7.40	7.41	7.42	7.43

Significant travel time is required to travel between the two points identified under the future no-build conditions (Table 9) and continues to worsen over time. This will continue to exacerbate congestion, worsen safety and mobility, and continue to divert traffic to local roads. All build alternatives provide immediate improvement to travel times. In year 2050, NR-4 provides the shortest travel times and greatest reduction between the two common points, just under two minutes less than the next best alternative, WR-1. This difference in travel time is significant (20 percent and greater) and consistent with the findings presented in the VMT/VHT section of this memorandum. Reductions of this magnitude in travel time are considered significant and are a key advantage of NR-4 in reducing congestion and travel time, as noted throughout this memorandum.

9. Alternative Life Analysis and Results

A key measure of effectiveness for the Alternatives Analysis is the relative transportation life of each of the evaluated alternatives. Transportation life is measured by determining the number of years an alternative will function before traffic volumes increase and the roadway or intersection reaches its capacity. The methodology for the Alternative Life Analysis is described below.

a. Widen Roadway Methodology

Typically, intersection capacity will fail before roadway capacity on arterial and collector roadways with signalized and unsignalized intersections. However, it is also important to understand the relationship between intersection and roadway capacities as some minor intersection improvements can result in increased capacities. The methodology for widen roadway transportation life analysis is comprised of two different approaches. The first approach is based on intersection capacity as determined by the Synchro/Sim traffic intersection analysis summarized in Section 7. The second approach uses the PACTS travel demand model capacities based on forecasted traffic volumes.

The widen roadway transportation life analysis is focused on the section of Route 22 and 114 in Gorham and Scarborough. This section is common to all WR alternatives. It is also the roadway section with the highest traffic volumes in each of the WR alternatives and therefore will have the least amount of available capacity and will be the critical link in the alternative life analysis. When this section reaches capacity, it will then drive diversion to other routes and local roads in the region.

i. Synchro/Sim traffic capacity.

To determine how much additional capacity an intersection contains, two values are compared: 1) the forecasted volume on the busiest approach, and 2) the capacity of the same approach as identified during optimized intersection analysis. Using the results of the Synchro/Simtraffic intersection capacity analysis for each of the WR alternatives, 2050 PM Peak Hour volumes traveling westbound (peak direction) on the section of Route 22 and 114 in Gorham/Scarborough were identified (Table 10) and used to determine remaining capacity.

Table 10 –Additional Capacity for Widen Roadway Alternatives.

Alternative	2050 WB PM Peak Hour volume (vehicles per hour)	WB intersection approach capacity (vehicles per hour)	Delta: Remaining Capacity (vehicles per hour)
WR-1 (Widen 114)	2,453	2,568	115
WR-2 (Widen Running Hill)	2,466	2,568	102
WR-3 (Widen Spring)	2,422	2,568	146

Differences between the forecasted WB PM Peak hour volume and the intersection approach capacity range from 102-146 vehicles per hour (Table 10). Using the identified annual growth rate from the PACTS travel demand model for this section of roadway of 1.5% per year, WR alternatives have a remaining transportation life of approximately 3 years beyond the year 2050.

ii. PACTS travel demand model capacity.

An alternate method to determining the transportation life of each of the widen roadway alternatives is to compare the forecasted directional volume to the model roadway capacity. Table 11 identifies the PACTS travel demand model capacity for a single lane for various link types. The roadway section of Route 22 and 114 is consistent with the Other Principal Arterial link type, which includes roadways with signalized and unsignalized intersections.

The calculated single lane capacity for the other principal arterial link type is 1,350 vehicles per hour (Table 11). This capacity is then compared to the 2050 PM Peak Hour volumes from the PACTS travel demand model forecasts for each WR alternative traveling westbound (peak direction) on the section of Route 22 and 114 (Table 12).

Table 11 - PACTS Travel Demand Model Link Capacities by Functional Classification.[2]

Link Type Code	Link Type Descriptor	Capacity in Urban Area (vph per lane)	Capacity in Rural Area (vph per lane)
1	Principal Arterial - Interstate	1,800	2,000
2	Principal Arterial - Other Limited Access	1,600	1,800
3	Other Principal Arterial	1,350	1,600
4	Minor Arterial	1,100	1,200
5	Major/Urban Collector	825	1,050
6	Minor Collector	not applicable	950
7	Local	550	950

Table 12 – Additional capacity for Widen Roadway Alternatives.

[2] Three sources have been consulted for this information: The Highway Capacity Manual, Special Report 209, 1994; “Delay-Volume Relations for Travel Forecasting” (Horowitz, FHWA, 1991); and “Calibration and Adjustment of System Planning Models (Ismart, FHWA, 1990).

Alternative	2050 WB PM Peak Hour forecast	PACTS Model Other Principal Arterial capacity	Delta (Additional Capacity)
WR-1	2,453	1,350x2 = 2,700	247
WR-2	2,466	1,350x2 = 2,700	234
WR-3	2,422	1,350x2 = 2,700	278

Differences between the forecasted WB PM Peak hour volume and the PACTS principal arterial approach capacity range from 234-278 vehicles per hour (vph)(Table 12). Using the identified annual growth rate from the PACTS travel demand model for the widened sections of Route 22 and 114 of 1.5% per year, we find that the remaining transportation life for WR alternatives is 6 years beyond the year 2050.

Analyses performed using two different methodologies resulted in similar findings: the estimated additional life beyond Year 2050 for WR alternatives ranges from 3-6 years.

b. New Roadway Methodology

Methodology used to estimate transportation life analysis for a new roadway consisted of comparing PACTS travel demand model forecasts for the most congested/highest volume section of the new roadway to the estimated roadway capacity as this would be the critical link in the alternative life analysis. The transportation life was calculated for both a single lane and two-lane in each direction roadway. As shown in Table 13, the single lane capacity for a principal arterial – interstate is 1,800 vehicles per hour. This value is consistent with the recent Portland Area Mainline Needs Assessment (2018 Assessment).[3] The 2018 Assessment identified the existing MTA single lane capacity at the same value of 1,800 vehicles per hour.

The NR-4 transportation life analysis focused on the section of new roadway between County Road/Route 22 in Scarborough and the intersection of Route 114 and the Gorham Bypass in Gorham as this section has the highest forecasted traffic volumes for this alternative based on the PACTS travel demand model and therefore, would be the critical link for the alternative life analysis.

Table 13 summarizes the 2050 PM Peak hour westbound volume as compared to the identified single and two-lane roadway capacity for NR-4.

[3] Portland Area Mainline Needs Assessment – Final Alternatives Analysis Report, August 2018, MTA and HNTB.

Table 13 –Additional Capacity for NR-4.

Alternative	2050 WB PM Peak Hour forecast	PACTS Model Principal Arterial capacity	Delta (Additional Capacity)
NR-4 – Single lane	1,383	1,800	417
NR-4 – Two-lane	1,383	3,600	2,217

2050 WB PM peak hour volumes identified in Table 13 represent the shift in traffic from the existing roadways to the NR alternatives. A key factor in the additional capacity analysis is that a single lane on the NR alternative has a higher capacity than a single lane on the WR alternatives (1,800 vs. 1,350 vph). As a result, the difference between the forecasted WB PM Peak hour volume and the PACTS single lane principal arterial capacity is notable – only an approximate quarter of the roadway capacity remains (Table 13). For a two-lane roadway, approximately two-thirds of the roadway capacity remains. Both single and two-lane roadway additional capacity are shown in Table 13 so that a comparison of the life of adding a single lane for NR-4 can be compared to adding a single lane under the WR alternatives. However, the NR-4 would be constructed as a two-lane in each direction facility, so the greater than 2,200 vehicles per hour additional capacity should be used for life analysis purposes. Using the identified annual growth rate from the PACTS travel demand model for the Gorham Connector of 1.8% per year (NR growth is slightly higher along this section than the WR alternatives), the remaining transportation life for NR-4 is estimated at 14 years beyond the year 2050 for a single lane and 53 years beyond the year 2050 for a two-lane roadway.

10. COVID-19 Pandemic

Similar to the rest of the United States, the COVID-19 pandemic temporarily altered trip purpose, travel patterns and traffic volumes in Maine. The long-term effects, or lack thereof, are becoming clearer as time passes. Traffic volumes have recovered significantly from the early days of the pandemic and, at the time the following data analysis was completed in Spring 2021 approximately one year after the pandemic hit Maine, were nearing or above pre-pandemic volumes based on data provided by MaineDOT and the MTA. This section summarizes trends and data to better understand the long-term effects of the pandemic on traffic in the Gorham Region and to anticipate future needs related to the east-west connection between Gorham and Portland.

a. Current Conditions within the Pandemic

Directly following Governor Mills declaration of a State of Emergency for Maine, traffic dropped by half in Cumberland County (Figure 10). Volumes rebounded slowly during the summer as more information about COVID transmission was made available, state borders re-opened, and weariness of isolation set in. Traffic volumes fell again as cases began resurging in the fall of 2020. Other factors likely contributing to the decrease include a return to remote schooling and an expansion of work-from-home. Coupled with a mild winter that resulted in poor snow conditions for winter sports, the vehicle miles traveled in Cumberland County fell once more, hovering between 20% and 30% less than 2019 volumes. With the distribution of vaccines and warmer weather, travel resumed and by the end of March 2021, Cumberland County vehicle miles travelled (VMTs) were greater than 2019 levels. Our conclusion is that traffic has rebounded.

Although it has been suggested that commuting traffic will not return to pre-COVID volumes because of paradigm shifts favoring working from home, PM Peak commuting volumes on the overlap of Routes 22 and 114 have already rebounded to pre-pandemic volumes (Figure 11).[4] This indicates that while some employees are continuing to work remotely, the PM Peak hour traffic has returned along this key commuting corridor. The volume of traffic on the overlap of Routes 22 and 114, which has exceeded capacity since the early 1990s, is anticipated to increase over time as schools and businesses re-open to full capacity.

Figure 10 - Percent Change in VMT from 2019 to August 2021 in Cumberland County, Maine.[5]

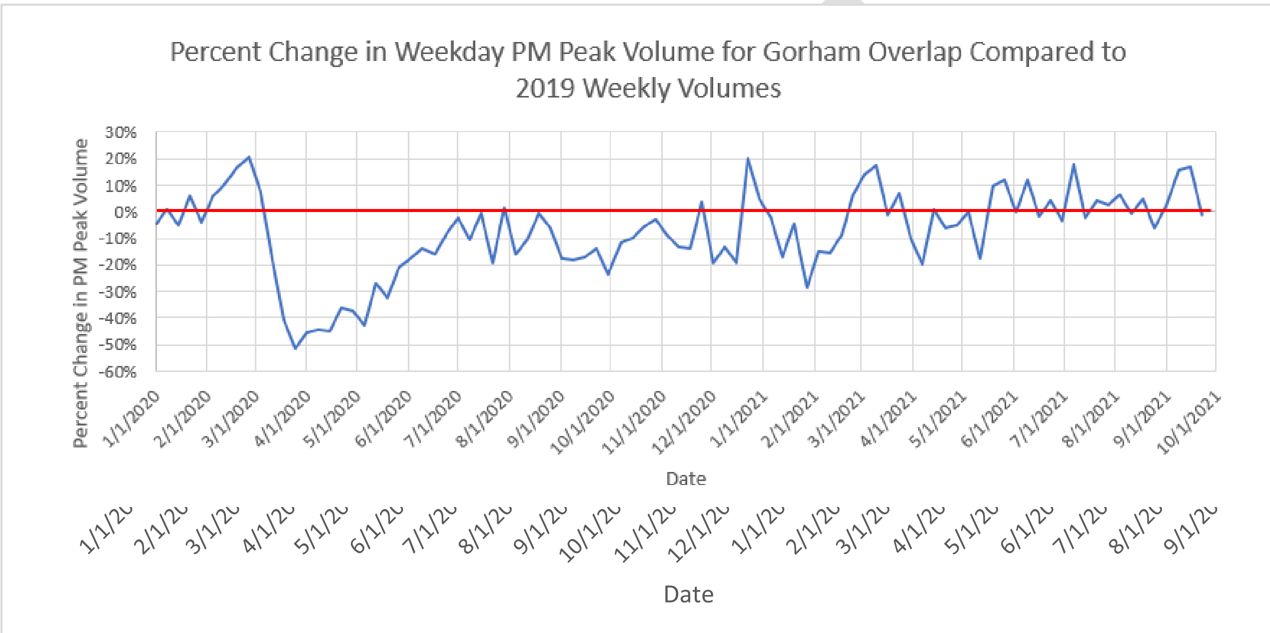

Figure 11 - Percent Change in Weekday PM Peak Volume on Overlap of Routes 114 and 22 in Gorham, Maine From January 2020 to September 2021.

Maine has re-opened. On May 13, 2021, Maine's Governor Mills announced the *Moving Maine Forward* plan - a phased, state-wide reopening of restaurants, lodging, and other services related to tourism, which will bring visitors back to Maine, encourage an increase in employment rate, and encourage in-state travel.[6] In the meantime, the biggest unknown - trip purpose - continues to evolve. While dine-in trips remain down, many restaurants have also adapted by changing business models – providing heated outdoor seating, curbside pickup, selling provisions, and working with delivery services. Online shopping continues to grow, as do trips related to curbside pickups, transportation of goods, and deliveries. In addition, Maine housing sales continue to boom as people seek out more remote, less populated places to live year-round (Maine Realtors Association,

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[4] Streetlight data analysis tool, Overlap traffic volume data (streetlightdata.com).

[5] Streetlight VMT Calculator: Near-real-time Daily Vehicle Miles Traveled (VMT) for 3,000+ U.S. Counties (streetlightdata.com).

[6] https://www.maine.gov/governor/mills/news/governor-mills-updates-moving-maine-forward-plan-lifts-restrictions-2021-05-13

January 22, 2021). While these new residents may not all be traveling to work on a daily basis, they are traveling local and state roads to shop, recreate and conduct other activities. The increase in home sales has occurred within close proximity to Portland, but the extremely limited availability in this area coupled with a pandemic-associated spike in those seeking more isolated living also accelerated the demand for residential development in more rural areas like those west of Portland. Most of the study area is zoned as rural/low-density residential and the pandemic is exacerbating an already high local demand for this type of development. Associated with this new development will be additional pressure on the already constrained travel corridors between the Portland/ South Portland urban center and points west.

b. Maine Post-COVID

According to Chetty et al. (2020), the expectation is for the economy to return to its pre-pandemic rate of growth within the next several years. While working remotely may persist for some employers, all employment sectors within the study area are not amenable to work-from-home or hybrid operations as standard practice (e.g., construction, transportation, delivery) (Figure 12 and Figure 13). While this data is presented in this section for Gorham and Scarborough, complete demographic analytics can be found in Appendix H, discussed later in this analysis. In addition, as service and retail industries recover, more people will resume traveling for work and tourism/recreational trips will return. As a demonstration of public willingness to resume travel, over the 2021 Memorial Day weekend the MTA reported traffic volumes within 7 percent of those recorded in 2019 pre-pandemic (MTA, Personal Communication 2021).

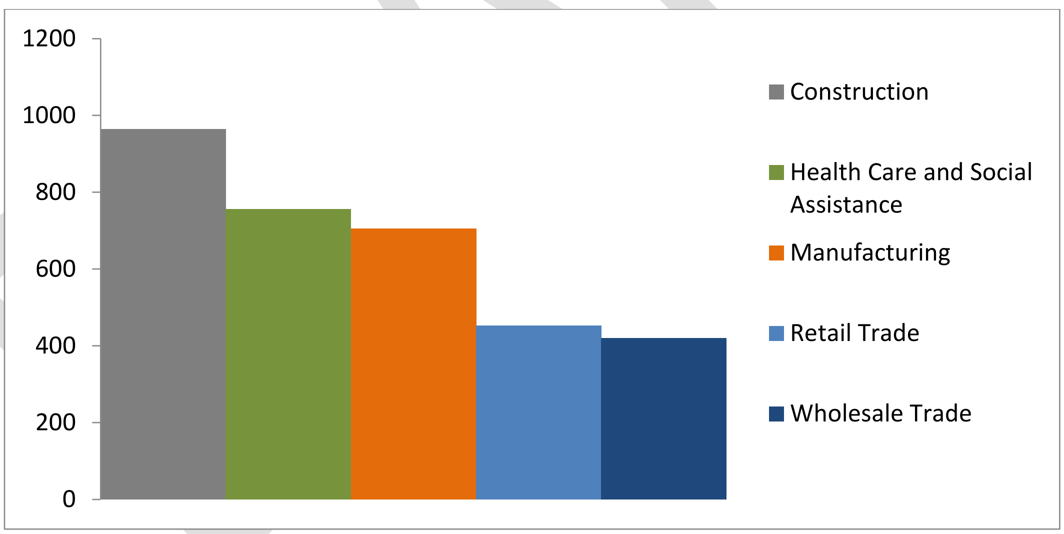

Figure 12 - Top Industries in Gorham by Employment.[7]

[7] rbouvier consultants llc, 2021

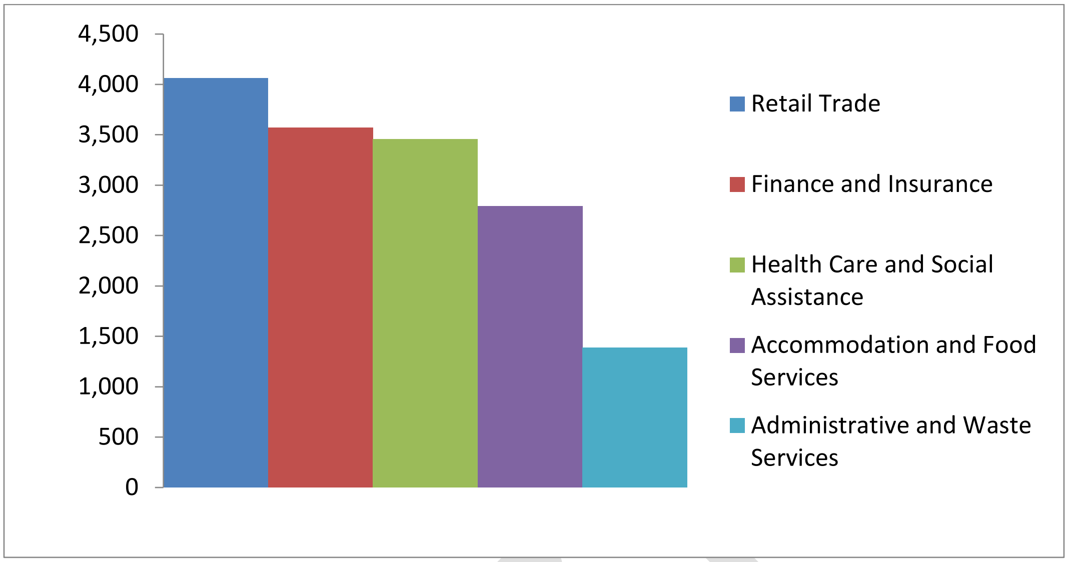

Figure 13 - Top Industries in Scarborough by Employment.[7]

Population and employment growth forecasts for Maine will only exacerbate the need for additional capacity in the study area. Roadways in the project area have exceeded design capacities since the 1990s when volumes were well below pre-COVID levels (MaineDOT, traffic data). Any pandemic-related traffic reductions are anticipated to be short term because trip purpose continues to shift to new economic models (e.g., non-peak travel, recreation) and increased regional residential development will replace commuters now working-from-home. This indicates that the region will continue to require additional capacity.

11. Findings and Conclusions

Based on the findings of the analyses performed for the widen and new roadway alternatives, the following conclusions were reached.

- NR-4 provides the greatest benefits for the majority of the analysis measures – volume change along existing roadways and intersection, VMT, VHT, travel time, and alternative life analysis.
- NR-4 performs significantly better than all widen roadway alternatives for five out of the six analysis measures.
    - *Volume change at existing intersections*: NR-4 reduces volumes at nine of 11 existing study area intersections compared to the widen roadway alternatives. This due to traffic shifting from existing roadways to the new roadway alternative, thus reducing volumes at existing intersections.
    - *VMT*: NR-4 is the only alternative that reduces VMT on major and minor roadways, the most congested roadways in the region. NR-4 also reduces VMT on local roadways more than the WR alternatives.
    - *VHT:* NR-4 provides an overall VHT benefit greater than the WR alternatives. VHT reductions are most notable on major and minor roadways, as well as local collectors.
    - *Travel Time:* NR-4 has the shortest travel time of all the alternatives between two common points – almost 2 minutes and more than 20 percent greater less than the next widen roadway alternative and approximately half the travel time under the

no-build alternative. This is a significant reduction that improves VHT and GHG emissions.

  - *Alternative Life Analysis:* NR-4, as a proposed two-lane roadway in each direction, will have a transportation life of more than 50 years beyond Year 2050. This is approximately 47 years greater than the life of the WR alternatives, which only provide from 3 to 6 years of transportation life beyond year 2050.

- NR-4 reduces volumes compared to No Build and widen roadway alternatives at six out of the eight current HCL's. Reduction in volumes at intersections and roadway segments is anticipated to reduce the overall number of crashes at these critical locations. WR alternatives increase volumes at these HCL's with additional traffic caused by added roadway capacity.

Based on the findings contained in this traffic analysis memorandum, HNTB concludes that the new roadway alternative provides significant transportation and safety benefit over the widen roadway alternatives and that it results in the greatest, most sustainable improvements in mobility and safety in the study area.